# ADDENDUM

Document: Environmental Baseline Study Work Plans, Grassy Mountain Project
Author: EM Strategies, Inc.
Version: September 22, 2017

**Addendum Information:**
Date: February 13, 2023
Author: Calico Resources USA Corp.
References:


Calico Resources USA Corp. (Calico). 2023. Memorandum re: Grassy Mountain Mine Environmental Baseline Study Work Plans, Modification Request to the Cultural Resources Baseline Work Plan. January 3.

Department of Geology and Mineral Industries (DOGAMI). 2023. Letter re: Grassy Mountain – Cultural Resources Baseline Data. State of Oregon, DOGAMI, Mineral Land Regulation & Reclamation. February 13.


In January 2023, Calico requested modifications to Section 3.13, Cultural Resources, in the *Environmental Baseline Study Work Plans* (EM Strategies, 2017). On February 2, 2023, the Technical Review Team approved the requested changes to the Cultural Resources Work Plan, and DOGAMI accepted the revised Cultural Resources Environmental Baseline Work Plan (DOGAMI, 2023), as detailed in Calico (2023).

Modifications to Section 3.13 are presented on the following pages and supersede the text shown in the *Environmental Baseline Study Work Plans* (EM Strategies, 2017, pp. 145-150).

## 3.13 Cultural Resources

CULTURAL RESOURCES ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.13.1 Purposes and Objectives

The cultural resource baseline study will provide information on the occurrences ~~and significance~~ of cultural resources in and near the project area. The historical significance of these cultural resources will be addressed in the Environmental Evaluation using the National Register of Historic Places criteria. All services discussed herein are in compliance with Section 106 of the National Historic Preservation Act (NHPA) and Oregon BLM requirements.

### 3.13.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |

Anticipated Project Disturbance (excluding access road): 400 acres

The cultural resources study area is the Cultural Area of Potential Effects (APE) shown in **Figure 23, Cultural Resources Study Area and Permit Area.**

### 3.13.3 Regulatory Framework

In cooperation with the federal Advisory Council on Historic Preservation (ACHP), the Oregon State Historic Preservation Office (SHPO) works with federal agencies and those agencies receiving federal funds to assist them in complying with Section 106 of the NHPA of 1966. Oregon SHPO is also responsible for assisting local governments in compliance with Oregon Revised Statutes (ORS) 358.653. Also,

archaeological resources are protected on non-federal, public land and private land under ORS 358.905. ORS 97.740 protects Native American graves, burial items, and items of cultural patrimony. Excavation of archaeological sites requires an Oregon archaeological permit as per ORS 390.235 and Oregon Administrative Rule (OAR) 736-051-0080 and OAR 736-051-0080.

The location of cultural resources will be maintained as confidential and exempt from the Oregon Public Records Law under ORS 192.501(11).

Oregon State Historic Preservation Office
725 Summer Street NE, Salem, OR 97301
www.oregonheritage.org

Matt Diederich
Archaeologist
(503) 986-0577
Matthew.diederich@state.or.us

### 3.13.4 Study Methodology

A preliminary online search of the Oregon Archaeological Records Remote Access (OARRA) system indicates that at least ten previous cultural resource studies have been performed for the Cultural APE (see Literature Review, below). Most recently, in 2016 Archaeological Services, LLC (ASCC) performed a Class III cultural resources inventory encompassing most Mine and Process Area and a 100-foot corridor along Twin Springs Road (see Smith et al. 2016). The remaining inventories primarily cover small sections of the proposed Access Road Area. The study methodology for the Grassy Mountain Project involves the following:

- A literature review of the Cultural APE and a one-mile radius, consisting of an online records search using the OARRA system and an in-person search at the BLM Vale District Office in Vale, Oregon. The literature search will provide information about known cultural resources within the Cultural APE. EM Strategies personnel will also review available historic topographic and General Land Office (GLO) maps, and a Mining Claim Geographic Report will be generated using the BLM's LR2000 System, which provides a list of both active and closed mining claims in the area by Section.
- A Class III cultural resource inventory of the Cultural APE will be conducted on the Permit Area to ~~assess the effects of the proposed Project on cultural resources~~ identify cultural resources that may be affected by the project. The effects of the proposed Project on cultural resources will be addressed in the Environmental Evaluation. The intensive pedestrian survey will be carried out in accordance with applicable agency guidelines~~,~~ and will be accomplished by archaeologists walking 30-meter interval transects across the Cultural APE. All previously recorded and newly identified archaeological sites, features, and isolates encountered during the survey will be appropriately mapped, documented, and photographed in accordance with BLM guidelines. SHPO field survey forms will be completed in the field; these forms are included in Appendix D. The survey crew will use Trimble GeoXT Global Positioning System (GPS) units to map cultural resources and important geographic features using customized data dictionaries that conform to the BLM standards. There will be no collection of cultural resources from BLM-administered land.
- Information will be obtained from BLM as to how the visual resources protection plan matches with the cultural resources inventory.

#### 3.13.4.1 Literature Review


- Archaeological Services. 2016. *Cultural Resource Reconnaissance Survey of the Twin Springs Road and Grassy Mountain Processing Parcel Project Areas.*

- 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
- Ferguson Daryl E., and David A. Harder. 1997. Archaeological Survey of the Cow Hollow Fire Rehabilitation Area in Malheur County, Oregon. In *Contributions in Cultural Resource Management*, No. 58. Prepared by Center for Northwest Anthropology for BLM. Report No. 15961 on file at BLM Vale District, Vale, Oregon.
- Harding, William M. 2006. *Cultural Resource Inventory of the Double Mountain Fire*. Report No. 20421 on file at BLM Vale District, Vale, Oregon.
- Holschuh, Dana L. 2015. *Cultural Resource Reconnaissance Survey of the Grassy Mountain Mine Project Area, Malheur County, Oregon.* Prepared by Archaeological Services LLC for HDR Engineering. Report No. 27108 on file at BLM Vale District, Vale, Oregon.
- Oregon State Historic Preservation Office (SHPO). 2011. *State of Oregon Archaeological Reporting Guidelines.* http://www.oregon.gov/oprd/HCD/ARCH/docs/state_of_oregon_archaeological_survey_and_reporting_standards.pdf
- Oregon State Historic Preservation Office (SHPO). 2013. *Guidelines for Conducting Field Archaeology in Oregon.* Oregon State Historic Preservation Office, Salem. Electronic document, http://www.oregon.gov/oprd/HCD/ARCH/docs/final_field_guidelines%202013.pdf, accessed February 27, 2017.
- Peterson, Robert R. 1991. *A Class III Cultural Resources Inventory of the Atlas Precious Metals Project, Malheur County, Oregon*. Prepared by Western Cultural Resource Management, Inc. for Atlas Precious Metals, Inc. Report No. 12112 on file at BLM Vale District, Vale, Oregon.
- Plew, Mark G. 1984. *Sagebrush Burn and Seeding*. Report No. 6485 on file at BLM Vale District, Vale, Oregon.
- Pritchard, Diane H. 1996. *A Cultural Resource Inventory of Cow Hollow Seeding, Malheur County, Oregon*. Report No. 18220 on file at BLM Vale District, Vale, Oregon.
- Senco-Phenix (September 1989). *Cultural Resource Survey – Grassy Mountain Site.*
- Senulis, John A. 1989. *Intensive Cultural Resource Block Survey and Inventory of the Proposed Grassy Mountain Mine Addendum Adjacent Exploration Areas, Malheur County, Oregon*. Prepared by Senco-Phenix for Atlas Precious Metals. Report No. 11906 on file at BLM Vale District, Vale, Oregon.
- Smith, Michael, Dana Holschuh, Julie Wilt, and Alexander Gall. 2016. *Cultural Resource Reconnaissance Survey of the Twin Springs Road and Grassy Mountain Processing Parcel Project Areas, Malheur County, Oregon*. Prepared by Archaeological Services LLC for HDR Engineering. Report on file at BLM Vale District, Vale, Oregon.
- State of Oregon. 2011. *State of Oregon Archaeological Reporting Guidelines*. Oregon State Historic Preservation Office, Salem.
- Stoner, Edward, and Robert Peterson. 1990. *A Cultural Resource Inventory of Proposed Access Roads and Shovel Testing of Previously Recorded Sites in the Grassy Mountain Project Area, Malheur County, Oregon.* Prepared by Western Cultural Resource Management, Inc. for Atlas Precious Metals, Inc. Report No. 11905 on file at BLM Vale District, Vale, Oregon.
- Western Cultural Resource Management, Inc. (MY 15, 1991). *A Cultural Resource Inventory of Proposed Access Roads and Shovel Testing of Previously Recorded Sites in the Grassy Mountain Project Area.* http://www.oregon.gov/oprd/HCD/ARCH/Pages/index.aspx


The previous field work and subsequent documentation (see Literature Review, above) will be reviewed to determine the number and type of archaeological sites that have been identified within the Cultural APE. Field work will be conducted per the 2013 *Oregon SHPO Guidelines for Conducting Field Archaeology in Oregon* (or most current version at the time the field work is conducted)

### 3.13.5 Timing and Duration of Baseline Data Collection and Verification

The cultural resources field work will be completed no later than 2018. The appropriate SHPO field survey protocols and reporting guidelines will be followed per the 2011 *State of Oregon Archaeological Reporting Guidelines*, and SHPO field forms will be used.

### 3.13.6 Further Anticipated Studies

If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies, including Oregon SHPO.

### 3.13.7 Baseline Characterization

Cultural resource baseline data will provide information on past human location, activity, occupation, and use, and historic and prehistoric cultural resources reflect past human activities on the landscape. A cultural resources assessment will be conducted to identify cultural resources within the Cultural APE and to provide information for later evaluation of ~~assess~~ the effects of the proposed Project on cultural resources. The cultural resources inventory report will be prepared following SHPO field and reporting guidelines and will include the required Cultural Resources Survey Cover Sheet that is included in Appendix D. If cultural resources are present in the APE, ~~recommendations will be made to avoid, minimize, or mitigate adverse effects~~general recommendations may be made to avoid, minimize, or mitigate adverse effects on cultural resources from the proposed Project until specific effects evaluations can be developed. Strategies to avoid, minimize or mitigate effects to NHRP eligible sites will be addressed in the Environmental Evaluation.

### 3.13.8 Bibliography

Archaeological Services. 2016. *Cultural Resource Reconnaissance Survey of the Twin Springs Road and Grassy Mountain Processing Parcel Project Areas.*

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

Ferguson Daryl E., and David A. Harder. 1997. Archaeological Survey of the Cow Hollow Fire Rehabilitation Area in Malheur County, Oregon. In *Contributions in Cultural Resource Management*, No. 58. Prepared by Center for Northwest Anthropology for BLM. Report No. 15961 on file at BLM Vale District, Vale, Oregon.

Harding, William M. 2006. *Cultural Resource Inventory of the Double Mountain Fire*. Report No. 20421 on file at BLM Vale District, Vale, Oregon.

Holschuh, Dana L.2015. *Cultural Resource Reconnaissance Survey of the Grassy Mountain Mine Project Area, Malheur County, Oregon.* Prepared by Archaeological Services LLC for HDR Engineering. Report No. 27108 on file at BLM Vale District, Vale, Oregon.

Oregon State Historic Preservation Office (SHPO). 2011. *State of Oregon Archaeological Reporting Guidelines.* http://www.oregon.gov/oprd/HCD/ARCH/docs/state_of_oregon_archaeological_survey_and_reporting_standards.pdf

Oregon State Historic Preservation Office (SHPO). 2013. *Guidelines for Conducting Field Archaeology in Oregon.* Oregon State Historic Preservation Office, Salem. Electronic document, http://www.oregon.gov/oprd/HCD/ARCH/docs/final_field_guidelines%202013.pdf, accessed February 27, 2017.

Peterson, Robert R. 1991. *A Class III Cultural Resources Inventory of the Atlas Precious Metals Project, Malheur County, Oregon*. Prepared by Western Cultural Resource Management, Inc. for Atlas Precious Metals, Inc. Report No. 12112 on file at BLM Vale District, Vale, Oregon.

Plew, Mark G. 1984. *Sagebrush Burn and Seeding*. Report No. 6485 on file at BLM Vale District, Vale, Oregon.

Pritchard, Diane H. 1996. *A Cultural Resource Inventory of Cow Hollow Seeding, Malheur County, Oregon*. Report No. 18220 on file at BLM Vale District, Vale, Oregon.

Senco-Phenix (September 1989). *Cultural Resource Survey – Grassy Mountain Site.*

Senulis, John A.1989. *Intensive Cultural Resource Block Survey and Inventory of the Proposed Grassy Mountain Mine Addendum Adjacent Exploration Areas, Malheur County, Oregon*. Prepared by Senco-Phenix for Atlas Precious Metals. Report No. 11906on file at BLM Vale District, Vale, Oregon.

Smith, Michael, Dana Holschuh, Julie Wilt, and Alexander Gall. 2016. *Cultural Resource Reconnaissance Survey of the Twin Springs Road and Grassy Mountain Processing Parcel Project Areas, Malheur County, Oregon*. Prepared by Archaeological Services LLC for HDR Engineering. Report on file at BLM Vale District, Vale, Oregon.

State of Oregon. 2011. *State of Oregon Archaeological Reporting Guidelines*. Oregon State Historic Preservation Office, Salem.

Stoner, Edward, and Robert Peterson.1990. *A Cultural Resource Inventory of Proposed Access Roads and Shovel Testing of Previously Recorded Sites in the Grassy Mountain Project Area, Malheur County, Oregon.* Prepared by Western Cultural Resource Management, Inc. for Atlas Precious Metals, Inc. Report No. 11905 on file at BLM Vale District, Vale, Oregon.

Western Cultural Resource Management, Inc. (MY 15, 1991). *A Cultural Resource Inventory of Proposed Access Roads and Shovel Testing of Previously Recorded Sites in the Grassy Mountain Project Area.* http://www.oregon.gov/oprd/HCD/ARCH/Pages/index.aspx

### 3.13.9

Cheryl Bradford
Archaeologist
U.S. Department of Interior
Bureau of Land Management, Vale District
541-473-6348
cbradford@blm.gov

Matt Diederich
State Historic Preservation Office
503-986-0577
Matthew.diederich@oregon.gov

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

Emily S. Whorton, M.A., RPA
Senior Archaeologist and Cultural Program Manager
EM Strategies, Inc.
775- 826-8822
emily@emstrats.com

# Environmental Baseline Study Work Plans

## Grassy Mountain Project

## September 22, 2017

Prepared by

EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822

# Environmental Baseline Study Work Plans

## Grassy Mountain Project

## Malheur County, Oregon

**May 17, 2017**

**Revised September 22, 2017**

**Prepared for**
Calico Resources USA Corp.

**Prepared by**

EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822

EM STRATEGIES

# Table of Contents

1 Introduction ..... 1
1.1 The Company ..... 1
1.2 Key Calico Management ..... 1
1.3 Contacts ..... 1
1.4 Project Background ..... 2
2 Grassy Mountain Project Environmental Baseline Work Plan ..... 5
2.1 Organization of Baseline Study Reports ..... 6
2.2 Additional Studies ..... 7
2.3 Unanticipated Conditions ..... 7
3 Resource Work Plans ..... 8
3.1 Geology and Soils ..... 8
3.1.1 Purposes and Objectives ..... 8
3.1.2 Project Study Area ..... 8
3.1.3 Regulatory Framework ..... 10
3.1.4 Study Methodology ..... 11
3.1.5 Timing and Duration of Baseline Data Collection and Verification ..... 14
3.1.6 Further Anticipated Studies ..... 14
3.1.7 Baseline Characterization ..... 14
3.1.8 Bibliography ..... 15
3.1.9 Contacts ..... 17
3.2 Geochemistry ..... 18
3.2.1 Purposes and Objectives ..... 18
3.2.2 Project Study Area ..... 19
3.2.3 Regulatory Framework ..... 21
3.2.4 Study Methodology ..... 21
3.2.5 Timing and Duration of Baseline Data Collection and Verification ..... 27
3.2.6 Further Anticipated Studies ..... 28
3.2.7 Baseline Characterization ..... 28
3.2.8 Bibliography ..... 28
3.2.9 Contacts ..... 29
3.3 Surface Water ..... 30
3.3.1 Purposes and Objectives ..... 30
3.3.2 Project Study Area ..... 31
3.3.3 Regulatory Framework ..... 33
3.3.4 Study Methodology ..... 34
3.3.5 Timing and Duration of Baseline Data Collection and Verification ..... 45
3.3.6 Further Anticipated Studies ..... 45
3.3.7 Baseline Characterization ..... 45
3.3.8 Bibliography ..... 46
3.3.9 Contacts ..... 47
3.4 Ground Water ..... 48
3.4.1 Purposes and Objectives ..... 48
3.4.2 Project Study Area ..... 49
3.4.3 Regulatory Framework ..... 51
3.4.4 Study Methodology ..... 52
3.4.5 Timing and Duration of Baseline Data Collection and Verification ..... 73

3.4.6 Further Anticipated Studies ..... 74
3.4.7 Baseline Characterization ..... 74
3.4.8 Bibliography ..... 74
3.4.9 Contacts ..... 75
3.5 Terrestrial (Uplands) Vegetation ..... 77
3.5.1 Purposes and Objectives ..... 77
3.5.2 Project Study Area ..... 77
3.5.3 Regulatory Framework ..... 78
3.5.4 Study Methodology ..... 80
3.5.5 Timing and Duration of Baseline Data Collection and Verification ..... 82
3.5.6 Further Anticipated Studies ..... 83
3.5.7 Baseline Characterization ..... 83
3.5.8 Bibliography ..... 83
3.5.9 Contacts ..... 84
3.6 Wetlands ..... 85
3.6.1 Purpose and Objectives ..... 85
3.6.2 Project Study Area ..... 85
3.6.3 Regulatory Framework ..... 86
3.6.4 Study Methodology ..... 87
3.6.5 Timing and Duration of Baseline Data Collection and Verification ..... 88
3.6.6 Further Anticipated Studies ..... 88
3.6.7 Baseline Characterization ..... 88
3.6.8 Bibliography ..... 89
3.6.9 Contacts ..... 90
3.7 Wildlife Resources ..... 91
3.7.1 Purposes and Objectives ..... 91
3.7.2 Project Study Area ..... 91
3.7.3 Regulatory Framework ..... 92
3.7.4 Study Methodology ..... 94
3.7.5 Timing and Duration of Baseline Data Collection and Verification ..... 106
3.7.6 Further Anticipated Studies ..... 108
3.7.7 Baseline Characterization Report ..... 108
3.7.8 Bibliography ..... 109
3.7.9 Contacts ..... 111
3.8 Aquatic Resources ..... 112
3.8.1 Purposes and Objectives ..... 112
3.8.2 Project Study Area ..... 112
3.8.3 Regulatory Framework ..... 114
3.8.4 Study Methodology ..... 116
3.8.5 Timing and Duration of Baseline Data Collection and Verification ..... 117
3.8.6 Further Anticipated Studies ..... 120
3.8.7 Baseline Characterization ..... 120
3.8.8 Bibliography ..... 120
3.8.9 Contacts ..... 121
3.9 Grazing Management ..... 123
3.9.1 Purposes and Objectives ..... 123
3.9.2 Project Study Area ..... 123
3.9.3 Regulatory Framework ..... 124
3.9.4 Study Methodology ..... 124
3.9.5 Timing and Duration of Baseline Data Collection and Verification ..... 125
3.9.6 Further Anticipated Studies ..... 125

3.9.7 Baseline Characterization ..... 125
3.9.8 Bibliography ..... 125
3.9.9 Contacts ..... 126
3.10 Visual Resources ..... 127
3.10.1 Purposes and Objectives ..... 127
3.10.2 Project Study Area ..... 127
3.10.3 Regulatory Framework ..... 128
3.10.4 Study Methodology ..... 129
3.10.5 Timing and Duration of Baseline Data Collection and Verification ..... 129
3.10.6 Further Anticipated Studies ..... 129
3.10.7 Baseline Characterization ..... 129
3.10.8 Bibliography ..... 130
3.10.9 Contacts ..... 130
3.11 Air Quality Resources ..... 131
3.11.1 Purposes and Objectives ..... 131
3.11.2 Project Study Area ..... 131
3.11.3 Regulatory Framework ..... 133
3.11.4 Study Methodology ..... 136
3.11.5 Timing and Duration of Baseline Data Collection and Verification ..... 137
3.11.6 Further Anticipated Studies ..... 137
3.11.7 Baseline Characterization ..... 137
3.11.8 Bibliography ..... 138
3.11.9 Contacts ..... 139
3.12 Noise ..... 140
3.12.1 Purposes and Objectives ..... 140
3.12.2 Project Study Area ..... 140
3.12.3 Regulatory Framework ..... 140
3.12.4 Study Methodology ..... 142
3.12.5 Timing and Duration of Baseline Data Collection and Verification ..... 142
3.12.6 Further Anticipated Studies ..... 143
3.12.7 Baseline Characterization ..... 143
3.12.8 Bibliography ..... 144
3.12.9 Contacts ..... 144
3.13 Cultural Resources ..... 145
3.13.1 Purposes and Objectives ..... 145
3.13.2 Project Study Area ..... 145
3.13.3 Regulatory Framework ..... 145
3.13.4 Study Methodology ..... 146
3.13.5 Timing and Duration of Baseline Data Collection and Verification ..... 148
3.13.6 Further Anticipated Studies ..... 148
3.13.7 Baseline Characterization ..... 148
3.13.8 Bibliography ..... 148
3.13.9 149
3.14 Land Use ..... 151
3.14.1 Purposes and Objectives ..... 151
3.14.2 Project Study Area ..... 151
3.14.3 Regulatory Framework ..... 152
3.14.4 Study Methodology ..... 154
3.14.5 Timing and Duration of Baseline Data Collection and Verification ..... 154
3.14.6 Further Anticipated Studies ..... 154
3.14.7 Baseline Characterization ..... 155

3.14.8 Bibliography ..... 155
3.14.9 Contacts ..... 155
3.15 Transportation ..... 157
3.15.1 Purposes and Objectives ..... 157
3.15.2 Project Study Area ..... 157
3.15.3 Regulatory Framework ..... 158
3.15.4 Study Methodology ..... 158
3.15.5 Timing and Duration of Baseline Data Collection and Verification ..... 158
3.15.6 Further Anticipated Studies ..... 159
3.15.7 Baseline Characterization ..... 159
3.15.8 Bibliography ..... 159
3.15.9 Contacts ..... 160
3.16 Socioeconomics ..... 161
3.16.1 Purposes and Objectives ..... 161
3.16.2 Project Study Area ..... 161
3.16.3 Regulatory Framework ..... 161
3.16.4 Study Methodology ..... 162
3.16.5 Timing and Duration of Baseline Data Collection and Verification ..... 162
3.16.6 Further Anticipated Studies ..... 162
3.16.7 Baseline Characterization ..... 162
3.16.8 Bibliography ..... 163
3.16.9 Contacts ..... 164
3.17 Environmental Justice ..... 165
3.17.1 Purposes and Objectives ..... 165
3.17.2 Project Study Area ..... 165
3.17.3 Regulatory Framework ..... 166
3.17.4 Study Methodology ..... 167
3.17.5 Timing and Duration of Baseline Data Collection and Verification ..... 168
3.17.6 Further Anticipated Studies ..... 168
3.17.7 Baseline Characterization ..... 168
3.17.8 Bibliography ..... 169
3.17.9 Contacts ..... 169
3.18 Recreation ..... 171
3.18.1 Purposes and Objectives ..... 171
3.18.2 Project Study Area ..... 171
3.18.3 Regulatory Framework ..... 171
3.18.4 Study Methodology ..... 172
3.18.5 Timing and Duration of Baseline Data Collection and Verification ..... 172
3.18.6 Further Anticipated Studies ..... 172
3.18.7 Baseline Characterization ..... 173
3.18.8 Bibliography ..... 173
3.18.9 Contacts ..... 173
3.19 Mined Land Reclamation ..... 174
3.19.1 Purposes and Objectives ..... 174
3.19.2 Project Study Area ..... 174
3.19.3 Regulatory Framework ..... 175
3.19.4 Study Methodology ..... 176
3.19.5 Timing and Duration of Baseline Data Collection and Verification ..... 176
3.19.6 Further Anticipated Studies ..... 176
3.19.7 Baseline Characterization ..... 176
3.19.8 Bibliography ..... 177

3.19.9 Contacts ..... 178
3.20 Wild, Scenic or Recreational Rivers ..... 179
3.20.1 Purposes and Objectives ..... 179
3.21 Areas of Critical Environmental Concern/Research Natural Areas ..... 179
3.21.1 Areas of Critical Environmental Concern ..... 179
3.22 Outstanding Natural Areas ..... 182
3.23 Oregon Natural Heritage Plan Areas ..... 182

## List of Tables

Table 1. Trace Metals in Whole-Rock Samples (all chemical values expressed in parts per million [ppm]) ..... 21
Table 2. Parameters for Multi-Element Analyses ..... 25
Table 3. Vale, Oregon, Historic Average Climate, Temperature-Precipitation[1] ..... 32
Table 4. List of Water Quality Analytes and Testing Methods ..... 38
Table 5. List of Water Quality Analytes, Hold Times, and Preservatives ..... 40
Table 6. Grassy Mountain Water Quality Monitoring Wells and Construction Details ..... 54
Table 7. GPS Coordinates for Grassy Mountain Monitoring Wells ..... 54
Table 8. Grassy Mountain Monitoring Well Ground Water Elevations ..... 55
Table 9. Grassy Mountain Water Level Monitoring Wells and Construction Details ..... 55
Table 10. GPS Coordinates for Grassy Mountain Water Level Monitoring Wells ..... 56
Table 11. Grassy Mountain Water Level Monitoring Well Ground Water Elevations ..... 56
Table 12. Grassy Mountain Wells Proposed for Continuous Water Level Monitoring ..... 57
Table 13. Grassy Mountain GPS Coordinates and Flow for Baseline/Background Springs ..... 58
Table 14. Grassy Mountain Monitoring Well Dedicated Pumps ..... 62
Table 15. List of Water Quality Analytes and Testing Methods ..... 66
Table 16. List of Water Quality Analytes, Hold Times, and Preservatives ..... 67
Table 17. Construction and Water Level Information for Monitoring Wells ..... 73
Table 18. Federal and State Listed Threatened, Endangered, Candidate, Species of Concern, and Special Status Species (Sensitive) Potentially Occurring within the Vicinity of the Proposed Project Study Area ..... 97
Table 19. Oregon Department of Fish and Wildlife Mitigation Goals and Implementation Standards by Habitat Category ..... 98
Table 20. BLM Visual Resource Management Classes (BLM 1986) ..... 128
Table 21. USEPA Class I Federal Wilderness Areas with Visibility of National Importance ..... 135
Table 22. Maximum Permissible Project Noise Levels at Noise-sensitive Properties (from Table 8, OAR 340-35-035) ..... 141
Table 23. Maximum Permissible Project Noise Levels in Quiet Areas (from Table 9, OAR 340-35-035) ..... 141
Table 24. Maximum Permissible Project Impulsive Noise Levels (from paragraph (1)(d) of OAR 340-35-035) ..... 142
Table 25. Existing Areas of Critical Environmental Concern ..... 180

## List of Photos

Photo 1. Discharge testing manifold photograph and diagram ..... 63

# Appendices

**Appendix A**: **Figures**


**Figure 1:** **Location Map**

**Figure 2:** **Permit Area Map**

**Figure 3:** **Geology Study Area and Permit Area**

**Figure 4:** **Soils Study Area and Permit Area**

**Figure 5:** **Geochemistry Study Area and Permit Area**

**Figure 6:** **Geochemistry Study Area**

**Figure 7:** **Workflow for Geotechnical Characterization Plan**

**Figure 8:** **Water Resources Study Area and Permit Area**

**Figure 9:** **Water Resources Study Area**

**Figure 10:** **Monitoring Wells and Springs**

**Figure 11:** **Monitoring Wells**

**Figure 12:** **Water Supply Wells**

**Figure 13:** **Terrestrial Vegetation Study Area and Permit Area**

**Figure 14:** **Wetland Study Area and Permit Area**

**Figure 15:** **Wildlife Study Area and Permit Area**

**Figure 16:** **Aquatic Resources Study Area and Permit Area**

**Figure 17:** **Aquatic Resources Study Area**

**Figure 18:** **Grazing Management Study Area and Permit Area**

**Figure 19:** **Visual Resources Study Area and Permit Area**

**Figure 20:** **Visual Resources Study Area**

**Figure 21:** **Local Air Quality Study Area and Permit Area**

**Figure 22:** **Noise Study Area**

**Figure 23:** **Cultural Resources Study Area and Permit Area**

**Figure 24:** **Land Use Study Area and Permit Area**

**Figure 25:** **Transportation Study Area**

**Figure 26:** **Traffic Counter Locations**

**Figure 27:** **Regional Socioeconomics Study Area**

**Figure 28:** **Environmental Justice Study Area**

**Figure 29:** **Recreation Study Area and Permit Area**

**Figure 30:** **Mined Land Reclamation Study Area**

**Figure 31:** **Wild and Scenic and Recreational Rivers in the Vicinity of Malheur County**

**Figure 32: Areas of Critical Environmental Concern in the Jordan and Malheur Resources Areas**

**Appendix B: Suggested Baseline Data Methodologies Calico Resources USA Corp. Technical Review Team**
**Appendix C: Monitoring Well Site-specific Testing Plan**
**Appendix D: Field Data Forms**

| | |
|---|---|
| ***Geology and Soils*** | • **Rock and Soil Sampling Reporting Form** |
| ***Terrestrial Vegetation*** | • **Vegetation Survey Reporting Form**<br>• **Daubenmire Field Form** |
| ***Visual Resources*** | • **BLM Visual Contrast Rating Worksheet** |
| ***Wetlands*** | • **DSL Wetland Determination/Delineation Report Requirements Checklist**<br>• **DSL Wetland Delineation/Determination Report Cover Form**<br>• **USACE Wetland Determination Data Form – Arid West Region**<br>• **DSL Streamflow Duration Field Assessment Form** |
| ***Cultural Resources*** | • **Oregon SHPO Survey Cover**<br>• **Oregon Archaeological Site Form** |
| ***Aquatic Resources*** | • **DSL Streamflow Duration Field Assessment Form**<br>• **Amphibian and Reptile Time Constrained Collecting Data Form**<br>• **General Encounter (Visual Encounter) Data Form**<br>• **Wildlife Inventory QA Forms 1-7** |
| ***Terrestrial Wildlife*** | • **Greater Sage-grouse Lek Survey Data Form**<br>• **Greater Sage-grouse Encounter Transect Data Form**<br>• **Golden Eagle Nest Location Data Form**<br>• **Raptor Nest Location Data Form**<br>• **Bat Detection and Roost Data Forms**<br>• **Pygmy Rabbit Transect Data Form**<br>• **White-tailed rabbit (and other hares) Transect Data Form**<br>• **Avian Observation Data Sheet**<br>• **General Encounter (Visual Encounter) Data Form**<br>• **Wildlife Inventory QA Forms 1-7** |

**Appendix E: Grassy Mountain Gold Project Water Resources Baseline Study Winter 2013 Monitoring Plan**

## Acronyms

| Term | Definition |
|---|---|
| ABA | acid base accounting |
| ABC | Adrian Brown Consultants, Inc. |
| ACEC | areas of critical environmental concern |
| ACDP | air contaminant discharge permit |
| ACHP | Advisory Council on Historic Preservation |
| ACZ | ACZ Inc. |
| ADA | Americans Disability Act |
| AERMOD | AMS/EPA Regulatory Model Improvement Committee [AERMIC] Model |
| ANSI | American National Standards Institute |
| AP | acid potential |
| APE | area of potential effects |
| ARD | acid rock drainage |
| ASTM | American Society for Testing and Materials |
| Atlas | Atlas Precious Metals, Inc. |
| BGEPA | Bald and Golden Eagle Protection Act |
| BLM | U.S. Department of the Interior Bureau of Land Management |
| BMP | best management practices |
| CAA | Clean Air Act |
| Calico | Calico Resources USA Corp. |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| CUP | conditional use permit |
| CWA | Clean Water Act |
| DC | direct current |
| DLCD | Oregon Department of Land Conservation and Development |
| DO | dissolved oxygen |
| DOGAMI | Oregon Department of Geology and Mineral Industries |
| DQO | data quality objectives |
| DSL | Oregon Department of State Lands |
| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| ERU | exclusive range use |
| ESA | Endangered Species Act |
| F | Fahrenheit |
| FLPMA | Federal Land Policy and Management Act |
| g/t | grams per ton |
| GEM | geo-environmental model |
| GIS | geographic information system |
| gpm | gallons per minute |
| GPS | global positioning system |
| GWMWP | Ground Water Monitoring Work Plan |
| HCT | humidity cell testing |
| HDR | HDR Engineering, Inc. |
| HUD | U.S. Department of Housing and Urban Development |
| IMS | IMS, Inc. |
| JMM | J.M. Montgomery, Consulting Engineers, Inc. |
| KOP | key observation point |

| Term | Definition |
|---|---|
| LHD | load-haul-dump vehicle |
| LWI | Local Wetland Inventory |
| MBTA | Migratory Bird Treaty Act |
| MOU | memorandum of understanding |
| MWMP | Meteoric Water Mobility Procedure |
| ML | metals leaching |
| MP | Measurement point |
| MSHA | Mine Health and Safety Administration |
| MSL | method detection limits |
| MW | megawatts |
| NAAQS | National Ambient Air Quality Standards |
| NAD83 | North American Datum 1983 |
| NAG | Net Acid Generation |
| NELAP | National Environmental Laboratory Accreditation Program |
| NEPA | National Environmental Policy Act |
| NMC | Newmont Mining Company Grassy Mountain Corporation |
| NNP | net neutralization potential |
| NOI | Notice of Intent |
| NOAA | National Oceanographic and Atmospheric Administration |
| NPDES | National Pollutant Discharge Elimination System |
| NPR | neutralization potential ratio |
| NRCS | Natural Resources Conservation Service |
| NSR | New Source Review |
| NWI | National Wetland Inventory |
| OAPA | Oregon Administrative Procedures Act |
| OAR | Oregon Administrative Rules |
| OBDIC | Oregon Biodiversity Information Center |
| ODEQ | Oregon Department of Environmental Quality |
| ODFW | Oregon Department of Fish and Wildlife |
| ODOJ | Oregon Department of Justice |
| ODOT | Oregon Department of Transportation |
| ODWR | Oregon Department of Water Resources |
| OHV | Off-highway vehicle |
| OHWM | ordinary high water mark |
| ONA | outstanding, natural area |
| OP | observation posts |
| OPDES | Oregon Pollutant Discharge Elimination System |
| ORELAP | Oregon Environmental Laboratory Accreditation Program |
| ORNHP | Oregon Natural Heritage Program |
| ORS | Oregon Revised Statutes |
| OSSC | Oregon Structural Specialty Code |
| PCC | project coordinating committee |
| PEA | preliminary economic assessment |
| PEM | palustrine emergent wetland |
| PFS | preliminary feasibility study |
| PM | particulate matter |
| PNAMP | Pacific Northwest Aquatic Monitoring Partnership |
| POO | plan of operations |

| Term | Definition |
|---|---|
| PSD | prevention of significant deterioration |
| PTC | Permit to Construct |
| PTP | payment to provide mitigation |
| QA/QC | quality assurance/quality control |
| RMEC | Rocky Mountain Environmental Corporation |
| RMP | resource management plan |
| RNA | research natural areas |
| ROD | record of decision |
| RPD | relative percent difference |
| SAAQS | State Ambient Air Quality Standards |
| SEM | scanning electron microscopy |
| SER | significant emission rate |
| SHPO | State Historic Preservation Office |
| SIP | State Implementation Plan |
| SLM | sound level meter |
| SMWMP | Sequential Meteoric Water Mobility Procedure |
| SOP | standard operating procedure |
| SRK | Steffen Robertson and Kirsten (U.S.) |
| T&E | threatened and endangered |
| TEC | threatened, endangered, and candidate |
| TES | threatened, endangered, and sensitive |
| TPR | Oregon Transportation Planning Rule |
| TRT | technical review team |
| TSF | tailings storage facility |
| TSP | total suspended particulate |
| UGB | Urban Growth Boundary |
| $ug/m^3$ | micrograms per meters cubed |
| USACE | U.S. Army Corps of Engineers |
| U.S.C. | United States Code |
| USDA | U.S. Department of Agriculture |
| USEPA | U.S. Environmental Protection Agency |
| USFS | U.S. Forest Service |
| USFWS | U.S. Department of the Interior Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| UTM | Universal Transverse Mercator coordinate system |
| V | volt |
| VES | visual encounter survey |
| VQO | visual quality objectives |
| VRM | Visual Resources Management |
| WRCC | Western Regional Climate Center |
| WTI | Western Technologies, Inc. |
| XRD | x-ray diffraction |

# 1 INTRODUCTION

## 1.1 The Company

Calico Resources USA Corp. (Calico), an exploration stage company and wholly-owned subsidiary of Paramount Gold Nevada Corp., engages in the acquisition, exploration, and development of mineral properties. Calico holds 100 percent interest in the Grassy Mountain Project.

The Grassy Mountain Project area is located in Malheur County, Oregon, approximately 22 miles south-southwest of Vale (see **Figure 1, Location Map**). The Permit Area defined in the *Third Notice of Intent Pre-Application Phase of a Proposed Mining Operation: Calico Resources USA Corp. Grassy Mountain Gold Project (February 2017)* includes two parcels, a Mine and Process Area, and an Access Road Area. The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the U.S. Department of the Interior, Bureau of Land Management (BLM) (see **Figure 2, Permit Area Map).** The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). All proposed mining would occur on the patented claims (private land).

The Grassy Mountain Project is considered to have a near-term production potential. It is Calico's flagship property. An underground operation is planned to mine the measured plus indicated resource of 3.2 million tons (Mt) with an average gold grade of 0.155 ounces per ton (oz/t) and an average silver grade of 0.260 oz/t, for a total of 503,700 oz gold and 843,200 oz silver. This is the topic of the environmental study work plans that follow.

Calico's goal is to coordinate the federal and state environmental, cultural, and socioeconomic baseline and permitting conditions to the maximum extent practicable.

## 1.2 Key Calico Management

The Calico management team is as follows:

- Glen van Treek – President, CEO, Director
- Carlo Buffone – CFO
- Michael McGinnis – Project Manager/Exploration
- Nancy J. Wolverson –Permitting Coordinator
- Andy Bentz – Public and Governmental Affairs, Bentz Solutions, Inc.
- Richard DeLong – Permitting/Environmental Manager, EM Strategies, Inc.

## 1.3 Contacts

The contact person for the project is Nancy J. Wolverson.

**Address**: Nancy J. Wolverson, Permitting Coordinator
Calico Resources USA Corp.
665 Anderson St.
Winnemucca, NV 89445

**Telephone**: (775)770-4615
**Email**: nancy@paramountnevada.com

The contact person for the environmental baseline work plan is Richard DeLong.

**Address**: Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502

**Telephone**: (775) 826-8822

**Email**: rich@emstrats.com

## 1.4 Project Background

Calico plans to construct an underground mine and surface mill complex to develop the Grassy Mountain gold resource. The Grassy Mountain Project area (Permit Area) is located in Malheur County, Oregon, approximately 22 miles south-southwest of Vale (**Figure 1)**, and consists of two parcels: the Mine and Process Area, and the Access Road Area (**Figure 2**).

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area parcel is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A portion of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |
| Anticipated Project Disturbance (excluding access road): | 400 acres |

Based on the production of a favorable bankable pre-feasibility study and the securing of adequate financing, Calico intends to construct an underground mine, surface mill, tailings and storage facility, as well as office/maintenance shop and warehouse in the area. The July 2015 Preliminary Economic Assessment (PEA) authored by Metal Mining Consultants, Inc. defined a measured plus indicated underground resource of 3.2 Mt with an average gold grade of 0.155 oz/t and an average silver grade of 0.260 oz/t, for a total of 503,700 oz gold and 843,200 oz silver. This is the focus of the environmental studies, and future operating plans. The resource is contained within three patented mining claims that cover an estimated 62 acres. The three patented mining claims are surrounded by unpatented mining claims held by Calico, all on public lands.

The PEA estimates that the underground operation will require that the mining and milling operations will process approximately 500 to 1,000 tons/day over a nine-year mine life. This mine life could be extended if additional ore is encountered. It is estimated that mine closure and reclamation will require an additional three years, followed by on-going post-closure environmental monitoring as required by permits.

At this time, Calico has not prepared a preliminary facilities arrangement for the project. This layout will be developed as part of a preliminary feasibility study (PFS), currently being developed by consultants to Calico. The PFS will describe the following:

- Mine area and mining method
- Milling operation
- Water supply
- Haul road arrangement
- Tailing storage method and facility
- Waste rock disposal sites
- Primary access route
- Power
- Reclamation strategy and costs

Initially, areas to be disturbed by construction activities will be stripped of any topsoil. Topsoil will be stockpiled, sloped, and seeded to stabilize the storage structure and help maintain the growth material's ability to support biomass growth. To extract the gold bearing ore, Calico will construct multiple underground accesses, either vertical excavations (shafts) or ramp excavations (declines). In either case, excavated material from the access construction will be stored in sites near the access on patented mining claims. Other excavations for ventilation could also connect the underground with the surface. Horizontal tunnels (drifts) will be constructed off the shafts and/or declines in order to access the ore zone. Typical drilling, blasting and loading underground mining techniques will be employed. Load-haul-dump (LHD) vehicles will likely be used to haul the ore to the surface.

The ore zone, as it is currently understood, lies at a depth of between 500 and 700 from the surface. Ore will likely be extracted using cut and fill mining methods, where gold bearing ore is removed, and the resulting void filled with a mixture of waste rock, aggregate, and cement. The cut and fill method has a number of functions: it is used to stabilize underground openings left by mining; it provides either a working platform or stable roof for subsequent mining operations; and it allows for the underground storage of tailings. Tailings are a mixture of finely-ground waste rock and water from which the valuable minerals have been removed. Mining the ore body will progress based on detailed mine plans developed by engineers and geologists. It is likely that ore will be extracted simultaneously from numerous working areas in the ore zone.

Ore and waste rock will be excavated using conventional drill and blast techniques. Loosened rock will be removed from the active working area. Ground support will be installed. Waste rock (rock outside the ore zone that has been excavated) will be placed in mined out areas in the ore zone, or hauled to the surface for above-ground storage. Broken ore will then be transported up the decline and deposited onto a course ore stockpile. The coarse ore stockpile will feed a crushing and grinding circuit. Ore will be crushed, screened then fed into the grinding circuit. Crushing is achieved with various types of crushers including jaw crushers and cone crushers. Grinding is typically achieved with ball mills, where crushed ore is introduced into rotating drums. It is then mixed with steel balls, water, and possibly reagents. The rock is then ground down to a pre-determined size to facilitate liberation of the precious metals.

The water supply for processing will be ground water from a well or series of wells that will be developed near the processing facilities. Calico has applied for an extension of time for permit number G-10994 (permit holder: Seabridge Gold Corporation). This permit was originally issued in April 1990 to Atlas

Precious Metals, Inc. (Atlas), and later assigned to Seabridge in 1993. The permit would provide for the withdrawal of 900 gallons per minute (gpm). Calico estimates its operation will require up to 500 gpm.

It is envisioned that the ground ore will then be introduced into a gravity separation circuit that will rely upon the differences between the specific gravities of the metals and the host rock to separate one from the other. Gravity circuits will likely include cyclones, spirals, jigs, and/or riffle tables. It is expected that most of the valuable metals will be recovered using gravity separation techniques.

The remaining precious metals will be separated from the rock using either froth flotation or closed circuit dissolution methods. Froth flotation uses agitation and reagents to separate waste material from valuable metals based on physical differences of constituent materials, and how they are attracted to frothing liquids. Solution extraction uses chemicals to dissolve the precious metals. Gold and silver are then recovered by passing the "pregnant solution" through a filter medium. Both systems employ closed circuit processing techniques where all inputs and discharges are controlled within vessels, tanks, and piping that are surrounded by secondary spill containment. The facility will be a "zero discharge" operation.

The final step in processing will be to treat the remaining tailings neutralize any residual cyanide. No discharge is planned; therefore, this operation will also be a zero discharge facility.

As currently envisioned, the operation would include tailings facilities. The PFS will define the tailings location, method, and amount that can be returned to the mine. Those tailings not returned to the mine will be land formed at mine closure, covered with topsoil, and re-planted with native grasses, shrubs, and forbs.

Post-mining reclamation will include: backfilling and sealing of shafts and/or declines as much as is practicable; removal of all man-made surface structures; re-contouring disturbed areas; placement of topsoil-like material; and re-seeding of reclaimed surfaces. Post-reclamation monitoring of ground and surface waters, vegetation, and wildlife will continue as required by conditions of the permit until final bond release.

## 2 GRASSY MOUNTAIN PROJECT ENVIRONMENTAL BASELINE WORK PLAN

The environmental baseline data methodology required for the Division 37 Oregon Chemical Process Mining Permit is described in Oregon Administrative Rules (OAR) 632-037-0005 through 632-037-0155. Division 43, Chemical Mining (OAR 340-043-0000 through 340-043-0180), further describes Oregon Department of Environmental Quality (ODEQ) requirements. Oregon Department of Fish and Wildlife (ODFW) requirements included in Division 420, Chemical Process Mining Consolidated Application and Permit Review Standards, address standards for the protection of wildlife and their habitat (OAR 635-420-000 through 635-420-0060.

This environmental baseline work plan has been developed using those criteria and/or guidelines and material provided by the technical review team (TRT) assembled for the project, pursuant to Oregon Revised Statute (ORS) 517.967 (See Appendix B for the Suggested Baseline Data Methodologies Calico Resources USA Corp. Technical Review Team). The TRT is an inter-agency group established in accordance with Section 11, Chapter 735, 1991 Oregon Laws.

The TRT is composed of members representing the following agencies, with DOGAMI as the lead agency:

- Oregon Department of Agriculture
- Oregon Department of Environmental Quality (ODEQ)
- Oregon Department of Fish and Wildlife (ODFW)
- Oregon Department of Geology and Mineral Industries (DOGAMI)
- Oregon Department of Land Conservation & Development (DLCD)
- Oregon Department of State Lands (DSL)
- Oregon Water Resources Department of (OWRD)
- Oregon State Historic Preservation Office (SHPO)

Several agencies serve as ex officio members of the TRT, including the following:

- Malheur County
- BLM

Participation on the project coordinating committee (PCC) involves all of these agencies. The City of Nyssa, U.S. Environmental Protection Agency (USEPA), U.S. Fish and Wildlife Service (USFWS), and the Mine Safety and Health Administration (MSHA) are also participants. The PCC was established under the statute to share information and avoid contradictory requirements.

The work plan contains the following:

- Background on Calico, key management, and contact personnel
- Description of the project area and project site location
- Summary project description
- Overview and listing of environmental baseline data collected to date
- Proposed baseline data collection
- Related information filed with DOGAMI as part of the notice of intent (NOI)

This information is necessary to characterize the biological, physical, socioeconomic, and cultural conditions in the proposed project area. The proposed work scopes address the following resource categories, as required in OAR 632-037-0055. In anticipation of likely federal environmental permitting conditions, some additional areas of study beyond that required by the state have been included.

- Geology and soils
- Geochemistry
- Surface water
- Ground water

- Terrestrial vegetation (covers threatened and endangered plant species)
- Wetlands
- Wildlife resources (covers threatened and endangered wildlife species)
- Aquatic resources
- Grazing management
- Visual resources
- Air quality
- Noise
- Cultural resources
- Land use
- Transportation
- Socioeconomics
- Environmental justice
- Recreation
- Mined land reclamation
- Wild, scenic or recreational rivers
- Areas of critical environmental concern/Research natural areas
- Outstanding natural areas
- Oregon National Heritage Plan areas

Existing data, completed baseline studies, and new data information need (where applicable) and the methodologies for developing these data, are discussed for each of these resource categories in Section 3.

The water resources (ground water and surface water), aquatic resources, and geology study areas are linked. If the water resources study area needs to be modified to address new conditions, such as inadequate ground water supply, the aquatic resources and geology study areas should be expanded (if needed for geology) to match the water resources study area.

As a general rule, "The level of detail required [for baseline data] may vary depending upon the location, size, scope, and type of mining operation. The applicant should consult with the TRT to determine the level of detail necessary for the applicant's proposed mining operation (OAR 632-037-0055(2)). This will ensure the process is consistent with the requirements described in Division 37.

The methodologies described in this work plan for the various resource categories have been previously reviewed and approved by the responsible agencies and their respective representatives, which comprise the TRT, established in accordance with OAR 632-37-0025. In the event that baseline studies determine the need for additional data in the future, or if these studies demonstrate a particular aspect of the work plan is not relevant or not needed, then that component will be modified according to the primary approved methodology described in this document.

## 2.1 Organization of Baseline Study Reports

Each resource baseline study report that will be developed under this work plan will be organized as follows:

- Section 1: Introduction (Purposes and Objectives)
- Section 2: Resource Study Area
- Section 3: Regulatory Framework
- Section 4: Study Methodology
- Section 5: Baseline Characterization
- Section 6: Bibliography
- Section 7: Contacts

- Section 8: List of Preparer(s)
- Appendices – Supporting Information (if any)

## 2.2 Additional Studies

At this time, all necessary infrastructure requirements for the project have not been fully identified. For example, the exact locations of the processing plant, water supply well, and the necessary water distribution system have not been defined. These and other infrastructure needs are part of the PFS currently being developed by a Calico consultant. The infrastructure components themselves will be described in the PFS and the General Information section (see OAR 632-037-0050) of the Grassy Mountain Consolidated Permit Application, as well as the operating plan (see OAR 632-037-0060).

At such time as more definitive operating plan information is available, particularly with respect to the facilities site arrangement, service areas, and system alignments for water and power or other infrastructure components, Calico will supplement applicable work plans using previously approved TRT methodologies to address the following as to environmental baseline needs:

- Land ownership for infrastructure component
- Affected permitting agencies
- Adequacy of coverage by approved environmental baseline work plans
- Additional needs by resource category according to the following:
    - purposes and objectives
    - project study area
    - regulatory framework
    - study methodology
    - timing and duration of baseline data collections and verification
    - further anticipated studies
    - baseline characterization
    - bibliography
    - contacts

Submittals will be made to appropriate agency contacts. Public notice requirements, if any, will be met. Once approval(s) are obtained and notice of readiness to collect baseline data is received for any new data determined to be required, that data will be collected and submitted to the appropriate agencies via the TRT process

## 2.3 Unanticipated Conditions

Unanticipated conditions may be encountered during baseline data collection. Should Calico encounter unanticipated conditions that warrant additional or different data collection methodologies to ensure a complete consolidated application, environmental evaluation, or socioeconomic impact analysis, the company is directed to notify the TRT through DOGAMI. The TRT will consider the unanticipated conditions encountered, and advise the company regarding additional data collection.

Should federal permitting actions conflict with the approved state baseline methodologies or study areas, Calico will notify the TRT through DOGAMI.

# 3 1RESOURCE WORK PLANS

## 3.1 Geology and Soils

GEOLOGY AND SOILS ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.1.1 Purposes and Objectives

DOGAMI guidelines require local and regional geologic information be collected to provide a characterization of baseline conditions, including soils, surface and ground water, geology and potential geologic hazards, seismicity, mineralogy, and pre-mining topography 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; OSBGE 1996; OSBGE 2005).

The following geologic data will be 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 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 area.

The following soil information will be included:

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

### 3.1.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |
| Anticipated Project Disturbance (excluding access road): | 400 acres |

The geology study area is shown in **Figure 3, Geology Study Area and Permit Area**. The soils study area is shown in **Figure 4, Soils Study Area and Permit Area**.

The Permit Area is located within the Basin and Range Physiographic Province. This province consists of a series of nearly parallel, generally north-trending, fault-block mountains (horsts) and intervening broad valleys (grabens). This province is underlain by several thousand feet of Miocene to Holocene volcanic rocks. Regionally, generally east-west extension was accompanied by large-volume eruptions of basaltic lava. About 15.5 million years ago, shortly after eruption of the basalt, extensive eruptions of rhyolitic ash occurred forming calderas in the Owyhee Reservoir area. At approximately the same time as the Owyhee volcanism, large-scale subsidence (such as crustal sinking) along the area that is now the Oregon-Idaho state line resulted in the Oregon-Idaho graben, a 35-mile wide, north-trending rift zone about 70 miles long. This graben subsided and evolved until about nine million years ago, when regional extension migrated to the western Snake River Plain. During its five-million-year history, more than 5,000 feet of sedimentary and volcanic rocks were deposited, and numerous hydrothermal systems produced hot spring and epithermal gold-silver deposits, such as the Grassy Mountain deposit. Grassy Mountain is the largest of 12 recognized epithermal hot springs precious metal deposits of the Lake Owyhee volcanic field.

The physical setting of the project area involves drainages bounded on the east and west by bedrock controlled ridges. Soils found on the ridges are high in rock fragments throughout the profile, with high amounts of clay in the subsoils.

The geology of the Grassy Mountain area consists of interbedded sedimentary and volcanic rocks of Miocene to Pliocene age deposited in structural basins (NMC 1993). These units have been displaced by faults associated with the Basin and Range extension.

The oldest unit mapped in the area consists of lower Miocene rhyolitic tuffs and breccias (Tdr). The lower to middle Miocene age Owyhee Basalt (Tbo) unconformably overlies rhyolitic tuffs (Tdr) (NMC 1993). Basal channel-fill arkose and conglomerates (Tgsc) locally consist of granite clast conglomerates that grade

upward into white-tan arkosic sandstones and tuffaceous siltstones with bentonitic clay interbeds (Ferns and Ramp 1989).

The tuff of Kern Basin (Tkt), a pumiceous, non-welded, lithic tuff, unconformably overlies unit Tgsc. The lower part of the Grassy Mountain Formation (Tgas) conformably overlies the Tkt and consists of white to tan arkosic sandstones and siltstones with interbedded channel-fill conglomerates containing granite and black chert clasts. Hot spring activity, associated with gold mineralization at Grassy Mountain, was synchronous with deposition of Tgas as indicated by clasts of siliceous sinter and lithified colloidal gel horizons (NMC 1993). The upper part of the Grassy Mountain formation is mainly a white to tan arkosic sandstone (Tgs), which grades finer upward into white bentonitic clays near the base of the Grassy Mountain Basalt (Tgb). These basalt flows unconformably overlie the lower sediments and cap Grassy Mountain. Areas of failure and extensive landslides are common where unit Tgb basalts overlie bentonite-rich units of Tgs (Ferns and Ramp 1989).

Landslide debris (Qls) is common on the southern flank of Grassy Mountain. A chert-pebble conglomerate interbedded with diatomaceous siltstone and clays (Tcc) unconformably overlies the Grassy Mountain Formation (Tgs). A sequence of intercalated volcanic and volcaniclastic rocks (Tmdf), unconformably overlie the Grassy Mountain Basalt (Tgb). Lithic tuff breccias (Tmdf) unconformably overlie Tcc and consist of mixed mafic and pumiceous clasts that grade upward into airfall tuffs and reworked tuffaceous silt and sandstones. These are conformably overlain by sandstone and tuffaceous siltstone with local bentonitic clay horizons of unit Trs that are interbedded with the basalt at Rock Springs (Trsb). Trs and Trsb were deposited over the same time· period with Trs sedimentation occurring in basins developed on eroded older rocks and among basalt flows (Trsb).

A sequence of upper Miocene to Pliocene age tuffaceous siltstones, sandstones, and limestones (Tdb) were deposited in a lacustrine environment, conformably overlie the basalt at Rock Springs (Trsb).

Gold mineralization at Grassy Mountain occurs primarily in embedded siltstone and fine-grained sandstone (arkose) sediments. Mineralization is associated with epithermal hot springs deposition, and several siliceous sinter terraces sediments (Gustavson 2012). The Grassy Mountain measured plus indicated underground resource is 3.2 Mt with an average gold grade of 0.155 oz/t and an average silver grade of 0.260 oz/t, for a total of 503,700 oz gold and 843,200 oz silver.

### 3.1.3 Regulatory Framework

Calico has entered into a memorandum of understanding (MOU) for cost recovery with DOGAMI to facilitate the environmental permitting process. The MOU also provides a mechanism whereby Calico, as the project proponent, agrees to reimburse DOGAMI and other primary state agencies for their involvement in processing permit applications for the Grassy Mountain Project.

A key, required permit is the Permit for Chemical Processing Mining, as required under Chapter 735, Division 037, 1991 Oregon Laws (OAR 632-037-0005). 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 metallurgical process. Currently, gravity separation, conventional flotation, and potentially cyanide leaching are being evaluated. Cyanide leaching would "dissolve" gold and silver minerals; therefore, the project would be subject to these regulations.

Calico has filed a notice of intent (NOI) in order to initiate the agency process, and provide for public notice that the project is proceeding into the permitting phase. As part of initiating the public notification, an inter-agency technical review team (TRT) has been organized to provide interdisciplinary review of technical permitting issues for the state consolidated application process. The state has hired a project manager to oversee the permitting program and the lead review team. A project coordinating committee (PCC) has been formed to share information and further coordinate the federal, state and local permitting requirements, optimize communication, facilitate the regulatory process, and avoid duplicative effort.

Mine facility construction permits for Malheur County will follow the standards of the Oregon Structural Specialty Code (OSSC). Oregon currently uses the 2007 version of the OSSC.

#### 3.1.3.1 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 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.

### 3.1.4 Study Methodology

The baseline geology and soils will be characterized primarily using existing information generated from previous studies; those listed in the Literature Review section, and additional documents, if found. The geology and soils baseline study will be stamped by a registered Oregon geologist.

The methodology used to characterize site geology and potential hazards will be documented in the baseline study. The evaluation will include the review and summarization of pertinent information and data, including field assessment and exploration, testing of rocks and soil to characterize site conditions. Documentation will include maps, figures, cross sections displaying horizontal and vertical control, tables, logs of subsurface exploration, including water well logs.

Care will be made to ensure the use of the most current information available to include new geologic reports and mapping, and potential reinterpretation of regional and site geology, and seismic modeling available on the USGS website.

As mentioned at the beginning of this subsection, desktop searches and use of existing reports on regional and site-specific geology and soils will be used. Field work will include site reconnaissance along with the collection of whole rock and soil samples. Field notes and field forms, along with new laboratory data will be included in the baseline study. (See Appendix D for the rock and soil sampling form.) New data will be presented in table format, and compared to existing data.

#### 3.1.4.1 Literature Review

- 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.
- Adrian Brown Consultants, Inc. (ABC). 1992. *Physical Resources Technical Memorandum*.
- 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.
- Geomatrix Consultants, Inc. 1995. *Seismic Design Mapping, State of Oregon*. Technical report to Oregon Department of Transportation, Salem, Oregon, under Contract 11688. Unpaginated, 5 pls., scale 1:1,250,000. January.
- Gustavson Associates. 2012. *NI 43-101 Technical Report on Resources*. Grassy Mountain Gold Project, Malheur County, Oregon.
- 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.
- International Building Code (IBC). 2003/2006. Published by the International Code Council.
- 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 ground water to supply the Grassy Mountain operational needs. The JMM findings include a section that characterizes the project area geology.
- Joyner, W.B. and D.M. Boore. 1988. "Measurement, Characterization, and Prediction of Strong Ground Motion." *Proc. Earthquake Engineering and Soil Dynamics II—Recent Advances in Ground-Motions Evaluation*. Park City, Utah. American Society of Civil Engineers (ASCE) Geotechnical Special Publication No. 20.
- Kramer, Steven L. 1996. *Geotechnical Earthquake Engineering*. Prentice-Hall, Inc. Upper Saddle River, New Jersey.
- Lovell, B.B. et al. 1972. Soil Survey of Malheur, Oregon, Northeastern Part. U.S. Department of Agriculture (USDA)-Soil Conservation Service.
- Madin, Ian P. 1994. *Earthquake Database for Oregon 1833 – 10/25/93.* Open File Report 0-94-4. Oregon Department of Geology and Mineral Industries.
- Madin, I.P. and M.A. Mabey. 1996. Earthquake Hazard Maps for Oregon. Oregon Department of Geology and Mineral Industries. Geological Map Series GMS-100, 1 sheet.
- McGinnis and Red Quill. 2015. *Geology and Soils Baseline Study, Grassy Mountain Project.*
- Newmont Mining Company (NMC) Grassy Mountain Corporation. 1993.
- Oregon Department of Geology and Mineral Industries (DOGAMI). 2009. Oregon Geologic Data Compilation Project. Available online at: http://www.oregongeology.com/sub/ogdc/index.htm.
- Oregon State Board of Geologist Examiners (OSBGE). 1996. Guidelines for Preparing Engineering Geologic Reports in Oregon.
- Oregon State Board of Geologist Examiners (OSBGE). 2005. Hydrogeology Report Guidelines. First Edition.
- Oregon State Board of Geologist Examiners (OSBGE) and the Oregon Board of Examiners for Engineering and Land Surveying. 1996. Guidelines for Site-Specific Seismic Hazard Reports for Essential and Hazardous Facilities and Major and Special-Occupancy Structures in Oregon.
- Oregon Structural Specialty Code (OSSC). 2007. Available online at: http://www2.iccsafe.org/states/oregon/07_Structural/Building07_Frameset.htm
- Orr, E.L., O, W.N., Baldwin, E.M. 1992. Geology of Oregon, 4th edition. Kendall/Hunt Publishing. Dubuque, IA.

- 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.
- Sheppard R. Occurrences of Erionite in Sedimentary Rocks of the Western United States. Denver, CO: US Department of the Interior, US Geological Survey; 1996. Open File Report 96-018. http://pubs.usgs.gov/of/1996/0018/report.pdf
- 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 ground water 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 soils 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).
- SRK. 1989/1990. Studies in connection with feasibility studies for the Grassy Mountain Project. Activities U.S. Department of Agriculture, Natural Resources Conservation Service soil survey at: http://websoilsurvey.nrcs.usda.gov/app/
- U.S. Department of Agriculture, Natural Resources Conservation Service soil survey at: http://websoilsurvey.nrcs.usda.gov/app/
- U.S. Geological Survey (USGS). 2009a. National Earthquake Information Center, Earthquake Search Web Page. Golden, Colorado. Available online at: http://neic.usgs.gov/neis/epic/epic_circ.html.
- U.S. Geological Survey (USGS). 2009b. Earthquake Hazards Program, National Seismic Hazard Mapping Project Web Page. Golden, Colorado. Available online at: http://eqhazmaps.usgs.gov.
- Walker, G.W. and N.S. MacLeod. 1991. Geologic Map of Oregon: U.S. Geological Survey, scale 1:500,000, 2 sheets.
- 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 will be reviewed and used to determine the seismic potential of the Permit Area.

#### 3.1.4.2 Field Studies

It is believed that there is sufficient existing information to characterize the baseline topography, soils, geology, geologic hazards and seismic conditions for the study area. However, additional fieldwork will be performed if there are unresolved or ambiguous issues identified through literature review and geologic site reconnaissance. Additional fieldwork will also be performed if the project footprint increases using the same approved methodologies.

Outcrop whole-rock and composite soils samples will be collected within the planned project footprint and access road areas. Up to 10 rock samples will be collected. Soil samples will be collected at representative soil types and those areas to be disturbed by mining. The soil types will be chosen based on classification of soils by the USDA – Soil Conservation Service (now NRCS) and the 1991 soil survey performed by IMS, Inc. The rock and soil samples will be tested for the following trace metals:

- Mercury

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

Laboratory test work for the Grassy Mountain mine project will be conducted using standard methods routinely used in the hardrock mining industry. For this baseline study, rock and soil trace element analysis will be determined using U.S. Environmental Protection Agency (USEPA) methods 3050 and 6010 at detection limits below regulatory standards. Coordination with the laboratory will occur to ensure correct methods and sample amounts. Presently, 0.5 kilograms rock material and a 1-gallon bag of soil is anticipated.

Ten composite soil samples will also undergo agricultural soil analyses to determine adequacy for reclamation.

### 3.1.5 Timing and Duration of Baseline Data Collection and Verification

Fieldwork, soil and rock sampling, and baseline data collection will be completed no later than 2018.

### 3.1.6 Further Anticipated Studies

No additional geology or soils studies are anticipated. If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies.

### 3.1.7 Baseline Characterization

The baseline characterization report for geology and soils will include:

- Introduction
- Regulatory environment
- Grassy Mountain geologic study area
- Data sources
- Methodology
- Existing geology environment and geotechnical conditions (description and mapping of the regional area around the study area, extended to 4,000 meters). However, regional geology features such as regional structures and faulting will be shown at an appropriate scale to include those features affecting the project area.
    - Topographic setting
    - Regional geology
    - Site geology
    - Structural geology
    - Ground water and springs
    - Seismic conditions (fault zones and probabilistic or deterministic ground motion estimates)

  - Slope stability
- Potential geologic hazards (description and mapping)
  - Earthquake failures
  - Unsuitable soils
  - Slope failures
  - Landslide areas
  - Ground water considerations
  - Soil erosion
  - Volcanic eruptions
  - Erionite deposits (if present)
- Existing geology environment and effects
  - Soil types in the project area (map of soils)
  - Soil profile thickness
  - Waste rock and ore characterization (from the geochemical baseline study write-up)
  - Estimated effects of the project proposal on the local-geologic environment
  - Potential monitoring and mitigation measures
  - Residual effects
  - Reclamation/closure considerations
- List of preparers

### 3.1.8 Bibliography

ACZ Inc. 1993. *Workplan for Baseline Hydrologic Studies.*

Adrian Brown Consultants, Inc. (ABC). 1992. *Physical Resources Technical Memorandum*.

Atlas Precious Metals, Inc. (Atlas). 1991. *Final Report: Soil Resources of the Grassy Mountain Project Area*.

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, Mark L. and Ramp, Len. 1989. Geology and Mineral Resources Map of the Grassy Mountain Quadrangle, Malheur County, Oregon. DOGAMI 1:24000. 1 sheet.

Geomatrix Consultants, Inc. 1995. *Seismic Design Mapping, State of Oregon*. Technical report to Oregon Department of Transportation, Salem, Oregon, under Contract 11688. Unpaginated, 5 pls., scale 1:1,250,000. January.

Gustavson Associates. 2012. *NI 43-101 Technical Report on Resources*. Grassy Mountain Gold Project, Malheur County, Oregon.

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*.

International Building Code (IBC). 2003/2006. Published by the International Code Council.

J.M. Montgomery, Consulting Engineers, Inc. (JMM). 1991. Hydrogeologic investigation findings.

Joyner, W.B. and D.M. Boore. 1988. "Measurement, Characterization, and Prediction of Strong Ground Motion." *Proc. Earthquake Engineering and Soil Dynamics II—Recent Advances in Ground-Motions Evaluation*. Park City, Utah. American Society of Civil Engineers (ASCE) Geotechnical Special Publication No. 20.

Kramer, Steven L. 1996. *Geotechnical Earthquake Engineering*. Prentice-Hall, Inc. Upper Saddle River, New Jersey.

Lovell, B.B. et al. 1972. Soil Survey of Malheur, Oregon, Northeastern Part. U.S. Department of Agriculture (USDA)-Soil Conservation Service.

Madin, Ian P. 1994. *Earthquake Database for Oregon 1833 – 10/25/93.* Open File Report 0-94-4. Oregon Department of Geology and Mineral Industries.

Madin, I.P. and M.A. Mabey. 1996. Earthquake Hazard Maps for Oregon. Oregon Department of Geology and Mineral Industries. Geological Map Series GMS-100, 1 sheet.

McGinnis and Red Quill. 2015. *Geology and Soils Baseline Study, Grassy Mountain Project.*

Newmont Grassy Mountain Corporation. 1993. *Environmental Baseline Studies Work Plan*.

Oregon Department of Geology and Mineral Industries (DOGAMI). 2009. Oregon Geologic Data Compilation Project. Available online at: http://www.oregongeology.com/sub/ogdc/index.htm.

Oregon State Board of Geologist Examiners (OSBGE). 1996. Guidelines for Preparing Engineering Geologic Reports in Oregon.

Oregon State Board of Geologist Examiners (OSBGE). 2005. Hydrogeology Report Guidelines. First Edition.

Oregon State Board of Geologist Examiners (OSBGE) and the Oregon Board of Examiners for Engineering and Land Surveying. 1996. Guidelines for Site-Specific Seismic Hazard Reports for Essential and Hazardous Facilities and Major and Special-Occupancy Structures in Oregon.

Oregon Structural Specialty Code (OSSC). 2007. Available online at: http://www2.iccsafe.org/states/oregon/07_Structural/Building07_Frameset.htm

Orr, E.L., O, W.N., Baldwin, E.M. 1992. Geology of Oregon, 4th edition. Kendall/Hunt Publishing. Dubuque, IA.

Seegmiller International (1989), Golder Associates, Inc. (1989, 1991, and Denver Knight Piesold Environmental Consultants, Inc. (1991). Geotechnical investigations.

Sheppard R. Occurrences of Erionite in Sedimentary Rocks of the Western United States. Denver, CO: US Department of the Interior, US Geological Survey; 1996. Open File Report 96-018. http://pubs.usgs.gov/of/1996/0018/report.pdf

SRK. 1989/1990. Studies in connection with feasibility studies for the Grassy Mountain Project. Activities U.S. Department of Agriculture, Natural Resources Conservation Service soil survey at: http://websoilsurvey.nrcs.usda.gov/app/

U.S. Geological Survey (USGS). 2009a. National Earthquake Information Center, Earthquake Search Web Page. Golden, Colorado. Available online at: http://neic.usgs.gov/neis/epic/epic_circ.html.

U.S. Geological Survey (USGS). 2009b. Earthquake Hazards Program, National Seismic Hazard Mapping Project Web Page. Golden, Colorado. Available online at: http://eqhazmaps.usgs.gov.

Walker, G.W. and N.S. MacLeod. 1991. Geologic Map of Oregon: U.S. Geological Survey, scale 1:500,000, 2 sheets.

Western Technologies, Inc. (WTI).1988. Monitoring and production well logs of drill cuttings and recordation of lithologies from drilling and installation of monitoring and production wells.

### 3.1.9 Contacts

Jim Johnson
Land Use and Water Planning Coordinator
Oregon Department of Agriculture
503-986-4706
jjohnson@oda.state.or.us

Bob Houston
Oregon Department of Geology and Mineral Industries
541-225-6451
Robert.HOUSTON@oregon.gov

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

## 3.2 Geochemistry

GEOCHEMISTRY ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.2.1 Purposes and Objectives

The purpose of this environmental baseline work plan is to geochemically characterize development rock, tailings, and backfill rock anticipated to be produced by the proposed Grassy Mountain mine. Development rock will be produced from access and haulage drifts mined adjacent to the ore body. Tailings will be produced by the metallurgical treatment process of ore. Backfill rock will come from adjacent surface pits. The results of the test work described herein will ultimately be used to assess how the project may alter geochemical and water quality conditions in the project area. These data will assist in assessing the potential effects to ground water and surface water for possible acid rock drainage (ARD) and metals leaching (ML). Tailings and/or development rock may also be used for underground backfill.

The chemical evaluation described will accommodate the following:

1 ) characterize process tailings and development rock, which includes
   a. surface development rock during road (and other) construction
   b. excavation of a decline to reach the ore zone,
   c. ore (that may be stockpiled),
   d. rock potentially exposed in the walls of underground workings,
   e. borrow and construction rock;
2 ) assess the potential for acid rock drainage and/or metals leaching from these sources; and
3 ) provide the geochemical component, in combination with baseline ground water characterization data needed to design a predictive model, which will simulate the potential for ARD and ML, and methods for prevention, moderation or control, should these conditions be determined to exist.

These data will also serve to allow for the development of the monitoring programs to confirm that preventative and/or control measures are working.

Determining the physical and chemical character of mine waste materials is a prerequisite to the following:

1) recognizing the physical, chemical, and biological impacts of mine waste disposal; and
2) developing appropriate mitigation measures.

Environmental test samples will be collected as part of a comprehensive program designed to examine the range of conditions that occur or could occur. Tested materials will include exploration samples (as available) and batch and/or pilot-plant waste products. Physical and chemical characterization studies will be conducted in a manner that provides conservative estimates of their composition, in order to provide information necessary to determine the potential environmental impacts in the environmental evaluation phase of the Division 37 permit process.

The present program to characterize development rock (waste rock from decline and underground workings) and process tailings will follow the guidance provided in the *Global Acid Rock Drainage (GARD) Guide* (www.gardguide.com), the industry best practices for characterization to support evaluation of potential future impacts to water resources and design of appropriate mitigation strategies. The plan further provides for strategic decision points at which regulating agencies are provided the opportunity to review, discuss and provide recommendations/requirements leading to approval of slated actions in this necessarily step-wise program.

Data are needed to characterize the geochemical variability of relevant rock types at the mine site and the chemical quality of any potential contact water. This includes data on the following for site materials sampled:

- ARD/ML potential of the following:
  - tailings from mineral benefaction processes
  - development rock in storage facilities or used for construction
  - ore placed in temporary storage stockpiles
- Total metals concentrations of rock deposited in development rock storage facilities
- Solution chemistry of water entrained in tailings

Laboratory test work to be conducted for the Grassy Mountain mine project will be conducted using standard methods routinely used in the hardrock mining industry and consists of the following procedures:

- Acid-base accounting (ABA) (with sulfur species in total inorganic carbon) to evaluate the ARD potential of waste rock.
- Net acid generation (NAG)
- Nevada meteoric water mobility procedure (MWMP) to evaluate the chemical quality of rainwater contacting freshly placed development rock, tailings and stockpiled ore. Results from this test can represent dissolution of readily soluble minerals or the first flush of stored-up products of sulfide mineral oxidation. Sequential MWMP data may also be generated to provide further insight into the evolution of water quality as it percolates through a stockpile.
- Total elemental composition will be determined for mine materials using a four-acid digestion. Method 6010 will primarily be used to analyze the resulting digestates, although other techniques (e.g., cold vapor atomic absorption) will be used as deemed appropriate and necessary.
- Mineralogy of development rock and tailings will be assessed using x-ray diffraction (XRD), scanning electron microscopy (SEM), and optical mineralogy to identify the minerals in the development rock, ore, and tailings. The objective of the mineralogical assessment is to determine bulk mineral composition as well as mineral associations and grain boundary conditions (mineral occlusion) that might restrict the reactivity of any acid-producing or acid-consuming phases. Optical and SEM work will also be used to assess, to the extent possible, the variation of sulfide minerals present to provide a basis to revise AP calculations to exclude any sulfide minerals unlikely to produce acidity.
- Humidity cell testing (HCT) (kinetic) work will be conducted on materials whose ABA characterization identifies them as uncertain with respect to acid generation in order to refine the material characterization, and to provide a means by which to gauge long-term contact water quality. Similarly, HCT work will be conducted on a limited number of material samples that are characterized as likely to generate acidity by ABA to confirm that assessment as well as provide a basis for estimating long-term contact water quality.

The present program provides for sampling to be tied to the mine plan and will be designed to represent the different lithologic units that will be encountered, excavated, processed, disposed of, or exposed. It will establish the chemical and physical variability of each geologic unit encountered during excavation of the decline constructed to reach the deposit ore zone, as well as samples of tailings produced during metallurgical process development.

### 3.2.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on

lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |
| Anticipated Project Disturbance (excluding access road): | 400 acres |

The geochemistry study area is shown in **Figure 5, Geochemistry Study Area and Permit Area and Figure 6, Geochemistry Study Area.**

Limited review of existing site studies indicates that gold mineralization at Grassy Mountain was formed by epithermal hot spring activity. The boiling water produced brecciation, alteration of county rock, and precipitation of precious metals with only trace amounts of base metals. Alteration occurred mainly by silicification with the precious metals commonly occurring in quartz adularia-sericite veinlets. Alteration may grade downward into alunite-kaolinite-pyrophyllite zones. Silica is almost always the most abundant gangue mineral. The mineralizing fluid appears to have been highly acidic, based on historic records of assessment of alteration assemblages. Pyrite and other iron sulfides are the most common sulfide phases. Arsenic mercury and antimony sulfides may also be present.

From previous visual geologic logging of drill core, it appears that the sulfide ore body originally emplaced has been partially to completely oxidized by contacting waters. Within the oxidized zone, sulfides may be wholly or partially replaced by oxides, hydroxides, sulfates, or carbonates.

Rock types at the grassy mountain site include the following:

- tuffaceous siltstones
- clay stones
- arkosic sandstones
- conglomerates
- olivine basalts

The sedimentary rocks are variably cemented in some places with calcite and silica in the immediate vicinity of the main deposit. Hydrothermal alteration and oxidation are also variable. Previous project geologists developed a classification of 11 geochemically distinct rock types, based on lithology, degree of alteration, and oxidation state. This classification may not be applicable to the mine plan currently in development and will be assessed and revised as necessary as part of this program.

**Table 1** lists a statistical summary of trace metals present in rocks associated with the Grassy Mountain ore deposit, based on prior studies. This list is consistent with the results of more recent multi-element analyses conducted by Calico exploration geologists. These data indicate mercury, arsenic, antimony, tungsten, and possibly selenium may be elevated, compared to their commonly-occurring ranges in sedimentary and igneous rocks. These are the elements commonly elevated in epithermal deposits (Hedenquist, et al., 2000) Base metals copper, molybdenum, lead, zinc, and cadmium are not elevated in Grassy Mountain rocks, according to previous studies.

**Table 1. Trace Metals in Whole-Rock Samples** (all chemical values expressed in parts per million [ppm])

| Element | # of Samples | Mean Concentration | Standard Deviation | Range of Crustal Rock |
|---|---|---|---|---|
| Mercury | 484 | 1.789 | 2.080 | 0.046 - 0.33 |
| Arsenic | 484 | 141 | 483 | 1.0 - 9.0 |
| Antimony | 484 | 27 | 27 | 0.14 - 0.81 |
| Tungsten | 48 | 11 | 14 | 0.56 - 1.9 |
| Tellurium | 48 | <0.05 | N/A | N/A |
| Thallium | 48 | 0.9 | 0.6 | 0.065 - 1.6 |
| Copper | 194 | 16 | 13 | 4.4 - 97 |
| Molybdenum | 194 | 21 | 2.3 | 0.50 - 4.2 |
| Lead | 194 | 8.1 | 8 | 14 - 80 |
| Zinc | 194 | 22 | 22 | 16 - 130 |
| Cadmium | 194 | 0.11 | 0.07 | 0.02 - 0.19 |
| Selenium | 194 | 0.9 | 1 | 0.05 - 0.60 |
| Bismuth | 194 | 0.11 | 0.06 | N/A |

(1) Range of crustal rock abundance from Horn and Adams (1966); from: Grassy Mountain Physical Resources Technical Memorandum, 1992, ABC.

### 3.2.3 Regulatory Framework

This work plan and methodology for geochemical characterization of development rock and tailings is prepared to meet the following regulatory requirements:

- Oregon Department of Geology and Mineral Industries (DOGAMI) Division 37 Chemical Process Mining, Oregon Administrative Rule (OAR) 623-037-055 and OAR 632-037-009; and
- applicable Oregon Department of Environmental Quality (ODEQ) Division 43 Chemical Mining Rules, OAR 430-043-000, which address process mining.

The property involves patented mining claims and public lands administered by the Vale District of BLM. Access to the project area is south from Vale on the Twin Springs Road. Calico proposes to develop an underground mine. The processing plant and tailings storage facility (TSF) would be located adjacent to the mine. Waste rock would be stored at the mine site.

### 3.2.4 Study Methodology

#### 3.2.4.1 Overview of Characterization

As described above, and repeated here for clarity and reference, the present program to characterize development rock (waste rock from decline and underground workings) and process tailings will follow the guidance provided in the *Global Acid Rock Drainage (GARD) Guide* (www.gardguide.com), the industry

best practices for characterization to support evaluation of potential future impacts to water resources and design of appropriate mitigation strategies. The plan further provides for strategic decision points at which regulating agencies are provided the opportunity to review, discuss and provide recommendations/requirements leading to approval of slated actions in this necessarily step-wise program.

Data are needed to characterize the geochemical variability of relevant rock types at the mine site and the chemical quality of any potential contact water. This includes data on the following for site materials sampled:

- ARD/ML potential of the following:
  - tailings from mineral benefaction processes
  - development rock in storage facilities or used for construction
  - ore placed in temporary storage stockpiles
- Total metals concentrations of rock deposited in development rock storage facilities
- Solution chemistry of water entrained in tailings

Laboratory test work to be conducted for the Grassy Mountain mine project will be conducted using standard methods routinely used in the hardrock mining industry and consists of the following procedures:

- Acid-base accounting (ABA) (with sulfur species in total inorganic carbon) to evaluate the ARD potential of waste rock.
- Net acid generation (NAG)
- Nevada meteoric water mobility procedure (MWMP) to evaluate the chemical quality of rainwater contacting freshly placed development rock, tailings and stockpiled ore. Results from this test can represent dissolution of readily soluble minerals or the first flush of stored-up products of sulfide mineral oxidation. Sequential MWMP data may also be generated to provide further insight into the evolution of water quality as it percolates through a stockpile.
- Total elemental composition will be determined for mine materials using a four acid digestion. Method 6010 will primarily be used to analyze the resulting digestates, although other techniques (e.g., cold vapor atomic absorption) will be utilized as deemed appropriate and necessary.
- Mineralogy of development rock and tailings will be assessed using x-ray diffraction (XRD), scanning electron microscopy (SEM), and optical mineralogy to identify the minerals in the development rock, ore, and tailings. The objective of the mineralogical assessment is to determine bulk mineral composition as well as mineral associations and grain boundary conditions (mineral occlusion) that might restrict the reactivity of any acid-producing or acid-consuming phases. Optical and SEM work will also be used to assess to the extent possible the variation of sulfide minerals present to provide a basis to revise AP calculations to exclude any sulfide minerals unlikely to produce acidity.
- Humidity cell testing (HCT) (kinetic) work will be conducted on materials whose ABA characterization identifies them as uncertain with respect to acid-generation in order to refine the material characterization, and to provide a means by which to gauge long-term contact water quality. Similarly, HCT work will be conducted on a limited number of material samples that are characterized as likely to generate acidity by ABA to confirm that assessment as well as provide a basis for estimating long-term contact water quality.

#### 3.2.4.2 Work Plan

The overall work plan to characterize development rock and metallurgical tailings is schematically presented in **Figure 7, Workflow for Geochemical Characterization Plan**.

#### 3.2.4.2.1 Geo-Environmental Model

The present plan provides for the development of a geo-environmental model (GEM) that provides for the integration of the ore deposit geology and mineralogy with mining and processing methods. These elements will subsequently be combined with information regarding environmental characteristics to assess potential environmental impacts. At the completion of this stage, as indicated in **Figure 7**, a detailed work plan regarding sample selection, laboratory procedures and key criteria for decision-making throughout the process will be submitted for agency review and approval.

#### 3.2.4.2.2 Sampling Procedures

As proposed, the Grassy Mountain Project will be developed as an underground mine. As such, limited amounts of development (waste) rock will be produced along with tailings resulting from the processing of ore. Backfill rock will be used to fill the mined areas after the ore is removed. This work plan provides for sampling of material representative of these waste streams, and as described above, is anticipated to include:

- surface development rock during road (and other) construction
- rock excavated for construction of a decline to reach the ore zone
- ore (that may be stockpiled)
- rock potentially exposed in the walls of underground workings
- borrow and construction rock
- potential backfill rock

##### 3.2.4.2.2.1 Development Rock

Sampling to characterize the development (waste) rock stream will be guided by the anticipated location of the decline (adit) constructed to access the deposit ore zone, but augmented with historical data as applicable. Exploration drilling borehole logs and geologic mapping (plan view and cross-sections) will be used to identify the specific rock units to be encountered during construction. In combination with anticipated engineering design of the decline, approximate volumes/masses of each anticipated rock unit will be calculated. Sampling for test material will be conducted to ensure that the sampling frequency for each unit will be proportional to the mass of each unit to be excavated. Rock units comprising a greater proportion of waste will be sampled more than those occurring less frequently, and only samples that are below ore cutoff grade will be targeted as development rock (not ore).

In addition to development rock associated with construction of a decline to access the deposit ore zone, the program anticipates the sampling of development rock that is in close association with the ore zones. This material will be related to the limited construction of underground work areas and will be identified by the mine plan.

Historical geochemical characterization data for the project site will be compiled and initially used to develop the GEM, but will also be used to the extent possible to characterize anticipated development rock. While the focus of the present plan is on waste rock that will be produced during construction of the decline, historical geochemical characterization will be used as applicable. In instances where historical data are available that correspond to the decline, they will be used preferentially to form a basis for augmentation with sampling from more recent drilling as available. Currently, it is not anticipated that archived material is available for further testing, owing either to its loss or damage over time.

This work plan provides for iterative sampling. Initially, it is anticipated that 60 samples of anticipated development rock will be collected and apportioned among the rock units expected in construction of the decline and underground workings in proportion to their relative masses. As illustrated in **Figure 7**, these samples will be submitted for ABA and total element composition analysis. A subset of samples corresponding to typically-observed ABA measurements and total composition will be submitted for mineralogical analysis. These data, augmented with applicable historical data, will be assessed to determine if they converge with respect to net neutralization potential (NNP; acid potential-neutralization potential)

and neutralization potential ratio (NPR; neutralization potential/acid potential). Convergence will be determined by calculating the running average of sample NNP and NPR as well as the standard deviation. To the extent that these parameters converge to within ±15 percent, they will demonstrate a lack of additional improvement in characterization confidence with additional sampling, and provide the basis to conclude sampling. Given the relatively small mass of development rock anticipated for the decline (compared to an open pit design), this convergence is anticipated as a result of the initial sampling, pending the actual geochemical variability of the mapped rock units. However, as illustrated in **Figure 7**, should sampling be deemed insufficient after an initial round with regulatory review, the program provides for further sampling until representativeness of samples is acceptable.

Samples will be identified through review of drilling logs for material associated with the vicinity of the proposed decline. A listing of identified samples (initial round and any required subsequent samples) will be presented to agency personnel and their representative, with supporting geologic descriptions, for discussion and approval. For each sample interval, approximately 8 to 10 kilograms (kg) of sample will be collected and will be composited from archived material. To the extent possible, sample material will be composited over a length of borehole that is consistent with the diameter of the proposed decline. Calico will prepare an assessment of initial sample representativeness and submit it to agency personnel and their representative to either conclude sample collection, or identify materials requiring further work.

Samples that are characterized as non-acid generating using NPR, NNP, and other material characteristics will be evaluated for identification of appropriate materials to be submitted for MWMP leach testing. Materials characterized as likely or uncertain to produce acidic drainage will be assessed to identify potential selections for HCT. The samples, selected for MWMP and HCT, and the basis for their selection, will be made by preparing frequency distribution diagrams to identify average material as well as that corresponding to one standard deviation from the mean to bracket potential contact water quality. A listing of samples selected for sampling, and the basis for the selection will be submitted to agency personnel and their representative. This submission will also identify the objectives of any HCT to establish appropriate test termination criteria[1] prior to initiation of testing.

If data are not already available from Calico's exploration analyses for total metals, samples will also be analyzed for a comprehensive suite of total metals to provide a baseline. These data can provide an indication of which metals are indicators of mine waste left exposed at closure. For example, a metal like arsenic could exceed the concentration in soil level build up, and potentially require a cover as mitigation in the actual mining and reclamation phases of the project. Although a substantial amount of data of this type is currently available for rock associated with the deposit, the present work plan will seek to assure that data corresponding specifically to development rock associated with the construction of underground facilities is also developed. Mineralogical data will also be collected on select, representative samples at this stage to evaluate the specific nature of potentially reactive materials and the manner in which they are exposed, and therefore, available to react with any contacting water.

#### 3.2.4.2.2.2 Tailings and Stockpiled Ore

Sampling of tailings and material representing stockpiled ore will necessarily be dependent on bench-scale metallurgical testing. As tailings samples are produced during metallurgical work, samples of the beginning ore (representing stockpiled ore), solid tailings as well as entrained tailings water resulting from processing will be collected. As shown in **Figure 7**, these materials will be submitted for ABA and total element composition, and subsequently either MWMP or HCT (or both depending on chemical character) Tailings will be developed as part of on-going project development studies, and will be submitted for characterization as materials become available.

[1]ASTM protocol for HCT dictates a minimum of 20 weeks duration, but the actual test length will be established to achieve program objectives.

#### 3.2.4.2.2.3 Backfill Rock

Backfill rock samples produced from surface pits will be collected. As shown in **Figure 7**, these materials will be submitted for ABA and total element composition, and subsequently either MWMP or HCT (or both depending on chemical character). Backfill rock will be developed as part of on-going project development studies, and will be submitted for characterization as materials become available.

### 3.2.4.2.3 Analytical Procedures

A range of analytical techniques will be employed to characterize development rock, tailings, and backfill rock. All are industry standards. An accredited analytical laboratory will be identified as part of producing the detailed characterization work plan that routinely conducts mine rock characterization, and will be used to conduct the analyses provided in this work plan. The plan provides for close interaction with the selected analytical laboratory by the project geochemist to assure proper methodologies are used, followed and, to the extent necessary, adapted to meet specific project objectives.

#### 3.2.4.2.3.1 Acid-base Accounting

All samples will be analyzed for ABA and NAG parameters. ABA testing is a static test procedure designed to measure the long-term potential for waste rock and/or tailings to generate acid.

A modified ABA testing procedure will be used for ABA analyses, based upon recent guidance developed by the Nevada Department of Environmental Protection (NDEP 2010). The modified ABA method determines the acid generation potential based on the pyritic form of sulfur present in the sample. However, the total sulfur and sulfate sulfur forms will also be reported per Sobek, et al. (1978). Neutralization potential (NP) in the modified ABA method is determined over a 24-hour period rather than only an initial titration, and uses a pH and endpoint of 8.3 opposed to 7.0 in the standard test. Paste pH will also be reported with the ABA results (USDA Method No. 21, Handbook 60).

Results will be evaluated in conjunction with available mineralogical analysis to assess the performance of the ABA measurements and modifications to the ABA procedure made, as necessary, to improve the utility of the method performance.

#### 3.2.4.2.3.2 Net-Acid Generation

The NAG procedure will be used to supplement the ABA procedure. If ABA results are uncertain or otherwise appear inconsistent with the expected mineralogy and geochemical behavior of the rock, the NAG results can help resolve the inconsistency. In addition, the procedure increases the confidence in the conclusions regarding potential ARD generation.

#### 3.2.4.2.3.3 Total Element Composition

The samples will be analyzed for a suite of metals and other analytes listed in **Table 2**. Four-acid digestion is anticipated for 48 metals and mercury.

**Table 2. Parameters for Multi-Element Analyses**

| Parameter | MWMP | Multi-Element | Parameter | MWMP | Multi-Element |
|---|---|---|---|---|---|
| Aluminum (Al) | X | X | Niobium (Nb) | -- | X |
| Antimony (Sb) | X | X | Phosphorus (P) | X | X |
| Arsenic (As) | X | X | Rhenium (Re) | -- | X |
| Barium (Ba) | X | X | Rubidium (Rb) | -- | X |
| Beryllium (Be) | X | X | Scandium (Sc) | -- | X |
| Bismuth (Bi) | -- | X | Selenium (Se) | X | X |

**Table 2. Parameters for Multi-Element Analyses**

| Parameter | MWMP | Multi-Element | Parameter | MWMP | Multi-Element |
|---|---|---|---|---|---|
| Boron (B) | X | X | Silver (Ag) | X | X |
| Cadmium (Cd) | X | X | Strontium (Sr) | X | X |
| Cerium (Ce) | -- | X | Tantalum (Ta) | -- | X |
| Cesium (Cs) | -- | X | Tellurium (Te) | -- | X |
| Chromium (Cr) | X | X | Thallium (Tl) | X | X |
| Cobalt (Co) | -- | X | Thorium (Th) | -- | X |
| Copper (Cu) | X | X | Tin (Sn) | X | X |
| Fluoride (F) | X | -- | Titanium (Ti) | -- | X |
| Gallium (Ga) | -- | X | Tungsten (W) | -- | X |
| Germanium (Ge) | -- | X | Vanadium (V) | X | X |
| Hafnium (HF) | -- | X | Yttrium (Y) | -- | X |
| Indium (In) | -- | X | Zinc (Zn) | X | X |
| Iron (Fe) | X | X | Zirconium (Zn) | -- | X |
| Lanthanum (La) | -- | X | Total Dissolved Solids | X | -- |
| Lead (Pb) | X | X | Calcium (Ca) | -- | X |
| Lithium (Li) | X | X | Magnesium (Mg) | -- | X |
| Manganese (Mn) | X | X | Sodium (Na) | X | X |
| Mercury (Hg) | X | X | Potassium (K) | X | X |
| Molybdenum (Mo) | X | X | Alkalinity | X | -- |
| Nickel (Ni) | X | X | Sulfate | X | -- |

X = Parameter will be analyzed
-- = Parameter will not be analyzed

#### 3.2.4.2.3.4 Meteoric Water Mobility Procedure

The MWMP (American Society for Testing and Materials method ASTM E2242-12e1; NDEP 1990) will be used as a leachate extraction test to estimate the types and levels of pollutants that may leach from various mine materials under the effects of rainfall or run-on. Each sample requires 5 kg of less than 5 centimeters (cm) material. For the MWMP procedure, synthetic meteoric water (i.e., de-ionized water with a pH around the 5-6) is used. MWMP involves a single pass leaching through the sample in a column at one-to-one water to solid ratio. Leachates will be analyzed for all regulated inorganic constituents.

#### 3.2.4.2.3.5 Kinetic Testing

Sample selection for HCT work will be made through evaluation of frequency distribution of NNP and NPR static test data. Samples deemed to be of uncertain acid production potential (1<NPR<3 and -20<NNP<+20) will be selected to correspond to average, bulk character. Other samples of uncertain character may also be selected to identify potential sulfide sulfur cutoff criteria for potential future waste rock segregation. Samples will also be selected corresponding to a likely acid production potential that is about one standard deviation off the mean uncertain material.

The humidity cell procedure consists of multiple weekly cycles that expose the sample to moisture and oxygen (ASTM D5744-12). Each cycle will consist of a 3-day application of dry air followed by a 3-day application of water-saturated air. During the seventh day, the sample will be flooded with deionized water

and the resulting leachate will be collected and analyzed for all iron, sulfate, pH, alkalinity and conductivity. Leachates will be composited over 5-week intervals and each will be analyzed for all regulated inorganic constituents.

The ASTM procedure for the HCT calls for a minimum test duration of 20 weeks. Test cells that are clearly acid producing, or have abundant alkalinity and no evidence of sulfide oxidation, may provide sufficient information to support termination after 20 weeks, while materials with more uncertain characteristics may require continued testing. In many cases with appreciable sulfide-bearing materials, more than 20 weeks may be required to evaluate reactivity of the sample. As shown in **Figure 7**, Calico will propose criteria for termination of HCTs to meet the objectives of the testing program at the time that HCT samples are identified and submitted for approval. HCTs will not be terminated without agency approval.

Once it is determined that HCTs have been conducted long enough to meet the objectives of the test, the test will be stopped. Columns will be dismantled and termination analyses will be conducted. These analyses will include multi-element analyses and ABA/NAG testing.

#### 3.2.4.2.3.6 Mineralogy

Mineralogical examination of HCT samples will be conducted to aid in interpretation of leachate chemistry from these tests. The analysis will be determined using XRD (Rietveld refinement) analysis, SEM, and optical microscopy. Existing Calico data may provide an important component of this analysis and will be incorporated as applicable. Assessment will be focused on mineral grain boundary issues (e.g., potential inclusion of sulfide minerals within unreactive matrices) that could affect weathering behavior, and potential variability of sulfide mineral composition that could affect calculation of ABA and assessment of acid potential.

#### 3.2.4.2.3.7 Quality Control

Quality control for the analysis of the solids will use duplicates collected during sample selection, if pulps are used. If core is used, samples will be split during sample preparation at the laboratory. In addition to the duplicates, the laboratory quality control data will be evaluated upon receipt of the analytical reports, and a summary will be provided in the baseline report evaluating the quality of the data.

#### 3.2.4.2.4 Schedule

It is anticipated that the initial steps presented in **Figure 7** (Development of GEM, Integration with Mine Plan, Development of Draft Workplan) will include review of all historic information and data related to the Grassy Mountain Project. This work plan will be submitted for agency review, discussion and approval prior to conducting official characterization activities, although it is possible that Calico may conduct various investigations of a similar nature outside the specific scope of the work plan. Characterization of mine-related materials will likely continue up to permit application, and throughout life-of-mine.

### 3.2.4.3 Summary

The present program provides for characterization of process tailings and a range of mine development rock associated with the proposed Grassy Mountain Mine. The program will conform to the GARD guide, the international standard for such work, and specifically provides for agency review and approval at specific, key points in the program.

## 3.2.5 Timing and Duration of Baseline Data Collection and Verification

Geochemistry baseline studies will be completed no later than 2018.

### 3.2.6 Further Anticipated Studies

No additional geochemistry studies are anticipated. If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies.

### 3.2.7 Baseline Characterization

The baseline characterization report for geochemistry will include:

- Introduction
- Regulatory environment
- Geochemistry study area
- Data sources
- Site conditions
  - Topographic setting and climate
  - Regional geology
  - Site geology
  - Surface water and springs
  - Ground water
- Mine plan, conceptual model, and program design
- Characterization program methodology
- Preliminary geochemical testwork results
  - Multi-element analysis
  - Acid base accounting
  - Net acid generation
- Leach testing
  - Short-and long-term term leach tests
- Erionite sampling and analysis
- List of preparers

### 3.2.8 Bibliography

ABC (1992) Grassy Mountain Physical Resources Technical Memorandum, 1992, ABC

Hedenquist, J. W., A. Arribas R, et al. (2000). Exploration for epithermal gold deposits. *Gold in 2000*. S. G. Hagemann and P. E. Brown. Littleton, CO, Soc. Econ. Geologists. **13:** 245-277.

Horn and Adams (1966) “Computer Derived Geochemical Balances and Element Abundances” from Geochemica et Cosmochimica Acta, v. 30, p. 279- 297.

NDEP (2010) State of Nevada Modified Sobek Procedure (http://ndep.nv.gov/bmrr/file/sobek.pdf)Nevada Department of Environmental Protection

Sobek, A.A., Schuller, W.A., Freeman, J.R. Smith, R.M. 1978. *Field and Laboratory Methods Applicable to Overburden and Minesoils*. EPA 600/2-78-054.

Stewart, W.A., Miller, S.D., and Smart, R. (2007) Advances in Acid Rock Drainage (ARD) Characterisation of Mine Wastes. 7thInternational Conference on Acid Rock Drainage (ICARD), March 26-30, 2006, St. Louis MO. R.I. Barnhisel (ed.) Published by the American Society of Mining and Reclamation (ASMR), 3134 Montavesta Road, Lexington, KY 40502.

### 3.2.9 Contacts

Ken Lucas
Oregon Department of Environmental Quality
541-278-4063
lucas.ken@deq.state.or.us

Amy Prestia
SRK Consulting
541-278-4611
aprestia@srk.com

Richard DeLong
EM Strategies, Inc.
775-826-8822
rich@emstrats.com

## 3.3 Surface Water

SURFACE WATER ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.3.1 Purposes and Objectives

The purpose of this surface water baseline study is to describe appropriate methodology needed to characterize existing surface water resources at the Grassy Mountain Project mine site. The overall water resources characterization includes surface water, hydrogeology and hydrochemistry of the project area in the vicinity of the mine and mill, in order to meet Oregon Department of Geology and Mineral Industries (DOGAMI) requirements: Division 37 Chemical Process Mining, Oregon Administrative Rule (OAR) 632-037-0055, Existing Environment-Baseline Data, and Oregon Department of Environmental Quality (ODEQ) requirements of Division 43 Chemical Mining, OAR 340-043-0000 through OAR 340-043-0160. An important aspect of the environmental baseline program will be characterizing existing surface water quality and quantity. This information will be used in future evaluations to determine potential impacts on local surface water quality. Note that spring baseline monitoring is described in the ground water baseline study work plan.

The water quality monitoring program will be periodically re-assessed to consider future exploration, mining programs and monitoring needs. An example would be changes in potential mining facilities sitings, like the processing plant, and related needs to modify the monitoring stations. A second example would be if site investigations demonstrate any effects on surface water are highly unlikely due to the lack of this resource at the proposed development sites. In this situation, Calico would advise DOGAMI and ODEQ of proposed changes to the plan and formally seek approval of those changes. All procedures and protocols described in this work plan and approved by the technical review team (TRT) would be applied to any proposed revisions or modifications in order to meet the requirements of Division 37 and Division 43.

The purposes of this surface water resources baseline study are as follows:

- Characterize the pre-project surface water resources baseline conditions.
- Meet the requirements of the Oregon Division 37 Chemical Process Mining rules and related Consolidated Application and Permit Review Standards for Chemical Process Mining.
- Meet related ODEQ Division 43 Chemical Mining and related regulations outlined in 340-043-0000 through 340-043-0160.
- Meet related Oregon Department of Fish and Wildlife (ODFW) Division 420, Chemical Process Mining consolidated application and permit review standards, including 635-420-0010, Wildlife Protection Plan, and 635-420-0030, Wildlife Mitigation Plan.
- The results of the monitoring programs will be reviewed by the regulatory and management agencies and the Grassy Mountain professional staff on a regular periodic basis.

A detailed discussion of characterization and measurement of surface water hydrology and ground water hydrogeology will be required to satisfy the Division 37 permitting process, and any related National Environmental Policy Act (NEPA) analysis that may be needed. The objectives of this surface water resources baseline study are as follows:

- Accurately characterize the local surface water resources, both quality and quantity, and the pre-project “environmental baseline.”
- Monitor the effects of exploration and mining-level operations impacts on these important resources.
- Ensure that the data collected is of known and acceptable quality.

- Ensure that project-specific methods and procedures are implemented.
- Determine if there are naturally occurring variables or trends, or project-related influences on local water quality.
- Collect data to be used in permit applications and environmental reviews of the proposed Grassy Mountain Project.
- Develop a database that will be used to further establish long-term reclamation and closure needs.

### 3.3.2 Project Study Area

#### 3.3.2.1 Project Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |
| Anticipated Project Disturbance (excluding access road): | 400 acres |

#### 3.3.2.2 Water Resources Study Area

The water resources study area is shown in **Figure 8, Water Resources Study Area and Permit Area and Figure 9, Water Resources Study Area**. The main study area boundary includes a background sampling site on Dry Creek Arm of Owyhee Lake, where Dry Creek and Twin Springs Creek enter the reservoir. This site was selected to assess any potential surface water runoff impacts of the project on Owyhee Lake, although no impacts are anticipated since the lake is considered to be in a separate watershed than the project. In addition to this location, the study area also includes two separate, non-contiguous, areas on the Owyhee River/Lake. One location is on the Owyhee River, four miles downstream of Owyhee Dam, and the other location is upstream of the dam and project area on the Owyhee River/Lake at Leslie Gulch.

Although we anticipate no potential for impacts to Owyhee River/Lake from the proposed project, these two areas were added to allow background water quality sampling from the Owyhee River/Lake.

#### 3.3.2.3 Regional Hydrologic Setting

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 above mean sea level (msl) along the west flank of Grassy Mountain. Elevation decreases to the north (about 3,250 feet above msl at Negro Rock Canyon). Elevation falls to about 2,400 feet above msl at the Malheur River (ABC 1992).

The Owyhee River is the largest surface water in the region. The U.S. Bureau of Reclamation supplies about 500,000 acre-feet of water to a little over 118,000 acres along the west side of the Snake River. Negro Rock Canyon drainage contains an intermittent stream that only flows in response to snowmelt or heavy precipitation. 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. Several reservoirs in the Malheur River Basin also report water surface elevation (USGS 2001).

There are no jurisdictional floodplains within the study area.

#### 3.3.2.4 Climate

The Grassy Mountain climate is typical of a cold desert environment. Annual precipitation is 10.3 inches. Pan evaporation exceeds 40 inches in a normal year. These estimates represent 30-year average values for precipitation and evaporation. Most of the precipitation falls in the winter as snow. Winds are predominantly from the south and west (Air Sciences 1990). Climate data for Vale, Oregon, which is the closest nearby site of reference, is listed in **Table 3**. Annual precipitation reported for the Negro Rock Canyon basin is 9.8 inches (ABC 1992).

**Table 3. Vale, Oregon, Historic Average Climate, Temperature-Precipitation[1]**

| | Jan | Feb | Mar | Apr | May | Jun |
|---|---|---|---|---|---|---|
| **Average high in °F** | 35 | 44 | 57 | 66 | 75 | 84 |
| **Average low in °F** | 18 | 24 | 30 | 35 | 44 | 51 |
| **Average precip in inches** | 1.22 | 0.94 | 0.98 | 0.87 | 1.06 | 0.75 |
| | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** |
| **Average high in °F** | 93 | 92 | 80 | 66 | 48 | 37 |
| **Average low in °F** | 56 | 53 | 42 | 33 | 26 | 18 |
| **Average precip in inches** | 0.47 | 0.39 | 0.51 | 0.63 | 1.1 | 1.34 |

[1]NOAA, 2011.

The average annual high temperature is 64.8 degrees Fahrenheit (°F). The average annual low temperature is 35.8°F (NOAA 2011).

The mean wind speed at the site is 7.6 miles per hour (mi/hr). Wind speeds are normally fairly light. About 3.3 percent of the 2-year-period monitored in 1989 through 1990 recorded wind speeds of greater than 18 mi/hr (Air Sciences 1991).

The annual average runoff within the Negro Rock Canyon basin is estimated to range from 1.3 to 1.5 inches per year, with peak runoff rates ranging from 5 to 15 cubic feet per second (cfs) per square mile (ABC 1992). Peak runoff in Negro Rock Canyon basin may be an order of magnitude greater due to the effect of isolated, infrequent thunderstorms.

The 100-year, 24-hour storm has been reported to be 2.2 inches (ABC 1992). This storm event is generally used for designing drainage facilities, although the 1-hour duration can be a more useful metric for small drainages such as those in the project area. The 100-year, 1-hour storm has been reported to be 1.0 inch (ABC 1992).

Supplemental climatological data to be used in the water resources hydrological evaluation for the Grassy Mountain Project is being collected at the site as part of the air quality resources work plan. Meteorological data to be collected will include:

- Precipitation and evaporation
- Relative humidity
- Temperature
- Delta temperature
- Wind direction
- Wind speed
- Barometric pressure
- Solar radiation
- $PM_{25}$ and $PM_{10}$

Climatological data collected on site will be used to verify the accuracy of reported storm and runoff values and produce updated storm design criteria and flood flow predictions.

#### 3.3.2.5 Watershed Boundaries

The two surface watersheds that could be impacted by surface runoff from Grassy Mountain Gold Project surface facilities are 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 from the Bishop Well into the Dry Creek drainage.

These watershed delineations will be investigated in the field as part of the overall baseline work and modified as needed to reflect the results of the field work.

### 3.3.3 Regulatory Framework

The primary regulatory requirements for the surface water baseline study are DOGAMI regulations described in the Division 37 Chemical Process Mining rule (OAR 632-037-0055). ODEQ also enforces the related requirements of the Division 43 Chemical Mining rule (OAR 340-043-0000 to -00180). The Oregon Department of State Lands (DSL) has jurisdiction over some surface waters, including rivers, intermittent and perennial streams, lakes, reservoirs, and ponds (OAR 141-085-0515). Streams and waterways will be characterized and reported under the wetland baseline study. These waters will be characterized using SDAM for Oregon.

All sampling and analytical methods used to meet the monitoring requirements will be done in accordance with the following:

- The latest edition of "Guidelines Establishing Test Procedures for the Analysis of Pollutants" (40 Code of Federal Regulations [CFR] 136).
- DOGAMI requirements of Division 37 Chemical Process Mining Rules, ODEQ Division 43 Chemical Mining Rules, and related ODFW Consolidated Application and Permit Review Standards for Chemical Process Mining (Division 420).

The following current sources are also referenced:

- American Public Health Association, Standard Methods for the Examination of Water and Waste Waters.

- American Society for Testing and Materials (ASTM) Standards, Part 31, Water, Atmospheric Analysis.
- U.S. Environmental Protection Agency (USEPA), Methods for Chemical Analysis of Water and Wastes.
- ODEQ, *Water Monitoring and Assessment Mode of Operations Manual*, March 2009.
- ODEQ, *Field Sampling Reference Guide*, January 2010.
- ODEQ, *Quality Manual*, May 2011.

### 3.3.4 Study Methodology

#### 3.3.4.1 Literature Review

The following documents and previous monitoring studies will be reviewed to determine the validity of the reports and data:

- ACZ collected water quality samples at the Grassy Mountain site from nine surface water stations in 1993. ACZ also collected streambed sediment samples from the site. ACZ also photographed and surveyed springs and seeps flowing in the project area in that same year.
- In 1992 and 1993, Adrian Brown Consultants, Inc. (ABC) evaluated physical resources at the Grassy Mountain site, including surface water hydrology and quality. This study also addressed water rights at the site.
- SPF Water Engineering, LLC (SPF). 2015. *Grassy Mountain Gold Project Water Resources Baseline Study 2013 Annual Sampling Report.*
- SRK prepared a surface water and ground water report in 1989 for the originally proposed surface mine and heap leach operation.
- In 1988, Western Technologies, Inc. (WTI) examined surface water hydrology and water quality at the Grassy Mountain gold mine site. This involved a seasonal hydrological flow analysis, surface water quality, and water rights.
- *Water Resources Technical Memorandum* developed for Atlas Precious Metals, Inc. (Atlas) as part of the *Grassy Mountain Project Environmental Impact Statement* (ABC 1992). The memorandum describes the geology and geochemistry of the project site, monitoring and production wells completed at the time, historical ground and surface water quality data, results of ground water modeling, and discusses the potential impacts of mining on ground and surface water resources.
- *Draft 2011 Hydrologic Testing Program Interpretive Report*, Rocky Mountain Environmental Corporation (RMEC).
- Initial baseline environmental studies conducted by Atlas, which included surface and ground water quality monitoring and a compilation of data collected from springs and wells in the area.
- WTI oversaw the installation of three monitoring wells (GW-1, GW-2, and GW-3) and one production well (Prod-1) on the site in 1988. The location of GW-2 is currently unknown and there is uncertainty over whether or not the WTI GW-3 is the same as the GW-3 where monitoring occurred in 2011 by RMEC. WTI collected water quality samples from the four wells, the BLM Owyhee Ridge Well, and from four surface water locations in 1989.
- In 1989 and 1990, SRK Consulting, Inc. (SRK) oversaw the installation of monitoring well GW-4 and the production wells (PW-1 and PW-4). Water quality samples were collected from these wells and test pumping was performed on the production wells. SRK presented the results to Atlas from SRK in a 1989 report.
- Quarterly reports by SPF Water Engineering, LLC from 2013 to 2017.

Once the environmental baseline study work plans for the Grassy Mountain Project have been approved, Calico will finalize all internal consultant selections for the various resource categories. At that point, extensive review of prior environmental studies will commence.

Calico will use the following validation/verification criteria to determine the applicability and competency of the previous environmental baseline data and studies:

- Are data and/or reports relevant to the characterization of the pre-mine environment (OAR 632-037-0040)?
- Have environmental conditions for this particular resource category changed substantially from the period during which previous data was collected?
- Do these data fall within the accuracies of currently accepted environmental criteria and standards?
- Were the methodologies used to collect the data appropriate at the time?
- Are these previously collected baseline data useful in making quantitative determinations of direct and indirect impacts that could result if the proposed project is implemented?
- Will these data be useful to agencies in making individual decisions to issue or deny a permit(s)?

Assuming a majority of the six criteria are met, the data may be used for comparative and qualitative purposes to indicate changes and/or trends that may have occurred since the early 1990s. In most cases, it is acknowledged that recent technologies and improvements in analytical procedures, quality control programs, and field procedures and methodologies have substantially improved during the past 20 years. Nevertheless, where applicable and agreed upon, these data and/or reports would be evaluated and used as appropriate.

#### 3.3.4.2 Field Studies

##### 3.3.4.2.1 Surface Water Quality Monitoring Sites

Calico Resources would conduct pre-project baseline monitoring at the Grassy Mountain site, as appropriate. The mine site and mill site do not have perennial surface waters in their vicinity. The area is a net evaporation condition (46.16 inches evaporation; 9.83 inches precipitation). On a larger scale, the Owyhee River, Twin Springs Creek, and Negro Rock Canyon will be sampled strictly to establish pre-project "background conditions."

This work plan proposes water quality sampling from three sites located on the Owyhee Lake/River, identified on **Figure 9**. One is south of the proposed processing area, at Dry Creek Arm on Owyhee Lake where Dry Creek and Twin Springs Creek enter the reservoir. Two other background sites are located at the upper end of the reservoir at Leslie Gulch and 4 miles downstream of the Owyhee Dam (see **Figure 9**). The downstream site has been used by ODEQ for water quality sampling in the past (Station 11048).

In addition to the three sites on Owyhee Lake/River, background sampling will also be conducted at Twin Springs Creek above the confluence with Dry Creek when flow is present during the bi-annual visit (spring and fall). This site is shown on **Figure 9**. Negro Rock Canyon Creek will also be sampled for background data at a location at the northern boundary of the water resources study area when flow is present during the bi-annual visit. This site is shown on **Figure 9**.

Additional surface water quality monitoring sites may be added at selected upgradient and downgradient sites where exploration activities are planned, if surface water is present. Certain of these sites may also be sampled as part of the background environmental data collection effort during ultimate facilities construction and operation. The results of data collection may reveal the need to add or remove surface water monitoring sites to provide additional baseline water quality and flow data that the existing sites cannot adequately provide in both the mining and the process areas. The baseline work plan should be viewed as a flexible, working guide that can be revised as needed to meet baseline reporting requirements and to adequately assess potential impacts to water resources.

#### 3.3.4.2.2 Sampling Schedule and Procedure

"Trend" monitoring implies that measurements will be made at regular time intervals in order to determine the long-term trend of a particular water quality parameter. Additionally, sampling must occur at a frequency to account for seasonal flow regimes (high, medium and low flow conditions). It is currently anticipated that bi-annual background monitoring of surface water will be conducted, in the spring and the fall.

Standard hydrologic field procedures and methodologies will be used to ensure accurate and reliable data collection. Sampling procedures will adhere to the following guidelines: *Field Sampling Reference Guide* (ODEQ 2010), *Water Monitoring and Assessment Mode of Operations Manual* (ODEQ 2009), and guidelines established in the *Environmental Baseline Study Work Plans, Grassy Mountain Project* (EM Strategies 2017).

Standardized log sheets for surface water sampling will be used for recording sampling data. These sheets list the locations being sampled and allow sampling personnel to record weather conditions and other relevant information during the sampling. See Appendix E for the *Grassy Mountain Gold Project Water Resources Baseline Study Winter 2013 Monitoring Plan* and a copy of the sampling form and Streamflow Duration Assessment Method (SDAM) form. All personnel conducting field work will receive adequate training on operation of equipment and sampling protocols to ensure accurate and reliable data collection.

Quality assurance and quality control (QA/QC) are an important component of the monitoring program. The QA/QC protocols described in the ODEQ *Water Monitoring and Assessment Mode of Operations Manual* (ODEQ 2009), the ODEQ *Quality Manual* (ODEQ 2011), and the *Environmental Baseline Study Work Plans, Grassy Mountain Project* (EM Strategies 2017) will be followed. Specific QA/QC details are described in Section 3.3.4.2.6.

Surface water quality sampling will include the following tasks:

1. Identify specific sampling locations for future reference. Surface water sampling sites will be marked with a handheld global positioning system (GPS) unit.
2. Digital photographs of each site will be taken to adequately document location and sampling conditions.
3. Conduct surface water monitoring at approved locations. Currently, "background" water quality sampling is scheduled at three sites. One site is located on the Owyhee River, a second site in Negro Rock Canyon, and a third site on Twin Springs Creek.
4. Measure (either directly or using gaging records) surface water flow at the time of data collection (see Section 3.3.4.2.3). The Oregon Department of State Lands (DSL) SDAM will be used to determine if a stream is perennial, intermittent, or ephemeral.
5. Conduct field measurements for certain water quality parameters (see Section 3.3.4.2.4).
6. Conduct water quality sampling according to approved sample collection procedures (see Section 3.3.4.2.5).
7. Perform field QA/QC (see Section 3.3.4.2.6).
8. Verify data results and transmittal of samples (Chain of Custody, see Section 3.3.4.2.5).
9. Report results.

#### 3.3.4.2.3 Flow Measurements

For all surface water monitoring locations, flow will be estimated or measured at the time of data collection.

Stream flow measurements will be as follows:

1. For sites with channels that can be waded, flow will be measured using an accepted U.S. Geological Survey (USGS) field measurement method.

2. For sites that cannot be waded and with available stream gaging records, these records will be used to measure flow at the time of data collection.

For the Owyhee River background sampling, stream gaging records will be used.

#### 3.3.4.2.4 Field Water Quality Parameters and Analysis

Surface water conditions will be considered steady state and only one set of field parameters (pH, alkalinity, electrical conductivity, specific conductance, dissolved oxygen) will be collected. Field measurements will be taken concurrently with water quality sampling.

The sensors for the pH meter, conductivity meter, and dissolved oxygen meter will be placed directly in the surface water for data collection. Readings will be recorded once the measurements have stabilized. Equipment calibration will be performed prior to the sampling event and checked again on the morning of each sampling day. Field personnel will be required to review an "instruction manual" prior to using the equipment.

The following equipment (or equal) is anticipated for field water quality data collection:

1. The pH (S.U.) will be measured using a YSI EcoSense Model pH100 meter. A 2-point calibration will be performed using pH 4, 7, or 10 standard solutions.
2. Specific conductance (SC, microsiemens per centimeter [µS/cm] at 25 degrees Celsius [°C]) will be measured using an YSI EcoSense Model EC300 meter.
3. Electrical conductivity (EC, µS/cm) will be measured using a YSI EcoSense Model EC300 meter.
4. Temperature (°C) will be measured using the YSI Model EC300 meter.
5. Dissolved oxygen (DO) (milligrams per liter [mg/L]) will be measured using an OxyGuard Handy Polaris 2 Portable DO meter. This DO meter automatically compensates for temperature and barometric pressure, and has an automatic calibration with stability check. The calibration of the instrument will be checked on a daily basis to ensure that the meter is operating within the acceptable range.

#### 3.3.4.2.5 Laboratory Parameters and Analysis

**Table 4** lists the constituents that will be sampled from each surface water site for analysis at the laboratory, including the proposed laboratory testing method. For metals, samples for both total and dissolved metals will be collected. These are identified in **Table 4**. For the other parameters, only total samples will be collected. **Table 4** also lists the testing method detection and reporting limit. The preservatives used by the laboratory and the recommended holding times for each testing method are summarized in **Table 5**.

**Table 4. List of Water Quality Analytes and Testing Methods**

| Parameter | Laboratory Method of Analyses | Detection Limit | Reporting Limit | Sample Type |
|---|---|---|---|---|
| Aluminum, Al | USEPA 200.7 | 0.03 mg/L | 0.15 mg/L | total and dissolved |
| Total Arsenic | USEPA 200.8 | 0.0002 mg/L | 0.001 mg/L | total and dissolved |
| Inorganic Arsenic | As speciation by HPLC ICP/MS | 0.5 ug/L | 0.5 ug/L | total and dissolved |
| Barium, Ba | USEPA 200.7 | 0.003 mg/L | 0.015 mg/L | total and dissolved |
| Cadmium Low | USEPA 200.8 | 0.0001 mg/L | 0.0005 mg/L | total and dissolved |
| Calcium, Ca | USEPA 200.7 | 0.2 mg/L | 1 mg/L | total and dissolved |
| Chromium Low | USEPA 200.8 | 0.0005 mg/L | 0.002 mg/L | total and dissolved |
| Copper Low | USEPA 200.8 | 0.0005 mg/L | 0.0025 mg/L | total and dissolved |
| Iron, Fe | USEPA 200.7 | 0.02 mg/L | 0.05 mg/L | total and dissolved |
| Lead Low | USEPA 200.8 | 0.0001 mg/L | 0.0005 mg/L | total and dissolved |
| Magnesium, Mg | USEPA 200.7 | 0.2 mg/L | 1 mg/L | total and dissolved |
| Manganese Low | USEPA 200.8 | 0.0005 mg/L | 0.0025 mg/L | total and dissolved |
| Mercury, Hg (Low Level) | 1631E | 0.2 ng/L | 0.5 ng/L | total and dissolved |
| Nickel Low | USEPA 200.8 | 0.0006 mg/L | 0.003 mg/L | total and dissolved |
| Potassium, K | USEPA 200.7 | 0.3 mg/L | 1.5 mg/L | total and dissolved |
| Selenium Low | USEPA 200.8 | 0.0001 mg/L | 0.00025 mg/L | total and dissolved |
| Silver Low | USEPA 200.8 | 0.00005 mg/L | 0.00025 mg/L | total and dissolved |
| Sodium, Na | USEPA 200.7 | 0.3 mg/L | 1.5 mg/L | total and dissolved |
| Zinc, Zn | USEPA 200.7 | 0.01 mg/L | 0.05 mg/L | total and dissolved |
| Antimony | USEPA 200.8 | 0.0004 mg/L | 0.002 mg/L | total and dissolved |
| Beryllium | USEPA 200.8 | 0.00005 mg/L | 0.00025 mg/L | total and dissolved |
| Bismuth | USEPA 200.7 | 0.04 mg/L | 0.2 mg/L | total and dissolved |
| Boron | USEPA 200.8 | 0.0005 mg/L | 0.001 mg/L | total and dissolved |
| Cobalt | USEPA 200.8 | 0.00005 mg/L | 0.00025 mg/L | total and dissolved |
| Gallium | USEPA 200.7 | 0.1 mg/L | 0.5 mg/L | total and dissolved |
| Lithium | USEPA 200.7 | 0.02 mg/L | 0.1 mg/L | total and dissolved |
| Molybdenum | USEPA 200.8 | 0.0005 mg/L | 0.0025 mg/L | total and dissolved |
| Scandium | USEPA 200.7 | 0.1 mg/L | 0.5 mg/L | total and dissolved |
| Strontium | USEPA 200.7 | 0.01 mg/L | 0.05 mg/L | total and dissolved |
| Thallium | USEPA 200.8 | 0.0001 mg/L | 0.0005 mg/L | total and dissolved |
| Tin | USEPA 200.8 | 0.0004 mg/L | 0.002 mg/L | total and dissolved |
| Titanium | USEPA 200.7 | 0.005 mg/L | 0.025 mg/L | total and dissolved |
| Vanadium | USEPA 200.8 | 0.0002 mg/L | 0.001 mg/L | total and dissolved |
| Nitrate (as N) | USEPA 353.2 | 0.02 mg/L | 0.1 mg/L | total |
| Ammonia Direct (as N) | USEPA 350.1 | 0.05 mg/L | 0.5 mg/L | total |
| Nitrite (as N) | USEPA 353.2 | 0.01 mg/L | 0.05 mg/L | total |
| Alkalinity | SM 2320B | 2 mg/L | 20 mg/L | total |
| Bicarbonate | SM 2320 | 2 mg/L | 20 mg/L | total |
| Carbonate | SM 2320 | 2 mg/L | 20 mg/L | total |

**Table 4. List of Water Quality Analytes and Testing Methods**

| Parameter | Laboratory Method of Analyses | Detection Limit | Reporting Limit | Sample Type |
|---|---|---|---|---|
| Chloride, Cl | USEPA 300.0 | 0.5 mg/L | 2.5 mg/L | total |
| Conductivity | SM 2510B | 1 umhos/cm | 10 umhos/cm | total |
| Cyanide, Total | USEPA 335.4 | 0.003 mg/L | 0.01 mg/L | total |
| Cyanide, Weak Acid Digestion | SM 4500 | 0.003 mg/L | 0.01 mg/L | total |
| Fluoride, F | USEPA 300.0 | 0.1 mg/L | 0.5 mg/L | total |
| Hardness | SM 2340 B | calc | calc | total |
| pH | SM 4500-H B | 0.1 C | 0.1 C | total |
| Sulfate, SO4 | USEPA 300.0 | 0.5 mg/L | 2.5 mg/L | total |
| Total Dissolved Solids | SM 2540C | 10 mg/L | 20 mg/L | total |
| Total Suspended Solids | SM 2540D | 5 mg/L | 20 mg/L | total |
| Total Phosphorus | USEPA 365.1 | 0.01 mg/L | 0.05 mg/L | total |

**Table 5. List of Water Quality Analytes, Hold Times, and Preservatives**

| Parameter | Laboratory Method of Analyses | Hold Time | Preservative | Bottle Type |
|---|---|---|---|---|
| Aluminum, Al | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Total Arsenic | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Inorganic Arsenic | HPLC ICP/MS | 28 Days | EDTA-HAc | 125 mL amber HDPE |
| Barium, Ba | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Cadmium Low | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Calcium, Ca | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Chromium Low | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Copper Low | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Iron, Fe | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Lead Low | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Magnesium, Mg | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Manganese Low | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Mercury, Hg (Low Level) | 1631E | 90 Days | 5mL HCl | 250 mL borosilicate glass |
| Nickel Low | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Potassium, K | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Selenium Low | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Silver Low | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Sodium, Na | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Zinc, Zn | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Antimony | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Beryllium | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Bismuth | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Boron | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Cobalt | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Gallium | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Lithium | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Molybdenum | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Scandium | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Strontium | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Thallium | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Tin | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Titanium | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Vanadium | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Nitrate (as N) | USEPA 353.2, Revision 2.0 | 28 Days | H2SO4 | 250 mL HDPE |
| Ammonia Direct (as N) | USEPA 350.1 | 28 Days | None | 250 mL HDPE |
| Nitrite (as N) | USEPA 353.2, Revision 2.0 | 28 Days | H2SO4 | 250 mL HDPE |
| Alkalinity | SM 2320B | 14 Days | None | 500 mL HDPE |
| Bicarbonate | SM 2320 | 14 Days | None | 500 mL HDPE |

**Table 5. List of Water Quality Analytes, Hold Times, and Preservatives**

| Parameter | Laboratory Method of Analyses | Hold Time | Preservative | Bottle Type |
|---|---|---|---|---|
| Carbonate | SM 2320 | 14 Days | None | 500 mL HDPE |
| Chloride, Cl | USEPA 300.0 | 28 Days | None | 250 mL HDPE |
| Conductivity | SM 2510B | 28 Days | None | 500 mL HDPE |
| Cyanide, Total | USEPA 335.4 | 14 Days | 5 mL 10N NaOH | 500 mL HDPE |
| Cyanide, WAD | SM 4500 | 14 Days | 5 mL 10N NaOH | 500 mL HDPE |
| Fluoride, F | USEPA 300.0 | 28 Days | None | 250 mL HDPE |
| Hardness | SM 2340 B | NA | NA | NA |
| pH | SM 4500-H B | * | None | 500 mL HDPE |
| Sulfate, SO4 | USEPA 300.0 | 28 Days | None | 250 mL HDPE |
| Total Dissolved Solids | SM 2540C | 7 Days | None | 500 mL HDPE |
| Total Suspended Solids | SM 2540D | 7 Days | None | 500 mL HDPE |
| Total Phosphorus | USEPA 365.1 | 28 Days | 2mL 25% H2SO4 | 250 mL HDPE |

*Perform in field within 15 minutes of sample collection. Laboratory analyses of pH are considered estimated.

BLM has recommended the following additional analytes be added to the list:

- antimony
- beryllium
- bismuth
- boron
- cobalt
- fluoride
- gallium
- lithium
- molybdenum
- scandium
- strontium
- thallium
- tin
- titanium
- vanadium

Calico has added these constituents. All of the analytes in the table above will be evaluated against current Oregon water quality standards and compared with known trace element chemistry of the area. Initial sampling analytes will be more extensive and possibly paired down based on sampling results and approved protocols.

For non-filtered samples (non-metals), water quality samples will be collected for analysis at the laboratory directly from each surface water site by the hand grab method, as described in the *Water Monitoring and Assessment Mode of Operations Manual* (ODEQ 2009). Surface water conditions will be considered steady state and samples will be collected immediately following field water quality measurements.

For filtered samples (metals), a water sample will be collected from the surface water in a clean container. All of the filtered samples at a site will be collected in the same container. A peristaltic pump (Geotech Geopump with easy-load pump head) and associated tubing will be used to transfer the water sample from

the container, through a disposable high-capacity field filter with 0.45 μm membrane, and into the appropriate sample bottle obtained from the laboratory. The procedure will follow the "in-line peristaltic pump filtration from a container" method described in the *Water Monitoring and Assessment Mode of Operations Manual* (ODEQ 2009). Filtration equipment, including tubing, collection container, and filter, will only be used at a single site and then discarded.

The USEPA Method 1669 is the recommended procedure for collecting water quality samples for trace metals at USEPA Water Quality Criteria Levels. The sample collection procedures described above and in the ODEQ *Water Monitoring and Assessment Mode of Operations Manual* (ODEQ 2009) will be followed. These procedures may differ from the exact requirements of USEPA Method 1669, but the collection and analysis of blank samples as described in Section 3.3.4.2.6 will be used to verify the accuracy of sampling procedures.

The laboratory that will be used for sample analysis will be an Oregon Environmental Laboratory Accreditation Program (ORELAP) accredited out-of-state lab for inorganic chemistry and physical properties in water. Initially, SPF anticipates using ACZ Laboratories in Colorado for this service. This laboratory is accredited by National Environmental Laboratory Accreditation Program (NELAP) for water analysis. The proposed analytical methods are appropriate to meet ODEQ reporting and detection limits.

Samples will be collected in bottles supplied by an accredited laboratory. The laboratory will prepare the bottles with the appropriate preservative as required by the testing method. Samples will be taken by field engineers wearing latex gloves discarded after each use. Care will be taken to prevent the sample bottles and other sampling equipment from contacting the ground or other potential sources of contamination.

Appropriate preservatives and approved holding times and methods will be used. Equipment blanks will be collected at a minimum frequency of ten percent.

Following collection, sample bottles will be properly labeled with the surface water location, date, time, and other pertinent information. The sample bottles will be immediately packed in a cooler with ice packs. Samples will be hand delivered or mailed to the laboratory within specified hold times with proper chain of custody documentation.

At the conclusion of each monitoring event, the field technician will review field data sheets to ensure completion of all appropriate data. Upon determination that the data sheet is complete, the technician will initial the sheet to verify its completion.

#### 3.3.4.2.6 Quality Assurance/Quality Control

Equipment blanks will be collected from the peristaltic pumping apparatus used for spring/surface water sampling at a ten percent sampling frequency. Collection of the equipment blank use the following procedure:

(1) Fill a clean container with deionized water.
(2) Install a new piece of Tygon tubing in the peristaltic pump head.
(3) Place the inlet end of the tubing into the container.
(4) Install a new 0.45 μm filter on the other end of the tubing.
(5) Start the pump and collect equipment blank samples in sample bottles.

The equipment blank will be analyzed for all the analytes listed in **Table 4**.

Collection of transfer blanks will be at a ten percent sampling frequency. Collection of the transfer blank will involve pouring a sample of deionized water from its original transport container directly to sample bottles. The transfer blank will be analyzed for all the analytes listed in **Table 4**.

The equipment and transfer blank analytical results will be compared with laboratory quality control limits. If the blanks fail the quality control limits, then target limits will be estimated for the sampling event.

Results will be presented in the sampling event monitoring report and any questionable sample results will be flagged. Corrective actions will be identified and implemented prior to the next sampling event.

**Quality Assurance Plan.** Field and laboratory quality assurance planning will be documented in detail in a quality assurance plan prepared by Calico, in compliance with the permit requirements, and the contract laboratory's quality assurance manual. This section summarizes many of the key elements of these quality assurance plans as they relate to surface water and ground water monitoring at the Calico Grassy Mountain Project.

- **Data Quality Objectives** – Data quality objectives (DQOs) include both quantitative and qualitative objectives, which define usable data for meeting the requirements of this program. DQOs define the quality of services provided by the laboratory and are used in the quality assurance review of the field and laboratory data. Review of the QC data against the DQOs determines if the data are full, usable, considered estimates, or rejected as unusable.

    1. **Quantitative DQOs** – The quantitative DQOs for the quality assurance plan include reporting limits, precision, accuracy and completeness.
        a) **Reporting Limits.** Reporting limits are determined by laboratory-provided or method-specified minimum levels, or by quantification levels specified by permit.
        b) **Precision.** Precision is the ability to replicate the measurement. It is expressed as relative percent difference (RPD).
        c) **Accuracy**. Accuracy is the closeness of the measurement to the true level of the variable. Accuracy is expressed as percent recovery (%R), usually 85-115 percent. The %R is normally determined by the use of known traceable laboratory control standards in the preparation and analysis of laboratory matrix spike samples.
        d) **Completeness.** Completeness is a measure of how many planned measurements for each constituent actually result in valid data. It is expressed as a percentage of the total number of samples collected under correct, normal conditions, usually 90 percent.
    2. **Qualitative DQOs** – The qualitative DQOs are representativeness and comparability.
        a) **Representativeness**. Representativeness is a measure of how well the sample represents the environmental conditions.
        b) **Comparability**. Comparability is a measure of how well data from different sources can be compared to each other.

- **Field Quality Assurance** - This component describes those QA/QC features that are required in the field, and are considered of the highest priority, because field personnel often change over the sampling program and the life of the project.

    1. **Sampling Personnel Training** – Personnel collecting field data and water quality samples will be Calico's staff or selected independent contractors/consultants. In either case, the personnel must have the following training:
        a) How to find and safely approach the sampling sites, including seasonal hazards.
        b) How to calibrate and operate field instruments, take specified field measurements, and follow proper sampling protocols.
        c) How to collect samples, including those for the analysis of mercury using USEPA Method 1631.
        d) How to fill out field data sheets and review for completeness and possible errors.
    2. **Maintenance and Calibration Field Instruments** – Procedures for maintaining and calibrating field instruments used to measure temperature dissolved oxygen, pH, and conductivity are discussed earlier. The quality objectives for the field parameters used for

monitoring require that all measurements are made with calibrated field instruments. Instruments are calibrated or calibrations are checked against known standards at scheduled times. Records of all such calibrations and checks will be maintained at the site.

3. **Collection of Field Quality Control Samples** – Field quality control samples consist of duplicates and blanks.

4. **Chain-of-Custody Forms** – During each sampling event, documentation consisting of a chain-of-custody form will be completed and copies included with the samples during shipment to the analytical laboratory. Chain-of-custody forms are used to document the possession history of the samples from the time collected in the field, throughout shipment, and during receipt by the analytical laboratory. Sample custody while at the project site will be maintained by

   a) keeping the samples in sight of the sampler; for example, in the sample backpack while sampling;

   b) keeping the samples refrigerated with ice or blue ice while in the field;

   c) sealing the samples in a cooler with blue ice and sealed with signed and dated custody seals.

   During shipment to the laboratory, custody will be maintained by sealing the samples and the chain-of-custody form inside a cooler with signed and dated custody seals. Once samples have arrived at the laboratory, they will be considered under custody within the laboratory environment. Upon receipt of the cooler at the laboratory, the sample custodian has the responsibility to note the conditions of the custody seals. If they are broken before receipt, note will be made by the sample custodian on the chain-of-custody form and that form will become part of the sample's permanent record.

5. **Field Data Documentation** – Field data are recorded on field data sheets. Field data sheets are designed to minimize errors in recording, to verify instrument calibration, to document the time samples were collected, and to note any unusual conditions or deviation from standard procedures. Either notebook logs or individual log forms will accompany field-monitoring equipment. These records are maintained in the environmental filing system. Included in the field data sheets are the following:

   - Sample date, time and exact place of monitoring
   - Weather observations
   - Field measurements such as dissolved oxygen, pH, conductivity, and temperature
   - Stream gauge readings
   - Sampling personnel
   - Samples collected
   - Unusual conditions

- **Laboratory Quality Assurance Plan** – This element of the overall QA/QC plan is equally important in meeting quality objectives. Once the contract laboratory is selected, this approach will be "final meshed" with the contract laboratory's plan.

  1. The analytical laboratory conducts analytical testing according to well-documented standard operating procedures (SOPs). Laboratory operations are regulated by a written, comprehensive quality assurance plan that is based on controlling, monitoring and documenting every aspect of operation.
  2. The following laboratory quality control samples will be prepared and evaluated in accordance with the analytical laboratories quality assurance plan.

     a) **Laboratory Quality Control Samples** - Laboratory duplicate samples to evaluate analytical precision will be prepared and analyzed.

b) **Matrix Spikes** – Laboratory matrix spikes to be evaluated for analytical accuracy will be prepared and analyzed.

c) **Laboratory Control Standards** – Calibration standards are analyzed and calibration curves developed for all applicable methods.

d) **Method Blanks and Instrument Blanks** – Method blanks are used to verify that contamination from laboratory reagents and glassware is not present.

- **Quality Assurance Review** – It is important that the data production and validation is fully described in the quality assurance review process.

1. Reduction of laboratory measurements and laboratory reporting of analytical parameters will be in accordance with the procedures specified for each analytical method (e.g., perform laboratory calculations in accordance with method specific procedures).
2. Data review and validation entails an examination of the field and laboratory quality control data and the raw data to verify that the laboratory was operating within control limits, the analytical results are correctly transcribed from the instrument read-outs.
3. Upon receipt of the data from the laboratory, each data package will be reviewed for the following:
    - Sample holding times
    - Instrumentation calibration
    - Review of calibration and preparation blanks
    - Interference checks
    - Laboratory quality control samples
    - Specific sample results
    - Field and other quality control sample results

### 3.3.5 Timing and Duration of Baseline Data Collection and Verification

SPF Water Engineering (SPF) anticipates that baseline data collection will be conducted on the schedule outlined in the Field Studies section of this work plan, with a minimum baseline data collection period of one year.

Although existing data have been collected during previous investigations, Calico understands that these data may not be accepted for inclusion in the baseline dataset if data collection methods were not in accordance with approved work plan methods, or were not properly documented. Calico will review existing data for applicability and, if acceptable, propose for inclusion in the dataset.

### 3.3.6 Further Anticipated Studies

No additional surface water studies are anticipated. If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies.

This work plan is intended to be adaptable so that monitoring sample sites can be added or eliminated as appropriate and sampling schedules, parameters, and methods can be modified as needed. Additional studies and changes to the work plan will undergo review and approval by the TRT.

### 3.3.7 Baseline Characterization

The baseline characterization report for surface water will include:

- Introduction
- Regulatory environment

- Surface water study area
- Sampling events
- Sampling sites
- Data collection methods
  - Description of sampling sites
  - Surface water quality data collection method
  - Surface water quality QA/QC
- Results and analyses
  - Surface water quality analysis
  - QA/QC
- List of preparers

### 3.3.8 Bibliography

ACZ. 1993. Water quality samples at the Grassy Mountain site.

Adrian Brown Consultants, Inc. (ABC). 1992/1993. Physical resources evaluation at the Grassy Mountain site.

Adrian Brown Consultants, Inc. (ABC). 1992. *Water Resources Technical Memorandum* developed for Atlas as part of the Grassy Mountain Project Environmental Impact Statement.

American Public Health Association, Standard Methods for the Examination of Water and Waste Waters.

American Society for Testing and Materials (ASTM) Standards, Part 31, Water, Atmospheric Analysis.

Atlas Precious Metals, Inc. (Atlas). 1990. *Initial Baseline Environmental Studies*: ground water, surface water, seeps and springs.

Atlas Precious Metals, Inc. (Atlas). 1989. *Groundwater and Surface Water Hydrology Report*, Atlas Grassy Mountain Project.

HydroGeo Consultants, Inc. 1993. *Procedure for the Performance and Evaluation of Pumping Tests, Grassy Mountain Project*.

National Oceanographic and Atmospheric Administration (NOAA). 2011.

Newmont Grassy Mountain Corporation. 1993. *Environmental Baseline Studies Work Plan*.

Oregon Department of Environmental Quality (ODEQ). 2009. *Water Monitoring and Assessment Mode of Operations Manual.*

Oregon Department of Environmental Quality (ODEQ). 2010. *Field Sampling Reference Guide.*

Oregon Department of Environmental Quality (ODEQ). 2011. *Quality Manual.*

Oregon Department of State Lands (DSL). Streamflow Duration Assessment Method for Oregon. http://www.oregon.gov/DSL/PERMITS/Pages/streamflow.aspx. Accessed February 13, 2013.

Rocky Mountain Environmental Corporation (RMEC). 2011. *Draft 2011 Hydrologic Testing Program Interpretive Report*.

SPF Water Engineering, LLC (SPF). 2015. *Grassy Mountain Gold Project Water Resources Baseline Study 2013 Annual Sampling Report.*

SRK. 1989. Surface water and groundwater report.

SRK. 1989/1990. Monitoring and production wells water quality and test pumping results.

U.S. Environmental Protection Agency (USEPA), Methods for Chemical Analysis of Water and Wastes.

Western Technologies, Inc. (WTI). 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.

Western Technologies, Inc. (WTI). 1988. Surface water hydrology and water quality analysis at the Grassy Mountain Gold Mine site.

### 3.3.9 Contacts

Marc Norton
Oregon Water Resources Department
503-986-0841
Marc.a.norton@state.or.us

John Dadoly
Water Quality Program
Oregon Department of Environmental Quality
541-278-4616
John.dadoly@state.or.us

Jason Thompson
SPF Water Engineering
300 E. Mallard Drive, Suite 350
Boise, Idaho 83706
208-383-4140
jthompson@spfwater.com

Alexis Clark
SPF Water Engineering
300 E. Mallard Drive, Suite 350
Boise, Idaho 83706
208-383-4140
aclark@spfwater.com

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

## 3.4 Ground Water

GROUND WATER ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.4.1 Purposes and Objectives

The ground water resources baseline study will characterize existing hydrogeology and hydrochemistry at the Grassy Mountain Project mine site.

The purpose of this work plan is to establish appropriate baseline data collection methodology.

- The work plan includes project-specific monitoring methods and procedures.
- The work plan defines the study area
- The work plan is flexible and adaptive, so that monitoring can be expanded, terminated, or otherwise adjusted as needed to best meet the objectives of the ground water resources baseline study.
- A primary purpose of the work plan is to ensure that the data collected are of known and acceptable quality, and that project-specific methods and procedures are implemented.
- The monitoring program will be periodically re-assessed to consider future exploration and mining programs. An example would be changes in the proposed location of potential mining facilities, like the processing plant, and related needs to modify the associated monitoring stations.
- An important aspect of the baseline program will be characterizing existing water quality and quantity to use in future evaluations to determine whether the project could adversely affect water quality and quantity. The information will also be used to evaluate water supply potential for the project area.

The objectives of the ground water resources baseline study are as follows:

- Meet Oregon Department of Geology and Mineral Industries (DOGAMI) Division 37 Chemical Process Mining Rules (Oregon Administrative Rule (OAR) 632-037-0055, (Existing Environment-Baseline Data), and related Oregon Department of Environmental Quality (ODEQ) Division 43 Chemical Mining Rules, and related Oregon Department of Fish and Wildlife (ODFW) Consolidated Application and Permit Review Standards for Chemical Process Mining (Division 420).
- Develop a conceptual model of the nature and interaction of the various water-bearing units and aquitards in relation to relevant geologic structures. The conceptual model should identify which water-bearing units are hydraulically connected (i.e., the same aquifer) and whether each aquifer is unconfined, semi-confined, or confined.
- Develop a monitoring well network capable of monitoring ground water quality and ground water level changes in each aquifer potentially affected by mining operations.
- Accurately characterize the study area ground water resources, both quality and quantity, and the pre-project "environmental baseline." This includes springs in the vicinity of Grassy Mountain.
- Determine if there are naturally occurring variables or trends, or project-related influences on local water quality.
- Provide data to be used in permit applications and environmental reviews of the proposed Grassy Mountain Project.
- Determine if potential environmental changes could result from project implementation

- Develop a database that will (1) be used in future monitoring of the effects of exploration and mining-level operations, and (2) will help establish long-term reclamation and closure needs.

The results of the baseline monitoring program and ground water resources baseline study will be reviewed by the regulatory and management agencies and the Grassy Mountain professional staff. If environmental changes are judged to be significant and adverse as a result of the mining operations, appropriate mitigation, reporting, and remedial measures will be implemented by Calico Resources USA Corp. (Calico). Specific details of these mitigation requirements would be negotiated between Calico, the State of Oregon, and/or other involved and responsible regulatory agencies.

### 3.4.2 Project Study Area

#### 3.4.2.1 Project Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |

Anticipated Project Disturbance (excluding access road): 400 acres

The Permit Area is rolling hill terrain. Negro Rock Canyon to the west of the main Permit Area and the Owyhee River Canyon to the southeast provide more relief in topography. The highest elevation is about 4,800 feet above mean sea level (msl) along the west flank of Grassy Mountain. Elevation decreases to the north (about 3,250 feet above msl at Negro Rock Canyon). Elevation falls to about 2,400 feet above msl at the Malheur River (ABC 1992).

The regional ground water system that includes the Permit 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. Ground water 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 Permit 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 Permit Area; and
- Sandstone and conglomerate units that are inconsistent water-bearing units.

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 (bgs). Ground water flow in the shallowest, unconfined water bearing zones generally follows the topography, with the flow direction in deeper, confined water-bearing zones likely disrupted by faults and other structures in the study area. Grassy Mountain appears to be a hydrologic divide between the Owyhee River and Negro Rock Canyon. Recharge to the regional system is by infiltration of incident precipitation and runoff.

#### 3.4.2.2 Water Resources Study Area

The water resources study area is shown on **Figure 8, Water Resources Study Area and Permit Area and Figure 9, Water Resources Study Area**. The study area for water resources is defined as that area where the Grassy Mountain Project may potentially impact water resources, including surface water, ground water, and springs. Specifically, water resource conditions are described as (1) surface water flow and quality; (2) ground water levels, quantity, and quality; and (3) spring flow and quality.

Initially, an area of impact developed by Adrian Brown Consultants, Inc. (ABC 1992) was considered for defining the water resources study area. ABC completed a finite element ground water model for a previous Grassy Mountain project. Model predictions were used to identify the outermost edge of the drawdown cone based on average sustained production flow rates of 575 gallons per minute (gpm) over a 10-year pumping duration from seven water supply wells (Prod-1, PW-1, PW-4, Rye Field, 89-1, 89-2, and 89-5). The water use estimate was based on the development of a large-scale, 851-acre, surface mine, heap leach operation, and other related facilities. ABC referred to the area of predicted drawdown as “the maximum area of impact.”

The maximum area of impact described by ABC was ultimately rejected for the following reasons:

1. The project type and scope have changed to involve a small underground mine and mill. Average ground water pumping rates for the currently proposed project are anticipated to range from approximately 150 to 300 gpm. Therefore, the 575-gpm average water use assumed by ABC for modeling drawdown is not representative of currently anticipated water demands. Consequently, the area of impact predicted by that modeling is greater than the area of impact that will occur from pumping for the currently proposed project.
2. The ABC area of impact relies solely on anticipated drawdown effects, without taking into account watershed boundaries.

Due to the reasons described above, a slightly different approach was taken to define the proposed water resources study area for the Calico Grassy Mountain Project. This approach uses the following criteria:

1. The study area will extend a minimum two-mile radius from potential ground water production facilities. It is anticipated that ground water production facilities could include the Bishop Well, PW-4, future wells in the Negro Rock Canyon watershed northwest of the mine, dewatering wells surrounding the deposit, or the underground mining workings.
    a. The two-mile radii reflects a smaller radii of impact than assumed by ABC due to anticipated average future pumping rates by Calico that are 25 to 50 percent of the pumping rate assumed by ABC.

b. The approximate two-mile radius from the mine workings was used to help define the southeastern boundary.
c. The most northerly extent of the study area is approximately two miles north of well PW-4.
d. The southern boundary was further extended to approximately seven miles south of the Bishop Well to encompass three springs (Twin Spring North, Twin Spring South, and Whiskey Spring) and a background surface water sampling site on Dry Creek Arm of Owyhee Lake. The springs have been historically sampled during past sampling efforts and are going to be sampled as part of the water resources baseline study.

2. The two surface watersheds that could be impacted by surface runoff from the Grassy Mountain Gold Project surface facilities were included. These watersheds consist of 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 from the Bishop Well into the Dry Creek drainage. The watershed delineation approach was used to better define the eastern and western edges of the study area.
3. An additional area further than two miles northwest of project facilities was also included, reflecting the anticipated northwesterly ground water flow direction from project facilities. This allows inclusion of more distant springs to the north and west.
4. The study area boundary is defined by section lines. Section lines provide definable boundaries, whereas watershed boundaries can be subject to interpretation given the complex topography in the project vicinity.

It is believed that this approach can accurately identify all water resources (ground water, surface water, springs) that could potentially be impacted by the currently-anticipated project. From a surface water perspective, any impacts from the project can be expected to occur within the same watershed. From a ground water perspective, the study area includes a reasonable maximum radius of influence around potential pumping wells, plus a larger area down-gradient of the project facilities and pumping wells, so that potential down-gradient water resources can be fully defined.

As stated under criterion one above, the study area will extend a minimum two-mile radius from potential ground water production facilities. If the future production wells are constructed at locations that are less than two miles from the proposed study area boundary, then the boundary will be expanded to maintain the two-mile radius from the production wells. The water resources study area boundary should be viewed as dynamic and will be modified as needed to adequately assess potential impacts to water resources.

The main study area boundary near the project includes a background sampling site on Dry Creek Arm of Owyhee Lake, where Dry Creek and Twin Springs Creek enter the reservoir. This site was selected to assess any potential surface water runoff impacts of the project on Owyhee Lake, although no impacts are anticipated since the lake is considered to be in a separate watershed than the project. In addition to this location, the study area also includes two separate, non-contiguous, areas on the Owyhee River/Lake. One location is on the Owyhee River, four miles downstream of Owyhee Dam, and the other location is upstream of the dam and Permit Area on the Owyhee River/Lake at Leslie Gulch. Although we anticipate no potential for impacts to Owyhee River/Lake from the proposed project, these two areas were added to allow background water quality sampling from the Owyhee River/Lake.

### 3.4.3 Regulatory Framework

The primary regulatory requirements for this component of the ground water baseline study work plan are DOGAMI regulations described in Division 37, Chemical Process Mining rule (OAR 632-037-0055). ODEQ also enforces the related requirements of the Division 43 Chemical Mining rule (OAR 430-043-0000). All sampling and analytical methods used to meet the monitoring requirements will be done in accordance with the following:

- The latest edition of "Guidelines Establishing Test Procedures for the Analysis of Pollutants" (40 Code of Federal Regulations [CFR] 136).
- DOGAMI Division 37 Chemical Process Mining Rules, ODEQ Division 43 Chemical Mining Rules, and related Consolidated Application and Permit Review Standards for Chemical Process Mining (Division 420).

The following current sources are also referenced:

- American Public Health Association, Standard Methods for the Examination of Water and Waste Waters
- American Society for Testing and Materials (ASTM) Standards, Part 31, Water, Atmospheric Analysis
- U.S. Environmental Protection Agency (USEPA), Methods for Chemical Analysis of Water and Wastes
- ODEQ, *Water Monitoring and Assessment Mode of Operations Manual*, March 2009.
- ODEQ, *Field Sampling Reference Guide*, January 2010.
- ODEQ, *Quality Manual*, May 2011.

### 3.4.4 Study Methodology

#### 3.4.4.1 Literature Review

- Adrian Brown Consultants, Inc. (ABC). 1992, *Water Resources Technical Memorandum* for Atlas as part of the *Grassy Mountain Project Environmental Impact Statement*.
- Atlas Precious Metals, Inc. (Atlas). 1989. *Groundwater and Surface Water Hydrology Report*, Atlas Grassy Mountain Project.
- Atlas Precious Metals, Inc. (Atlas). 1990. *Initial Baseline Environmental Studies*: groundwater, surface water, seeps and springs.
- Calico Resources USA Corp. 2016. *Drill Program Work Plan Grassy Mountain Project, Malheur County, Oregon, October 4, 2016.*
- Rocky Mountain Environmental Corporation (RMEC). 2012. *Draft 2011 Hydrologic Testing Program Interpretive Report*.
- SPF Water Engineering (SPF). 2012. *Grassy Mountain Gold Project Groundwater Monitoring Report, May 2012 Sample Period, July 24, 2012 Draft.*
- SPF Water Engineering, LLC (SPF). 2015. *Grassy Mountain Gold Project Water Resources Baseline Study 2013 Annual Sampling Report.*
- SPF Water Engineering (SPF). 2016. *Work Plan for Grassy Mountain Monitor Wells, August 31, 2016.*
- SPF Water Engineering (SPF). 2016. *Preliminary Groundwater Conceptual Model at Grassy Mountain, November 16, 2016.*

Other monitoring efforts performed at the site, and which will be reviewed as applicable, include the following:

- Initial baseline environmental studies conducted by Atlas Precious Metals, Inc. (Atlas), which included surface and ground water quality monitoring and a compilation of data collected from springs and wells in the area.
- Western Technologies, Inc. (WTI) oversaw the installation of three monitoring wells (GW-1, GW-2, and GW-3) and one production well (Prod-1) on the site in 1988. The location of GW-2 is currently unknown and there is uncertainty over whether or not the WTI GW-3 is the same as the GW-3, where monitoring occurred in 2011 by RMEC. WTI collected water quality samples from the four wells, the BLM Owyhee Ridge Well, and from three surface water locations in 1989.

- In 1989 and 1990, SRK oversaw the installation of monitoring well GW-4 and the production wells (PW-1 and PW-4). Water quality samples were collected from these wells and test pumping was performed on the production wells. Results were presented to Atlas in a 1989 report.
- In 1991, JMM collected data in support of a ground water supply study for the then proposed Grassy Mountain Gold Project. The work included construction of three monitoring wells (GW-3A, GW-5, and GW-6), construction of one piezometer (GW-3B), measurement of ground water levels and spring flow rates, and conducting pumping tests on three wells.
- In 1992, ABC prepared a *Water Resources Technical Memorandum* for Atlas as part of the Grassy Mountain Project environmental impact statement (EIS). The memorandum describes the geology and geochemistry of the project site, monitoring and production wells completed at the time, historical ground water and surface water quality data, results of ground water modeling, and discusses the potential impacts of mining on ground water and surface water resources.
- In June 1993, ACZ Inc. collected ground water data from several springs and wells (GW-1, GW-6, BLM, Prod-1, 57-1, and 89-2). In September 1993, 12 new test and monitoring wells were installed, with work documented by Hydro-Geo Consultants, Inc. Water quality samples were also collected from these new wells. Hydro-Geo Consultants, Inc. also participated in rising head permeability testing of seven of the new wells, slug tests of four of the new wells, and pumping tests of two of the new wells. Results of this testing are currently unavailable.

#### 3.4.4.2 Field Studies

##### 3.4.4.2.1 Monitoring Wells

Twelve wells proposed for water level measurement and water quality sampling for the baseline monitoring effort are identified in **Table 6**, along with construction details, and illustrated on **Figure 10, Monitoring Wells and Springs,** and **Figure 11, Monitoring Wells**. The well name from Calico historical records, well logs, and the associated well tag number from the Oregon Water Resources Department (OWRD) are identified in **Table 6**. This table also includes completion depth, screened interval, and well casing diameter.

All twelve monitoring wells proposed for the baseline monitoring effort were sampled in late May/early June 2012 (SPF 2012). During that sampling event, these wells were located by global positioning system (GPS) using a Garmin GPS unit (Etrex Vista HCX). The Universal Transverse Mercator (UTM) coordinates (Zone 11N, NAD 83) are provided in **Table 7**.

The twelve wells identified in **Table 6** and **Figure 10** were selected for water level and water quality baseline monitoring based on a November 2011 evaluation of the construction, condition, productivity, and water quality of 15 monitoring wells as described in *Draft 2011 Hydrologic Testing Program Interpretive Report* by the Rocky Mountain Environmental Corporation *(*RMEC). Based on that evaluation, RMEC identified 11 wells as suitable for baseline monitoring. In addition to these wells, the Bishop Well is also included as a baseline monitoring location due to its proximity to the proposed mine processing area.

Static water levels were measured in these 12 wells in late May/early June 2012 by SPF (SPF 2012). SPF also measured ground elevation of each monitoring well using a handheld Garmin GPS unit (Etrex Vista HCX). These elevations are not survey-grade quality and vertical errors associated with a standard-grade GPS are generally considered to be +/- 10 to 20 meters. There are future plans to survey all of the monitoring wells to achieve more accurate well elevations. Using the measured ground elevation and static water levels, the ground water surface elevation in each well can be calculated. The ground elevation, static water level, and ground water elevation for each of the 12 monitoring wells is summarized in **Table 8**.

**Table 6. Grassy Mountain Water Quality Monitoring Wells and Construction Details**

| Calico Well ID | OWRD Well Tag Number | Alternate Name | Well Const. Depth (ft) | Screened Interval (ft) | Well Casing Diameter (in) |
|---|---|---|---|---|---|
| GW-1 | 107469 | 47-1 | 155.5 | 135.5-155.5 | 4 |
| GW-4 | 107460 | | 370 | 280-350 | 4 |
| Prod 1 | 107457 | | 425 | 145-255 | 4 |
| | | | | 325-355 | |
| | | | | 380-420 | |
| PW-1 | 109353 | | 550 | 320-340 | 6 |
| | | | | 400-420 | |
| PW-4 | 109351 | | 375 | 280-300 | 6 |
| | | | | 340-360 | |
| BLM | 109398 | Owyhee Ridge | 175 | 159-166 | 6 |
| 59760 | 107462 | Middle Sweizer, TW-1 | 203 | 163-203 | 6 |
| 59761 | 109400 | Lower Sweizer, MW-2 | 118 | 97-117 | 4 |
| 59763 | 109356 | TW-4 | 323 | 293-323 | 6 |
| 59766 | 107468 | MWS-8 | 45 | 25-45 | 4 |
| 59772 | 109352 | Upper Sweizer, MWS-13 | 207 | 146-206 | 4 |
| Bishop Well | None | Rye Field | 482 | 135-145 | 12 |

**Table 7. GPS Coordinates for Grassy Mountain Monitoring Wells**

| Calico Well ID | OWRD Well Tag Number | Northing (UTM 11N, NAD83) | Easting (UTM 11N, NAD 83) |
|---|---|---|---|
| GW-1 | 107469 | 4835644 | 471460 |
| GW-4 | 107460 | 4838740 | 470557 |
| Prod 1 | 107457 | 4837684 | 470904 |
| PW-1 | 109353 | 4835627 | 471431 |
| PW-4 | 109351 | 4838778 | 470535 |
| BLM | 109398 | 4835898 | 470406 |
| 59760 | 107462 | 4835250 | 471497 |
| 59761 | 109400 | 4835286 | 471532 |
| 59763 | 109356 | 4835105 | 469094 |
| 59766 | 107468 | 4836380 | 469927 |
| 59772 | 109352 | 4835229 | 471504 |
| Bishop Well | None | 4833564 | 466562 |

**Table 8. Grassy Mountain Monitoring Well Ground Water Elevations**

| Calico Well ID | OWRD Well Tag Number | May/June 2012 Static WL (ft bgl) | Ground Elevation (ft)[1] | May/June Ground Water Elevation (ft bgl) |
|---|---|---|---|---|
| GW-1 | 107469 | 51.98 | 3,715 | 3,663 |
| GW-4 | 107460 | 80.93 | 3,347 | 3,266 |
| rod 1 | 107457 | Flowing | 3,447 | NA |
| PW-1 | 109353 | 51.96 | 3,709 | 3,657 |
| PW-4 | 109351 | 77.27 | 3,343 | 3,266 |
| BLM | 109398 | 156.30 | 3,584 | 3,428 |
| 59760 | 107462 | 86.11 | 3,779 | 3,693 |
| 59761 | 109400 | 86.45 | 3,761 | 3,675 |
| 59763 | 109356 | 277.63 | 3,519 | 3,241 |
| 59766 | 107468 | 24.06 | 3,462 | 3,438 |
| 59772 | 109352 | 92.53 | 3,796 | 3,703 |
| Bishop Well | None | 105.43 | 3,400 | 3,295 |

1 - Ground Elevation from SPF (2012) using Garmin Etrex Vista HCX

In addition to the 12 wells proposed for water level and water quality monitoring, seven monitoring wells are proposed for quarterly baseline water level measurements. These wells and their construction details are listed in **Table 9**, and are also shown on **Figure 10** and **Figure 11**. **Table 9** includes OWRD well tag number, completion depth, screened interval, and well casing diameter. OWRD has located these wells using a hand-held GPS, and reported the locations as latitude and longitude. The latitude and longitude as reported by OWRD and the converted UTM coordinates (Zone 11N, NAD 83) for these wells are provided in **Table 10**.

SPF did not measure static water levels in these seven wells during the May/June 2012 sampling event. Static water levels have been measured in these wells during previous monitoring efforts and these are reported in **Table 11**, along with reported surface elevation, ground water elevation, and the source of the data. During the winter 2013 sampling event, well locations and elevations were identified using a handheld Garmin GPS unit (Etrex Vista HCX). All of the monitoring wells will be surveyed to achieve more accurate well elevations.

**Table 9. Grassy Mountain Water Level Monitoring Wells and Construction Details**

| Calico Well ID | OWRD Well Tag Number | Alternate Name | Well Const. Depth (ft) | Screened Interval (ft) | Well Casing Diameter (in) |
|---|---|---|---|---|---|
| GW-2 | 109357 | 47-2 | 325 | 290-320 | 4 |
| GW-3 | 107467 | 47-3 | 350 | 320-350 | 4 |
| GW-6 | 109368 | | 340 | 300-340 | 2 |
| 89-2 | 109360 | | 425 | 386-406 | unknown |
| 59762 | 109371 | MW-3 | 700 | 550-660 | 4 |
| 59764 | 107466 | MW-5 | 305 | 279-299 | 4 |
| 26-092-915 | 109354 | | 915 | 228-268 | 2 |

**Table 10. GPS Coordinates for Grassy Mountain Water Level Monitoring Wells**

| Calico Well ID | OWRD Well Tag Number | Latitude[1] | Longitude[1] | Northing (UTM 11N, NAD83)[2] | Easting (UTM 11N, NAD 83)[2] |
|---|---|---|---|---|---|
| GW-2 | 109357 | 43.659110 | -117.367150 | 470396 | 4834077 |
| GW-3 | 107467 | 43.672780 | -117.365150 | 470563 | 4835595 |
| GW-6 | 109368 | 43.672880 | -117.392810 | 468334 | 4835616 |
| 89-2 | 109360 | 43.683350 | -117.397060 | 467997 | 4836780 |
| 59762 | 109371 | 43.673890 | -117.359760 | 470999 | 4835716 |
| 59764 | 107466 | 43.668270 | -117.384100 | 469034 | 4835101 |
| 26-092-915 | 109354 | 43.672440 | -117.355860 | 471312 | 4835554 |

1 - Latitude and longitude reported by OWRD

2 - Northing and Easting converted from latitude and longitude

**Table 11. Grassy Mountain Water Level Monitoring Well Ground Water Elevations**

| Calico Well ID | OWRD Well Tag Number | Reported Static WL (ft bgl) | Ground Elevation (ft) | Ground Water Elevation (ft bgl) | Source |
|---|---|---|---|---|---|
| GW-2 | 109357 | 164 | 3,822 | 3,658 | JMM 1991 |
| GW-3 | 107467 | 230 | 3,626 | 3,396 | JMM 1991 |
| GW-6 | 109368 | 138 | 3,365 | 3,227 | JMM 1991 |
| 89-2 | 109360 | 59 | 3,300 | 3,241 | JMM 1991 |
| 59762 | 109371 | 600 | 3,718 | 3,118 | Hydro-Geo 1993 |
| 59764 | 107466 | 271 | 3,519 | 3,248 | Hydro-Geo 1993 |
| 26-092-915 | 109354 | 56 | 3,704 | 3,648 | JMM 1991 |

These seven wells were selected for quarterly water level monitoring to provide additional baseline water level data and to better define ground water flow within the water resources study area. These wells were not selected for water quality monitoring because either the well has been reported as unsuitable for water quality sampling (RMEC 2012, JMM 1991), the well has not been evaluated for condition in the last 20 years, or the well is considered to be redundant to a well that is being sampled (constructed similarly with similar water levels and located in close proximity to a well that will be sampled).

In addition to the wells proposed for monitoring, there are also two wells known to be dry; these are 59765 (MW-6, OWRD well tag number 109355) and GW-3A. There are also two flowing wells identified on the topographic map in Section 27 of T21S, R43E. One of these wells is called Darky Rock Well and the other is called Flowing Well in ABC (1992). These wells will be visited, photographs taken, and flow measured semi-annually (spring and fall). These wells are shown on **Figure 10**.

Three monitoring wells will be used for continuous baseline water level measurements using water level pressure transducers, which were installed during the 2013 sampling event.

At least one well in the mill area will also be equipped with a transducer to characterize water levels in the mill site vicinity. Additional transducers may also be installed in one or more wells completed in the aquifers developed as water sources.

Measuring water levels at a higher frequency will provide a more complete description of seasonal ground water level trends. The wells selected for continuous water level measurements have different completion depths, ground water elevations, and are located around the project site in an attempt to collect water level data from different water-bearing zones and at various locations throughout the study area. The wells proposed for continuous water level monitoring are listed in **Table 12** and **Figure 10**. Well GW-2 is

currently proposed for continuous water level measurements, but SPF has not visited this well to confirm location, condition, and access. If GW-2 cannot be used, then well 59763 will be used.

**Table 12. Grassy Mountain Wells Proposed for Continuous Water Level Monitoring**

| Calico Well ID | OWRD Well Tag Number | Well Const. Depth (ft) | Screened Interval (ft) | Ground Water Elevation (ft bgl) |
|---|---|---|---|---|
| GW-1 | 107469 | 155.5 | 135.5-155.5 | 3,663 |
| GW-4 | 107460 | 370 | 280-350 | 3,266 |
| GW-2 | 109357 | 325 | 290-320 | 3,658 |
| **OR** | | | | |
| 59763 | 109356 | 323 | 293-323 | 3,241 |
| Well in Mill Area | --- | --- | --- | --- |

The results of data collection may reveal the need to add or remove monitoring wells to provide additional baseline ground water quality or ground water level data that the existing wells cannot adequately provide in both the mining and the process areas. The baseline work plan should be viewed as a flexible, working guide that can be revised as needed to meet baseline reporting requirements and to adequately assess potential impacts to water resources.

The goal of the water quantity and quality investigations in the mining area are to identify all water bearing zones that could potentially be affected by the mine and their hydraulic characteristics (such as flow direction, yield, interconnectedness and the like). Likewise, in the process area, ground water data will need to be collected in the vicinity of process or disposal areas to characterize the vulnerability of the shallowest laterally extensive water-bearing zone, and to provide data pertinent to process and disposal area engineering designs. An initial plan for ground water characterization near the ore body and processing area is described in Section 3.4.4.3.2. Additional data will be collected in the aquifers developed as the source of water for the mine site.

#### 3.4.4.2.2 Springs

There are numerous springs located within the water resources study area. This ground water baseline study work plan proposes quarterly visits to 11 springs, with water-quality sampling and flow measurement if there is observed flow. These springs are listed in **Table 13**, along with the May/June 2012 measured flow rate, and the UTM coordinates (Zone 11N, NAD 83). These springs are also shown on **Figure 10**.

During the May/June 2012 sampling event conducted by SPF, seven of these springs had measurable flow and a location suitable for collecting samples. These springs were also located by GPS using a Garmin GPS unit (Etrex Vista HCX). Three of the springs appeared to be dry, and another spring (Poison Spring) did not have a defined source and location appropriate for sampling. At Poison Spring, water quality sampling will occur during future sampling events if a suitable location can be identified.

**Table 13. Grassy Mountain GPS Coordinates and Flow for Baseline/Background Springs**

| Spring | Northing (UTM 11N, NAD83) | Easting (UTM 11N, NAD 83) | Flow Rate (gpm) |
|---|---|---|---|
| **Baseline Study Springs** | | | |
| Government Corral Spring | 4838649 | 472953 | 1.3 |
| Sagebrush Spring | 4839227 | 474047 | 1.9 |
| Grassy Spring Stock Tank | 4836114 | 470717 | 0.2 |
| Twin Spring North | 4829624 | 466218 | 1.7 |
| Twin Spring South | 4829253 | 466389 | 9.4 |
| Sourdough Spring Upper | 4833121 | 463632 | 0.4 |
| Whiskey Spring | 4829321 | 469195 | 0.9 |
| Sourdough Spring Lower | 4834094 | 470470 | Dry |
| Grassy Spring* | 4840108 | 471660 | Dry |
| Lowe Spring* | 4839604 | 467781 | Dry |
| Poison Spring* | 4839604 | 467781 | No Measurement |
| **Background Springs**** | | | |
| Bull Spring* | 4833030 | 472642 | No Data Available |
| Grassy Mountain Spring* | 4833030 | 472642 | No Data Available |
| Oxbow Spring* | 4830340 | 472202 | 0.36 (12-15-90) |
| Oxyoke Spring* | 4829509 | 472161 | 0.33 (12-15-90) |
| Unnamed spring in Section 13 T22S, R44E* | 4833096 | 477302 | No Data Available |
| West Whiskey Spring* | 4839057 | 464143 | 0.50 (No Date Reported) |
| Wildcat Spring* | 4839039 | 465444 | 0.45 (12-9-90) |
| Unnamed spring in Section 19, T21S, R44E* | 4841682 | 469488 | No Data Available |

*Northing and Easting taken from topographic map. These springs will be located by GPS when visited.

**Flow rates for the background springs are the most recent as reported by ABC 1992, with the sample date noted in parentheses.

In addition to the 11 baseline springs listed in **Table 13** that will be visited quarterly and sampled if flow is present, a reconnaissance inventory of spring sites in the study area and background area will be performed. This reconnaissance inventory will include an examination of aerial photography and topographic maps and field verification work to provide a complete inventory of all springs in the study area and background area. After completing the spring inventory, all known springs within the study and background areas will be visited semi-annually in the spring and fall to provide background flow data. These springs will be visited, photographs taken, and flow measured if flow is observed. Currently, there are believed to be eight more springs that will be part of the semi-annual investigation. These are Bull Spring, Grassy Mountain Spring, Oxbow Spring, Oxyoke Spring, unnamed spring in section 13, T22S, R44E, West Whiskey Spring, Wildcat Spring, and an unnamed spring in section 19, T21S, R44E. These springs are identified in **Table** 13 as background springs and shown on **Figure 10**.

Only springs with a minimum flow of approximately ¼ liter per minute that can be adequately captured for sampling will be sampled. Flow less than ¼ liter per minute that is considered unsuitable for collecting samples. Similarly, diffuse flow that cannot be captured and measured will not be sampled.

The springs proposed for quarterly water quality and flow monitoring in this ground water baseline study work plan are considered to adequately characterize baseline ground water conditions in the study area. However, the results of future data collection, including the complete inventory and resulting semi-annual investigation, may reveal the need to add or remove springs to provide additional baseline spring quality or flow data. The baseline work plan should be viewed as a flexible, working guide that can be revised as needed to meet baseline reporting requirements and to adequately assess potential impacts to water resources.

#### 3.4.4.2.3 Sampling Schedule

"Trend" monitoring implies that measurements will be made regular time intervals in order to determine the long-term trend of a particular water-quality parameter. Additionally, sampling must occur at a frequency to account for seasonal spring-flow and ground water water-level variations.

Calico will conduct quarterly ground water monitoring, with sampling events planned for the mid-point of each quarter. The schedule may vary due to poor weather and limited access to the site. However, a minimum of three weeks will separate each sampling event. Due to the relative flexibility of the schedule, it is very unlikely that a quarterly sampling event will be completely missed. See Appendix E for the *Grassy Mountain Gold Project Water Resources Baseline Study Winter 2013 Monitoring Plan*.

During each sampling event, water quality and water levels will be collected from the wells identified in **Table 6**, water levels will be measured in the wells identified in **Table 9**, and water quality and flow will be measured in the springs identified in **Table 13**. Continuous water level data will be collected from the wells identified in **Table 12**. All springs in the study area (other than the 11 that will be visited quarterly) and the 2 flowing wells in Section 27 of T21S, R43E, will be visited semi-annually (spring, fall) for flow measurements and photo documentation.

#### 3.4.4.2.4 Sampling Procedure

Standard hydrologic field procedures and methodologies will be used to ensure accurate and reliable data collection. Sampling procedures will follow the *Field Sampling Reference Guide* (ODEQ 2010), the *Water Monitoring and Assessment Mode of Operations Manual* (ODEQ 2009), and the guidelines established in the *Environmental Baseline Study Work Plans, Grassy Mountain Project* (EM Strategies 2017).

A monitoring plan will be developed for each specific sampling event, identifying the specific wells, springs, and surface water sites that will be visited during that event. The plan will describe the specific type of monitoring (i.e., water-quality sampling, water-level measurements, flow measurements) that will be conducted at each site. The monitoring plan for the winter 2013 sampling event is included as Appendix E.

Standardized log sheets for ground water/spring sampling will be used for recording sampling data. These sheets list the locations being sampled and allow sampling personnel to record weather conditions and other relevant information during the sampling. All personnel conducting field work will receive adequate training on operation of equipment and sampling protocols to ensure accurate and reliable data collection. A copy of the log sheets is included with the *Grassy Mountain Gold Project Water Resources Baseline Study Winter 2013 Monitoring Plan* included as Appendix E.

Quality assurance and quality control (QA/QC) are important components of the monitoring program, and the QA/QC protocols described in the *Water Monitoring and Assessment Mode of Operations Manual* (ODEQ 2009), the ODEQ *Quality Manual* (ODEQ 2011), and the *Environmental Baseline Study Work Plans, Grassy Mountain Project* (EM Strategies 2017) will be followed. Specific QA/QC details are described in Section 3.4.4.2.11.

Ground water quality sampling will include the following tasks:

1. Identify ground water and spring monitoring locations (see 3.4.4.2.1 and 3.4.4.2.2).

2. Identify specific sampling location for future reference. Sampling sites will be marked with a handheld GPS unit.
3. Digital photographs of each well and spring will be taken to adequately document location and sampling conditions.
4. Measure static water levels of each well (see Section 3.4.4.2.5).
5. Install continuous water level transducers and perform quarterly calibration and data download (see Section 3.4.4.2.5).
6. Measure spring flow at the time of data collection (see Section 3.4.4.2.6).
7. Install dedicated pumps in wells for purging and sample collection (see Section 3.4.4.2.7).
8. Initiate purge pumping prior to sample collection (see Section 0).
9. Conduct field measurements for certain water quality parameters (see Section 3.4.4.2.10).
10. Conduct water quality sampling according to approved sample collection procedures (see Section 3.4.4.2.11).
11. Perform field QA/QC (see Section 3.4.4.2.11).
12. Verification of data results and transmittal of samples (chain of custody, see Section 3.4.4.2.11).
13. Report results (see Section 3.4.4.2.12).

#### 3.4.4.2.5 Well Static Water Level

The static water level of each well will be measured prior to purge pumping using an electric-line well sounder relative to the top of the outer well casing, as described *Draft 2011 Hydrologic Testing Program Interpretive Report*. The measurement point on each well casing shall be marked for consistency. If the well cap is not vented, then measurements will be taken after the static water level has had adequate time to reach equilibrium.

A data collection form has been developed for recording important field data. Static water level will be recorded on the data collection form along with the well name, OWRD well tag number (if present), date, time, height of outer well casing relative to ground surface, measurement point (MP) description, well condition, and other relevant information. For the well condition assessment, the well casing(s) and concrete pad (if present) will be visually examined for damage. The area around the well will be examined for standing water. These measurements and observations will occur prior to the start of purge pumping.

The electric line well sounder unit used for each measurement shall be identified. Calibration information for each well sounder used shall be provided with the measurement report. Both raw and adjusted (based on calibration) measurements shall be provided. SPF currently uses a Waterline electric-line well sounder that is calibrated annually (at a minimum) with a steel tape.

The well designated as Prod-1 has artesian flow, and is allowed to flow continuously for stockwater use. Accurate measurement of static water level would require that the well be shut in for an extended period (days or weeks) to allow the water level to equilibrate. Rather than shut the well in, the well can best be monitored similar to a spring, with artesian flow rate measured at the time of each sampling event.

To continuously record water levels, water-level and barometric-pressure transducers will be installed in three monitoring wells (GW-1, GW-4, GW-2 or 59763). Solinst Levelogger Edge (Model 3001) pressure transducers will be installed in each monitoring well to continuously record water level and temperature data. A single Solinst Barologger (Model 3001) will be installed in GW-1 (a centrally located monitoring well) to compensate water level observations for fluctuations in atmospheric pressure. Equipment accuracy of the Solinst Levelogger Edge is listed at 0.05 percent over the full-scale length of 10 meters.

At each monitoring well, the Levelogger will be suspended via a stainless steel cable attached to an I-bolt affixed to the top of the well casing. The Levelogger will be placed approximately 4 meters (13 feet) below

the static ground water surface. At the centrally located monitoring well (GW-1), the Barologger will be attached to a 1-meter section of stainless steel cable affixed to the I-bolt to ensure it is above the water table. Prior to installation, the Leveloggers and Barologger will be set up for recording data using standard manufacturer software. All Levelogger pressure transducers will be set to record water level (or barometric pressure for the Barologger) at 30-minute intervals.

At the time of installation of the Levelogger, a calibrated electric-line sounder will be used to manually measure the depth to water relative to the top of the well casing. Manual water level measurements will occur at the wells where transducers are installed on a quarterly basis. The manually recorded depth to water, along with barometric data, will be used to generate a calibrated time series of ground water elevation. Levelogger data retrieval will coincide with manual observations of ground water level on a quarterly basis to allow for recalibration of each quarterly data set. SPF uses a Waterline electric-line sounder that is calibrated annually with a steel tape.

#### 3.4.4.2.6 Spring Flow Measurement

The flow from each spring will be measured using a container of known volume and a stopwatch. When possible, flow measurements will be accomplished without altering the spring or disturbing the area around the spring. In some instances, temporary piping will be used to collect flow into a measureable stream. A general description of the spring and any associated stock tanks or ponds will be recorded along with photographic documentation.

#### 3.4.4.2.7 Dedicated Pump Installation

Permanent, dedicated pumps will be installed in the eight monitoring wells that do not already have pumps installed and where water quality samples will be collected. The Bishop Well and wells PW-1 (109353), Prod-1 (107457), and 59760 (107462, Middle Sweizer, or TW-1) already have permanent pumps. The new pumps were installed prior to the winter 2013 sampling event.

A 3-inch submersible pump manufactured by Grundfos will be installed in each of the eight wells. The pumps are constructed of stainless steel and synthetic materials. The pumps do not contain mercury. Pumps were selected for each well based on well capacity and available drawdown, so that the time required to purge each well can be minimized. The pumps will be set on 1.25-inch diameter Schedule 80 PVC drop pipe with stainless steel couplers. The pump to be installed in each of the eight wells is listed in **Table 14**, along with motor horsepower, design criteria, drop pipe diameter, and setting depth. This information will be recorded on the data collection form during each sampling event. Each pump will be powered by a portable generator with a 240V, 30 amp breaker. A hole will be drilled in each pump check valve to allow water to slowly drain from the drop pipe to prevent freezing.

**Table 14. Grassy Mountain Monitoring Well Dedicated Pumps**

| Well No. | Well Casing Diameter [in] | Constructed Well Depth [ft] | Design Pumping Rate [gpm] | Drop Pipe Diam [in] | Setting Depth Below Casing [ft] | TDH [ft] | Recom Grundfos Pump | Motor HP |
|---|---|---|---|---|---|---|---|---|
| GW-1 | 4 | 156 | 20 | 1.25 | 105 | 98 | 22SQ-120 | 0.75 |
| GW-4 | 4 | 370 | 30 | 1.25 | 126 | 133 | 22SQ-220 | 1.5 |
| PW-4 | 6 | 375 | 30 | 1.25 | 147 | 144 | 22SQ-220 | 1.5 |
| BLM | 6 | 175 | 5 | 1.25 | 168 | 170 | 5SQ-180 | 0.5 |
| 59761 | 4 | 118 | 10 | 1.25 | 105 | 99 | 10SQ-110 | 0.5 |
| 59763 | 6 | 323 | 3 | 1.25 | 322 | 302 | 5SQ-230 | 0.75 |
| 59766 | 4 | 45 | 3 | 1.25 | 42 | 36 | 5SQ-90 | 0.5 |
| 59772 | 4 | 207 | 26 | 1.25 | 126 | 133 | 22SQ-160 | 0.75 |

At the time of pump installation, the following additional equipment will also be installed:

- A sanitary well seal installed on the top of the well casing inside the outer protective surface casing. The well seal (Baker cast iron well seal or equal) will have double holes and access port. One hole will be used for drop pipe penetration, one hole will be used for accessing the sounding tube, and the access port will be used for access to the pump motor electrical cable. The access port will provide venting for the well, and additional venting will be provided by cutting slots in the sounding tube above the static water level.
- A stainless-steel tee installed on top of the well seal, with the bottom vertical leg supporting the pump drop pipe by a threaded connection, the top vertical leg capped but available for connection to the field water-quality testing/flow bypass manifold, and the horizontal leg fitted with a stainless steel ball valve and barbed fitting available for connection to temporary Tygon tubing for water-quality sampling.
- 1-inch Schedule 40 PVC sounding tube, placed from the top of the casing to the top of the pump and strapped to the drop pipe at each joint with stainless steel straps. The sounding tube shall be accessed at the surface through the well seal.

Prior to installation of the permanent pumps, one of the pumps will be set on one piece of PVC drop pipe and lowered into a 30-gallon container of deionized water. A stainless-steel tee, ball valve, and barbed fitting will be installed on top of the drop pipe. A piece of Tygon tubing will be connected to the barbed fitting. All equipment will be decontaminated using deionized water. The pump will be turned on, and deionized water will be pumped through the pump, drop pipe, tee, ball valve, barbed fitting, and tubing. An equipment blank will be collected from this pumped deionized water and submitted to the laboratory for analysis of all the analytes listed in **Table 15**. A transfer/equipment blank will also be collected directly from the 30-gallon container of deionized water to determine if the deionized water is contaminated prior to pumping through the equipment.

Collection of the pumping system equipment blank will be used to evaluate the effectiveness of the decontamination procedure and to assess any potential contamination resulting from the pump and associated equipment. It is anticipated that analytical results from the equipment blank will be received and evaluated prior to installation of the pumps in the monitoring wells. If the laboratory analyses indicate the presence of any of the analytes outside acceptable laboratory accuracy control limits, then corrective action will be taken, which may include decontaminating the pumping equipment again and collecting another equipment blank.

All pumps, drop pipe, and other equipment will be decontaminated and rinsed with deionized water prior to installation in the monitoring wells.

#### 3.4.4.2.8 Field Water-quality Testing Manifold

To allow for measurement of field water quality parameters directly from the pump discharge, a testing manifold will be connected to the top vertical leg of the stainless steel tee installed above the well seal in each monitoring well. This testing manifold (see **Photo 1)** will also provide an outlet for bypass and purge flows from the pump. Discharge manifold piping and valves in contact with water samples are constructed of inert PVC.

The testing manifold provides a flush line for purge flows and a connection to a field water quality sampling port and multi-probe flow container. A third leg originally intended to provide a connection to a water quality sampling port with filter will no longer be used. When purging the well prior to sample collection, the stainless steel ball valve located on the horizontal leg of the tee will be closed and the PVC ball valve on the manifold flush line will be opened. When field water quality parameters are to be measured, the PVC ball valve on the manifold field water-quality line will be opened to direct flow to the multi-probe flow container.

The 0.45-micrometer (μm) filter has a maximum pressure rating of 23 pounds per square inch (psi), so the PVC ball valve on the main testing manifold line can be opened as needed to prevent excessive pressure through the filter.

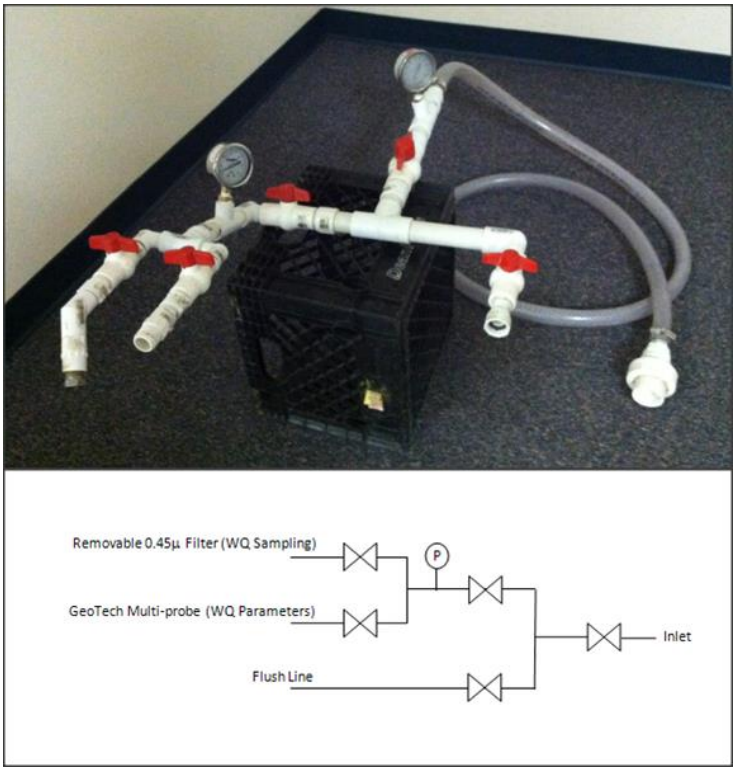



**Photo 1. Discharge testing manifold photograph and diagram**

#### 3.4.4.2.9 Purge Pumping

Each monitoring well will be pumped to purge a minimum of three casing volumes of water from the well, standard practice to remove stagnant water prior to ground water sample collection. Purge water will be discharged to waste at the well site through the field water quality testing manifold.

During pumping, the pumping rate will be measured using a 5-gallon bucket and stopwatch. Pumping volume will be calculated from the pumping rate and pumping duration. Pumping rate and volume will

recorded on the field data collection form. Additionally, field water quality parameters will be measured and recorded on the data collection form. The appearance and odor of the purged water will be noted.

After a minimum of three casing volumes have been pumped, and once field water quality parameters have stabilized, water-quality samples can be collected. The anticipated time required for purging each well can be calculated based on the design pumping rate of the pump that will be installed and the casing volume of each well. This information is presented in a summary table of monitoring well construction and purge pumping calculations included with the monitoring plan in Appendix E. Note that because Prod-1 continuously flows by artesian pressure, this well will not be purged and samples will be collected directly from the artesian flow.

#### 3.4.4.2.10 Field Water Quality Parameters and Analysis

Purge water will be discharged from the pump into the testing manifold and part of the flow will be diverted through the Geotech multiprobe flow container. This flow container allows for continuous measurement of field parameters (pH, temperature, electrical conductivity, specific conductance) without aeration of the sample. Field parameters will be monitored during purging to ensure parameters are stable prior to sampling. Parameters will be considered stable when consecutive measurements taken a maximum of one casing volume apart meet the following conditions: temperature within 1 degree Celsius, pH within 0.3 standard pH units, and specific conductance measurements within 10 percent of each other (ODEQ 2009). Dissolved oxygen will be measured in a separate purge water container (clean plastic bucket). At least two measurements of field water quality data will be recorded on the data collection form.

The testing manifold and flow container will only be used for measuring field water quality parameters; water collected for laboratory analyses will not pass through the manifold but will instead be diverted through the horizontal leg of the stainless steel tee at the well head. Therefore, decontamination and collection of equipment blanks from the testing manifold is not considered necessary.

Only springs with a minimum flow of approximately ¼ liter per minute will be sampled. Any flow less than that is considered unsuitable for collecting samples. For those springs that flow continuously, conditions will be considered steady state and only one set of stabilized field parameters (pH, electrical conductivity, specific conductance, dissolved oxygen) will be collected. For those springs that are normally valved off, the isolation valve will be opened and the spring will be allowed to flow for a minimum of 15 minutes prior to field water quality measurements.

Spring flow will be collected in a 5-gallon plastic bucket (or smaller plastic container for low-flow rate springs), pre-rinsed with water from that spring. Flow measurements will be accomplished without altering the spring or disturbing the area around the spring. The sensors for the pH meter, conductivity meter, and dissolved oxygen meter will be rinsed with spring water and placed in the sample bucket. Readings will be recorded once the measurements have stabilized. The same meters will be used as for ground water sampling.

Equipment calibration will be performed prior to the sampling event and checked again on the morning of each sampling day. Field personnel will be required to review an “instruction manual” prior to using the equipment.

The field equipment (or equal) that will be used for measuring field water quality parameters is listed below, along with the equipment calibration procedure. Personnel performing equipment calibration will be adequately trained, and results of calibration will be recorded on the calibration form included with the monitoring plan in Appendix E.

1. The pH (S.U.) will be measured using a YSI EcoSense Model pH100 meter. A 2-point calibration will be performed using pH 4, 7, or 10 standard solutions.
2. Specific Conductance (SC, µS/cm @ 25ºC) will be measured using a YSI EcoSense Model EC300 meter.

3. Electrical Conductivity (EC, µS/cm) will be measured using a YSI EcoSense Model EC300 meter.
4. Temperature (°C) will be measured using the YSI Model EC300 meter.
5. Dissolved Oxygen (mg/L) will be measured using an OxyGuard Handy Polaris 2 Portable DO meter. This DO meter automatically compensates for temperature and barometric pressure, and has an automatic calibration with stability check. The calibration of the instrument will be checked on a daily basis to ensure that the meter is operating within the acceptable range.

#### 3.4.4.2.11 Sample Collection for Laboratory Analysis

Ground water quality samples will be collected from monitoring wells for analysis at the laboratory after a minimum of three casing volumes have been purged and the field water-quality parameters have stabilized as evidenced by the conditions described above. The constituents that will be sampled from each well for analysis at the laboratory are listed in **Table 15**. **Table 15** also includes the laboratory testing method, the laboratory detection limit, and the reporting limit. The laboratory that will be used for sample analysis will be an Oregon Environmental Laboratory Accreditation Program (ORELAP) accredited out-of-state lab for inorganic chemistry and physical properties in water. Initially, SPF anticipates using ACZ Laboratories in Colorado for this service.

For metals, samples for both total and dissolved metals will be collected. These are identified in **Table 15**. For the other parameters, only total samples will be collected. The preservatives used by the laboratory and the recommended holding times for each testing method are summarized in **Table 16**.

This list of constituents is quite extensive and some may be removed from the list after a number of sampling events demonstrate that the constituent is not of concern.

Water quality samples from wells will be collected using permanent dedicated pumps installed in each monitoring well. The pump will be installed on drop-pipe below the cast iron well seal, and a stainless steel tee will be installed above the well seal with a threaded connection to the drop-pipe. On the horizontal leg of the tee, a stainless steel ball valve and barbed fitting will be installed in each well. A piece of disposable Tygon tubing will be connected to the barbed fitting for collecting water quality samples. This tubing will only be used once and then discarded.

For collection of samples to be analyzed for dissolved metals, samples will be filtered in the field using a disposable high-capacity field filter with 0.45-µm membrane (Geotech dispos-a-filter with Versapor membrane) connected directly to the disposable Tygon tubing. Pressure to the filter will be maintained below the filter maximum pressure rating of 23 psi. The filter and tubing will be discarded after use at a single monitoring well.

Collection of samples from continuously flowing artesian wells will be conducted in the same manner as spring water samples (described below).

**Table 15. List of Water Quality Analytes and Testing Methods**

| Parameter | Laboratory Method of Analyses | Detection Limit | Reporting Limit | Sample Type |
|---|---|---|---|---|
| Aluminum, Al | USEPA 200.7 | 0.03 mg/L | 0.15 mg/L | total and dissolved |
| Total Arsenic | USEPA 200.8 | 0.0002 mg/L | 0.001 mg/L | total and dissolved |
| Inorganic Arsenic | As speciation by HPLC ICP/MS | 0.5 ug/L | 0.5 ug/L | total and dissolved |
| Barium, Ba | USEPA 200.7 | 0.003 mg/L | 0.015 mg/L | total and dissolved |
| Cadmium Low | USEPA 200.8 | 0.0001 mg/L | 0.0005 mg/L | total and dissolved |
| Calcium, Ca | USEPA 200.7 | 0.2 mg/L | 1 mg/L | total and dissolved |
| Chromium Low | USEPA 200.8 | 0.0005 mg/L | 0.002 mg/L | total and dissolved |
| Copper Low | USEPA 200.8 | 0.0005 mg/L | 0.0025 mg/L | total and dissolved |
| Iron, Fe | USEPA 200.7 | 0.02 mg/L | 0.05 mg/L | total and dissolved |
| Lead Low | USEPA 200.8 | 0.0001 mg/L | 0.0005 mg/L | total and dissolved |
| Magnesium, Mg | USEPA 200.7 | 0.2 mg/L | 1 mg/L | total and dissolved |
| Manganese Low | USEPA 200.8 | 0.0005 mg/L | 0.0025 mg/L | total and dissolved |
| Mercury, Hg (Low Level) | 1631E | 0.2 ng/L | 0.5 ng/L | total and dissolved |
| Nickel Low | USEPA 200.8 | 0.0006 mg/L | 0.003 mg/L | total and dissolved |
| Potassium, K | USEPA 200.7 | 0.3 mg/L | 1.5 mg/L | total and dissolved |
| Selenium Low | USEPA 200.8 | 0.0001 mg/L | 0.00025 mg/L | total and dissolved |
| Silver Low | USEPA 200.8 | 0.00005 mg/L | 0.00025 mg/L | total and dissolved |
| Sodium, Na | USEPA 200.7 | 0.3 mg/L | 1.5 mg/L | total and dissolved |
| Zinc, Zn | USEPA 200.7 | 0.01 mg/L | 0.05 mg/L | total and dissolved |
| Antimony | USEPA 200.8 | 0.0004 mg/L | 0.002 mg/L | total and dissolved |
| Beryllium | USEPA 200.8 | 0.00005 mg/L | 0.00025 mg/L | total and dissolved |
| Bismuth | USEPA 200.7 | 0.04 mg/L | 0.2 mg/L | total and dissolved |
| Boron | USEPA 200.8 | 0.0005 mg/L | 0.001 mg/L | total and dissolved |
| Cobalt | USEPA 200.8 | 0.00005 mg/L | 0.00025 mg/L | total and dissolved |
| Gallium | USEPA 200.7 | 0.1 mg/L | 0.5 mg/L | total and dissolved |
| Lithium | USEPA 200.7 | 0.02 mg/L | 0.1 mg/L | total and dissolved |
| Molybdenum | USEPA 200.8 | 0.0005 mg/L | 0.0025 mg/L | total and dissolved |
| Scandium | USEPA 200.7 | 0.1 mg/L | 0.5 mg/L | total and dissolved |
| Strontium | USEPA 200.7 | 0.01 mg/L | 0.05 mg/L | total and dissolved |
| Thallium | USEPA 200.8 | 0.0001 mg/L | 0.0005 mg/L | total and dissolved |
| Tin | USEPA 200.8 | 0.0004 mg/L | 0.002 mg/L | total and dissolved |
| Titanium | USEPA 200.7 | 0.005 mg/L | 0.025 mg/L | total and dissolved |
| Vanadium | USEPA 200.8 | 0.0002 mg/L | 0.001 mg/L | total and dissolved |
| Nitrate (as N) | USEPA 353.2 | 0.02 mg/L | 0.1 mg/L | total |
| Ammonia Direct (as N) | USEPA 350.1 | 0.05 mg/L | 0.5 mg/L | total |
| Nitrite (as N) | USEPA 353.2 | 0.01 mg/L | 0.05 mg/L | total |
| Alkalinity | SM 2320B | 2 mg/L | 20 mg/L | total |
| Bicarbonate | SM 2320 | 2 mg/L | 20 mg/L | total |

**Table 15. List of Water Quality Analytes and Testing Methods**

| Parameter | Laboratory Method of Analyses | Detection Limit | Reporting Limit | Sample Type |
|---|---|---|---|---|
| Carbonate | SM 2320 | 2 mg/L | 20 mg/L | total |
| Chloride, Cl | USEPA 300.0 | 0.5 mg/L | 2.5 mg/L | total |
| Conductivity | SM 2510B | 1 umhos/cm | 10 umhos/cm | total |
| Cyanide, Total | USEPA 335.4 | 0.003 mg/L | 0.01 mg/L | total |
| Cyanide, Weak Acid Digestion | SM 4500 | 0.003 mg/L | 0.01 mg/L | total |
| Fluoride, F | USEPA 300.0 | 0.1 mg/L | 0.5 mg/L | total |
| Hardness | SM 2340 B | calc | calc | total |
| pH | SM 4500-H B | 0.1 C | 0.1 C | total |
| Sulfate, SO4 | USEPA 300.0 | 0.5 mg/L | 2.5 mg/L | total |
| Total Dissolved Solids | SM 2540C | 10 mg/L | 20 mg/L | total |
| Total Suspended Solids | SM 2540D | 5 mg/L | 20 mg/L | total |
| Total Phosphorus | USEPA 365.1 | 0.01 mg/L | 0.05 mg/L | total |

**Table 16. List of Water Quality Analytes, Hold Times, and Preservatives**

| Parameter | Laboratory Method of Analyses | Hold Time | Preservative | Bottle Type |
|---|---|---|---|---|
| Aluminum, Al | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Total Arsenic | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Inorganic Arsenic | HPLC ICP/MS | 28 Days | EDTA-HAc | 125 mL amber HDPE |
| Barium, Ba | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Cadmium Low | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Calcium, Ca | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Chromium Low | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Copper Low | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Iron, Fe | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Lead Low | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Magnesium, Mg | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Manganese Low | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Mercury, Hg (Low Level) | 1631E | 90 Days | 5mL HCl | 250 mL borosilicate glass |
| Nickel Low | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Potassium, K | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Selenium Low | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Silver Low | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Sodium, Na | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Zinc, Zn | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Antimony | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Beryllium | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Bismuth | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |

**Table 16. List of Water Quality Analytes, Hold Times, and Preservatives**

| Parameter | Laboratory Method of Analyses | Hold Time | Preservative | Bottle Type |
|---|---|---|---|---|
| Boron | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Cobalt | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Gallium | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Lithium | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Molybdenum | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Scandium | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Strontium | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Thallium | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Tin | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Titanium | USEPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Vanadium | USEPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Nitrate (as N) | USEPA 353.2, Revision 2.0 | 28 Days | H2SO4 | 250 mL HDPE |
| Ammonia Direct (as N) | USEPA 350.1 | 28 Days | None | 250 mL HDPE |
| Nitrite (as N) | USEPA 353.2, Revision 2.0 | 28 Days | H2SO4 | 250 mL HDPE |
| Alkalinity | SM 2320B | 14 Days | None | 500 mL HDPE |
| Bicarbonate | SM 2320 | 14 Days | None | 500 mL HDPE |
| Carbonate | SM 2320 | 14 Days | None | 500 mL HDPE |
| Chloride, Cl | USEPA 300.0 | 28 Days | None | 250 mL HDPE |
| Conductivity | SM 2510B | 28 Days | None | 500 mL HDPE |
| Cyanide, Total | USEPA 335.4 | 14 Days | 5 mL 10N NaOH | 500 mL HDPE |
| Cyanide, WAD | SM 4500 | 14 Days | 5 mL 10N NaOH | 500 mL HDPE |
| Fluoride, F | USEPA 300.0 | 28 Days | None | 250 mL HDPE |
| Hardness | SM 2340 B | NA | NA | NA |
| pH | SM 4500-H B | * | None | 500 mL HDPE |
| Sulfate, SO4 | USEPA 300.0 | 28 Days | None | 250 mL HDPE |
| Total Dissolved Solids | SM 2540C | 7 Days | None | 500 mL HDPE |
| Total Suspended Solids | SM 2540D | 7 Days | None | 500 mL HDPE |
| Total Phosphorus | USEPA 365.1 | 28 Days | 2mL 25% H2SO4 | 250 mL HDPE |

*Perform in field within 15 minutes of sample collection. Laboratory analyses of pH are considered estimated.

Water quality samples from springs will be analyzed for the same constituents as for samples collected from monitoring wells. **Table 16** lists the constituents that will be sampled from each spring for analysis at the laboratory, including the proposed laboratory testing method. For metals, samples for both total and dissolved metals will be collected. For the other parameters, only total samples will be collected. Water quality samples will be collected without altering the spring or disturbing the area around the spring.

For non-filtered samples (non-metals), water quality samples will be collected for analysis at the laboratory directly from each spring by placing sample bottles directly under the spring discharge pipe (if present), or dipped directly from the spring water surface (if a pipe is not present). For those springs that flow continuously, conditions will be considered steady state and sampled will be collected immediately following field water quality measurements. For those springs that are normally valved-off, the isolation

valve will be opened and the spring will be allowed to flow for a minimum of 15 minutes prior to sample collection.

All of the filtered samples at a site will be collected in the same clean container. A peristaltic pump (Geotech Geopump with easy-load pump head) and associated Tygon tubing will be used to transfer the water sample from the container, through a disposable high-capacity field filter with 0.45-µm membrane, and into the appropriate sample bottle obtained from the laboratory. The procedure will follow the "in-line peristaltic pump filtration from a container" method described in the *Water Monitoring and Assessment Mode of Operations Manual* (ODEQ 2009). Filtration equipment, including tubing, collection container, and filter, will only be used at a single site and then discarded. A site-specific testing plan for each spring is included with the monitoring plan in Appendix E.

The USEPA Method 1669 is the recommended procedure for collecting water quality samples for trace metals at USEPA Water Quality Criteria Levels. The sample collection procedures described above and in the ODEQ *Water Monitoring and Assessment Mode of Operations Manual* (ODEQ 2009) will be followed. These procedures may differ from the exact requirements of USEPA Method 1669, but the collection and analysis of blank samples as described in Section 3.4.4.2.12 will be used to verify the accuracy of sampling procedures.

The laboratory that will be used for water quality sample analysis will be accredited by National Environmental Laboratory Accreditation Program (NELAP) for water analysis. The proposed analytical methods are appropriate to meet ODEQ reporting and detection limits.

Samples will be collected in bottles supplied by the accredited laboratory. The laboratory will prepare the bottles with the appropriate preservative as required by the testing method. Samples will be taken by field engineers wearing latex gloves discarded after each use. Care will be taken to prevent the sample bottles and other sampling equipment from contacting the sampling source (i.e., supply pipe), ground, or other potential sources of contamination.

Following collection, sample bottles will be properly labeled with the sampling location, date, time, and other pertinent information. The sample bottles will be immediately packed in a cooler with ice packs. Samples will be mailed to the laboratory within specified hold times with proper chain-of-custody documentation.

At the conclusion of each monitoring event, the field technician will review field data sheets to ensure completion of all appropriate data. Upon determination that the data sheet is complete, the technician will initial the sheet to verify its completion.

Following receipt of all laboratory data, the monitoring event shall be reported in a monitoring event memo or report. This document shall include all event data (field measurements, photographs, laboratory data, QA/QC, etc.). The report shall be available in electronic and hard copy formats, and shall be stamped by a registered Oregon geologist. Data shall be incorporated into a baseline water resource monitoring data base.

#### 3.4.4.2.12 Quality Assurance/Quality Control

Prior to installation of the permanent pumps, an equipment blank will be collected from one of the pumping systems (pump, piece of drop pipe, tee, valve, tubing, and filter) by pumping deionized water through the system. All equipment will be decontaminated using deionized water prior to collection of the equipment blank. The equipment blank will be used to evaluate the effectiveness of the decontamination procedure and to assess any potential contamination resulting directly from the pump and associated equipment. This equipment blank is considered to be representative of all the pumping equipment installed in the wells. If this blank indicates adequate decontamination procedures, then no additional equipment blanks will be collected from the monitoring wells.

Equipment blanks will be collected from the peristaltic pumping apparatus at a 10 percent sampling frequency. A total of between 7 and 11 springs, depending upon whether flow is observed at the spring,

plus well Prod-1 will be sampled. Therefore, one equipment blank will be collected from the pumping apparatus. Collection of the equipment blank will follow this procedure: (1) a clean container will be filled with deionized water, (2) a new piece of Tygon tubing will be installed in the peristaltic pump head, (3) the inlet end of the tubing will be placed into the container, (4) a new 0.45-µm filter will be installed on the other end of the tubing, and (5) the pump will be started and equipment blank samples will be collected in sample bottles. The equipment blank will be analyzed for all of the analytes listed in **Table 15**.

Water quality samples for non-filtered samples will be collected directly from each spring by placing sample bottles directly under the spring discharge pipe or the water surface of the spring. Therefore, collection of transfer blanks at a 10 percent sampling frequency is appropriate. One transfer blank will be collected at a randomly selected spring. Collection of the transfer blank will involve pouring a sample of deionized water from its original transport container directly to sample bottles. The transfer blank will be analyzed for all the analytes listed in **Table 15**.

The equipment and transfer blank analytical results will be compared with laboratory quality control limits. If the blanks fail the quality control limits, then target limits will be estimated for the sampling event. Results will be presented in the sampling event monitoring report and any questionable sample results will be flagged. Corrective actions will be identified and implemented prior to the next sampling event.

Field duplicate samples will be collected at a 10 percent sampling frequency for quality assurance purposes and is used to measure precision between samples. A total of 12 wells will be sampled and between seven and one springs, so two field duplicate will be collected from one monitoring well and one spring selected at random. This duplicate sample will be identified as such and analyzed for all the analytes listed in **Table** 15. The laboratory's duplicate precision control limit will be used to evaluate field duplicate samples. The primary sample and duplicate samples will be compared based on the precision control limits, and any discrepancies noted. Results of the duplicate sample analyses will be presented in the sampling event monitoring report and any questionable sample results will be flagged.

In addition to field QA/QC, the laboratory will complete blank, spike, and duplicate sample tests in accordance with ISO 17025 and ISO 9001 standards. Results will be presented in the sampling event monitoring report.

#### 3.4.4.3 Plan for Future Testing

##### 3.4.4.3.1 Plan for Testing of Future Water Supply Wells

There are four identified water supply wells within one mile of the proposed permit boundary. These are the BLM Well, PW-1, PW-4, and Prod-1. Construction details for these wells are provided in **Table 6**, and ground water elevations based on static water level measurements made in May/June 2012 and approximate ground elevations are provided in **Table 8**. A map showing these wells, the permit boundary, and the one-mile radius is included as **Figure 12, Water Supply Wells**. In addition to the four wells identified above, an additional well (PW-4) is located more than 1 mile from the permit boundary.

The existing onsite wells, PW-1, PW-4, and Prod-1, have all been test-pumped in the past as described in JMM 1991 and SRK 1989. This testing occurred in 1989 and 1991. Aquifer testing was performed with the objective of characterizing the hydrogeology and for assessing water supply potential. Additional testing of these wells is not considered necessary at this time because of this historical testing.

It is anticipated that additional wells will need to be constructed and tested to meet water demands for mining, processing, and hauling operations. Water supply for the processing area may be met in part by piping water from dewatering/production wells located near the mine site. The project's anticipated peak water use is currently estimated to be approximately 350 gpm, average water use will likely range from 150 to 300 gpm. Given the relatively low yield of existing onsite water supply wells, two or more new wells may be needed to meet project water demands. At this point in time in the project development, a general description of potential locations for water supply wells, potential construction details, and an outline for a

testing program can be made. A more concrete plan for water supply development can be put forth once site infrastructure and mining plans are better defined. Therefore, it is possible that the general description provided below may change as the project moves forward.

Once the two new wells are completed, the first production well will be test pumped at the design capacity of the well. Flow will be measured using a flow meter or other acceptable means. Water level drawdown will be measured using an electric-line well sounder with measurements occurring throughout the test. The second new well and the other existing wells be used as monitoring wells. Additionally, other wells in the vicinity (one to two miles) would be used as monitoring wells, such as well 89-2 in Negro Rock Canyon.

Drawdown will be measured in the monitoring wells to assess the drawdown response of pumping the production well. It is anticipated that water levels will be measured manually with an electric-line well sounder. A pressure transducer may also be installed in a monitoring well for continuous water level measurements. The pumping test would be planned for several days. If an adequate water supply cannot be developed from the existing water supply wells and the two new wells, additional exploration drilling will be conducted to develop the remaining project water supply. Plans for testing of additional test production wells will be similar to the testing proposed for new wells.

#### 3.4.4.3.2 Plan for Additional Ground Water Characterization and Monitoring Well Construction

This section describes an initial plan for ground water characterization near the ore body and in the processing area as well as the general content of a more detailed plan. Because the project is in the early stage of planning, it is not possible to identify the exact locations of all future monitoring wells, definitively describe how they will be constructed, and the specific details of the testing program. Incorporating the results of the initial characterization, a more detailed plan for ground water characterization will be developed as the project progresses and site infrastructure and mining plans are better defined.

The initial characterization will include two steps:

1. A thorough examination of past work to determine what may be useful for ground water characterization, as well as to identify data gaps where additional information is needed, and
2. Development of a report describing the conceptual model of the site. The conceptual model will identify the nature and interaction of the various water-bearing units and aquitards in relation to relevant geologic structures, which water-bearing units are hydraulically connected (i.e., the same aquifer) and whether each aquifer is unconfined, semi-confined, or confined.

The detailed characterization plan will use the site conceptual model to propose additional ground water characterization work sufficient to fill existing data gaps. The detailed ground water characterization work plan will be submitted for review prior to completion of the Oregon Division 37 Chemical Process Mining Consolidated Permit Application.

Additional characterization work near the ore body will include at least one exploration borehole near the ore body drilled to a depth below the ore body; a depth of 1,000 feet is initially proposed. The boring will be drilled using a “drill a while then wait a while” method to minimize the potential for drilling past water-bearing zones. All water-bearing zones encountered by the borehole will be noted by the observing geologist. Well cuttings will be collected, examined in the field for moisture content, and inventoried and a geophysical log may be performed to provide additional information on the formation. If the borehole encounters ground water, the hole may be completed as a 6-inch well with a screen interval targeting the deepest water-producing zone. Filter pack would be placed around the screens and the well would be sealed to the surface. This well may be used as a future dewatering/water supply well for the mine. Well construction will comply with OWRD guidelines and requirements.

Based on the results of the first exploration borehole, additional wells may be needed to adequately characterize the water quantity and quality of all potentially affected water-bearing zones near the ore body. These additional wells would be constructed to target additional water-bearing zones encountered by the

first hole. These wells would likely be shallower than the first well and completed as monitoring wells with minimum 4-inch PVC casing and screen. Filter pack would be placed around the screens and the well would be sealed to the surface.

In the proposed ore processing area, the Bishop well has been test pumped, and water-quality samples have been collected in the past. This data is useful for a preliminary description of ground water-quality and aquifer characteristics, but additional data are needed with the objective of characterizing the water quality and water quantity of the uppermost regional water-bearing zone. The ore processing area is a promising location for water supply development, as described in Section 3.4.4.3.2. Additional ground water quality characterization in the ore processing area may be accomplished by collecting ground water quality samples during test pumping of the proposed test production wells described in Section 3.4.4.3.2. Future sampling can be conducted using a temporary or permanent pump.

Near the ore body, there are numerous (approximately 200) exploration holes. There are records of total depth, collar elevation, depth to water, and an estimate of flow when water was encountered. A map of these holes has been located, but what is not known is if any of these holes are still open and their locations relative to recent mining plans. If any are holes are determined to be open, piezometers may be installed to provide additional hydraulic data for ground water characterization.

In 1993, test pumping and rising head permeability tests were performed on several wells understood to be located near the ore body. Wells included in this testing were 59760 (also referred to as middle Sweizer or TW-1), 59761 (also referred to as lower Sweizer or MW-2) and MW-3. A more thorough examination of these tests and associated results will occur to determine if this previous work as well as other work already performed on site to determine whether ground water in the vicinity of the ore body has been fully characterized. Previous work will be used to the extent possible to assess potential impacts from mining on ground water-quality and quantity, and to quantify ground water inflows into the mine.

After a thorough examination of previous hydrogeological studies, additional wells will be installed in the vicinity of the ore body for ground water characterization. Wells would be sited in a location near the ore body but outside the active mining area so the wells can be used for the life of the mine. Exact locations for the wells can be determined once site facilities and mine workings are better defined.

Ground water quality samples can be collected from these wells using temporary or permanent pumps, with sampling and analysis procedures consistent with baseline study work plan procedures. Additionally, these wells may be used to determine hydraulic head, gradient, and conductivity information (by slug-testing or test pumping) in the area of the ore body. Long-term test pumping of one or more of these wells would be conducted to better define hydraulic parameters in the near vicinity of the deposit. Test-pumping may provide useful information to estimate ground water flow into the mine workings during operations. It is anticipated that new and existing wells in the vicinity would be used as monitoring wells.

#### 3.4.4.3.3 Plan for Designating an Upgradient Monitoring Well

Ground water elevation contours generated from ground water levels measured during May/June 2012 indicate ground water generally flows in a westerly to northwesterly direction in the area of the project facilities. This is a general observation and does not account for localized conditions such as aquitards, aquicludes, or perched aquifers. It also does not account for the boundary effects of faults in the area.

These results are generally consistent with previous studies, including RMEC 2011and ABC 1992. JMM (1991) concluded that potentiometric data from the study area indicates that Grassy Mountain is a hydrologic divide between the Owyhee River and the Negro Rock Canyon.

SPF will continue to collect ground water level measurements during future quarterly sampling events and, once a site conceptual model is approved, develop ground water contour maps for each aquifer to further define the flow of ground water in the area of the mine. A survey of well head elevations will be completed to provide more accurate ground water elevations.

There are several existing monitoring wells that may be located upgradient (located easterly to southeasterly) of the mine site. These existing wells may serve as upgradient ground water quality monitoring sites. These wells are 59772 (upper Sweizer, MWS-13, OWRD Tag #109352), 59760 (middle Sweizer, TW-1, OWRD Tag #107462), 59761 (lower Sweizer, MW-2, OWRD Tag #109400), and GW-2 (OWRD Tag #109357). These wells are shown on **Figure 10** and available information on these wells is summarized in **Table 17**.

**Table 17. Construction and Water Level Information for Monitoring Wells**

| Calico Well ID | OWRD Well Tag Number | Well Const. Depth (ft) | May/June 2012 Static WL (ft bgl) | Well Casing Diameter (in) |
|---|---|---|---|---|
| GW-2 | 109357 | 325 | Not Measured | 4 |
| 59760 | 107462 | 203 | 86.11 | 6 |
| 59761 | 109400 | 117 | 86.45 | 4 |
| 59772 | 109352 | 207 | 92.53 | 4 |

Wells 59760, 59761, and 59772 were sampled (water level, water quality) during May/June 2012. These wells are also proposed for future quarterly baseline monitoring. GW-2 was not visited in May 2012 and at this time is not included in the list of wells that will sampled in the future. However, GW-2 may be a useful monitoring location because it is deeper than the other upgradient wells (total depth of 325 feet). This well is proposed for water level monitoring, and if conditions are acceptable will be used for continuous water level monitoring. Samples collected from GW-2 in 1989 by Western Technologies (WTI) as described in JMM 1991 were generally turbid and produced questionable water quality data. GW-2 was subsequently redeveloped, and found to contain significant drilling fluid. It appears that GW-2 was successfully redeveloped, and samples were collected by JMM in 1991.

None of the existing up-gradient wells reach to the total anticipated depth of the mine workings (approximately 1,000 feet). To better describe ground water quality upgradient and from depths at or below the ore body, a deep monitoring well will be needed. Construction of this well would serve two main purposes: (1) provide a ground water monitoring location upgradient of the mine and (2) be used to characterize ground water in the vicinity of the ore body.

As described in Section 3.4.4.3.2, at least one well will be constructed near the ore body and located to serve the life of the mine. The first exploration borehole would be drilled to a depth below the ore body. If the borehole encounters ground water, the hole may be completed as a 6-inch well with screens targeting the deepest water-producing zone. This well could then be sampled to provide upgradient ground water quality information. Ultimately this well could be used as a future dewatering/water supply well for the mine. Based on the results of the first exploration borehole, additional wells will be constructed to adequately characterize the water quantity and quality of all potentially affected water-bearing zones near the ore body.

### 3.4.5 Timing and Duration of Baseline Data Collection and Verification

It is anticipated that baseline data collection will be conducted on the schedule outlined in Section 3.4.4.2.3, with a minimum baseline data collection period of one year.

Although existing data have been collected during previous investigations as described in Section 3.4.4.1, Calico understands that these data may not be accepted for inclusion in the baseline data set if data collection methods not in accordance with approved work plan methods or were not properly document. Existing data will be reviewed by Calico for applicability and, if acceptable, proposed for inclusion in the data set. Calico understands that existing data may not be accepted.

### 3.4.6 Further Anticipated Studies

No additional studies beyond those already proposed are currently anticipated. However, if additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies.

As previously noted, this baseline study work plan presents methodology that allows for additional baseline studies to occur as needed. This work plan is intended to be adaptable, so that monitoring wells, springs, and other sample sites can be added or eliminated as appropriate and sampling schedules, parameters, and methods can be modified as needed. Additional studies, and changes to the work plan, will undergo review and approval by the TRT.

### 3.4.7 Baseline Characterization

The baseline characterization report for ground water will include:

- Introduction
- Regulatory environment
- Ground water study area
- Sampling events
- Sampling sites
  - Monitoring wells
  - Springs
  - Flowing wells
- Data collection methods
  - Description of sampling sites
  - Water-level measurements
  - Continuous water-level measurements
  - Spring flow measurement
  - Pump installation and sampling manifold
  - Monitoring well water quality data collection method
  - Spring water quality data collection method
  - Spring water quality QA/QC
- Results and analyses
  - Water level data
  - Spring/flowing well flow data
  - Water quality analyses
  - QA/QC
- List of preparers

### 3.4.8 Bibliography

Adrian Brown Consultants, Inc. (ABC). 1992, *Water Resources Technical Memorandum* for Atlas as part of the *Grassy Mountain Project Environmental Impact Statement*.

American Public Health Association, Standard Methods for the Examination of Water and Waste Waters.

American Society for Testing and Materials (ASTM) Standards, Part 31, Water, Atmospheric Analysis.

Atlas Precious Metals, Inc. (Atlas). 1989. *Groundwater and Surface Water Hydrology Report*, Atlas Grassy Mountain Project.

Atlas Precious Metals, Inc. (Atlas). 1990. *Initial Baseline Environmental Studies*: groundwater, surface water, seeps and springs.

Calico Resources USA Corp. 2016. *Drill Program Work Plan Grassy Mountain Project, Malheur County, Oregon, October 4, 2016.*

James M. Montgomery, Consulting Engineers (JMM). 1991. *Phase I Hydrogeological Report on the Grassy Mountain Mine Project, Malheur County, Oregon*.

Newmont Grassy Mountain Corporation (NMC). 1993. *Baseline Study for Newmont Grassy Mountain Mine Project.*

Oregon Administrative Rules (OAR). Chapter 690, Division 240, Construction and Maintenance of Monitoring Wells.

Oregon Department of Environmental Quality (ODEQ). 2009. *Water Monitoring and Assessment Mode of Operations Manual*.

Oregon Department of Environmental Quality (ODEQ). 2010. *Field Sampling Reference Guide*.

Oregon Department of Environmental Quality (ODEQ). 2011. *Quality Manual.*

Rocky Mountain Environmental Corporation (RMEC). 2011. *Draft 2011 Hydrologic Testing Program Interpretive Report*.

SPF Water Engineering (SPF). 2012. *Grassy Mountain Gold Project Ground Water Monitoring Report, May 2012 Sample Period, July 24, 2012 Draft*.

SPF Water Engineering, LLC (SPF). 2015. *Grassy Mountain Gold Project Water Resources Baseline Study 2013 Annual Sampling Report.*

SPF Water Engineering (SPF). 2016. *Work Plan for Grassy Mountain Monitor Wells, August 31, 2016*.

SPF Water Engineering (SPF). 2016. *Preliminary Groundwater Conceptual Model at Grassy Mountain, November 16, 2016.*

SRK. 1989. *Groundwater and Surface Water Hydrology Report*.

U.S. Environmental Protection Agency (USEPA), Methods for Chemical Analysis of Water and Wastes.

### 3.4.9 Contacts

Marc Norton
Oregon Water Resources Department
503-999-3879
Marc.A.Norton@nrd.state.or.us

John Dadoly
Water Quality Program
Oregon Department of Environmental Quality
541-278-4616
John.dadoly@state.or.us

Jason Thompson
SPF Water Engineering
300 E. Mallard Drive, Suite 350
Boise, Idaho 83706
208-383-4140
jthompson@spfwater.com

Alexis Clark
SPF Water Engineering
300 E. Mallard Drive, Suite 350
Boise, Idaho 83706
208-383-4140
aclark@spfwater.com

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

## 3.5 Terrestrial (Uplands) Vegetation

TERRESTRIAL (UPLANDS) VEGETATION ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.5.1 Purposes and Objectives

This terrestrial vegetation environmental baseline work plan is intended to characterize the pre-project terrestrial vegetation communities, including species diversity; presence or absence of federally-listed threatened, endangered and sensitive (TES) species, Oregon and Bureau of Land Management (BLM) sensitive species; and condition and presence of noxious weeds. The vegetation study will accomplish the following:

- Clearly describe accepted field procedures, methodologies and documentation requirements needed to characterize existing vegetation baseline conditions at the mine and mill sites and road access corridor, as well as the regional setting, as it relates to the predominant terrestrial vegetation communities.
- Describe methodology to inventory vegetation.
- Identify other current land uses which could affect the condition of existing terrestrial vegetation resources at the site (i.e., grazing).
- Survey and record potential threatened, endangered, candidate and sensitive plant species within the project area.
- Survey for noxious weeds that occur in the project area and describe potential management options for controlling weeds while constructing and operating a mine at the site.

A key feature and goal of this work plan is to develop a baseline program focused on natural revegetation, wildlife habitat restoration, and reclamation at the end of the potential mine life.

### 3.5.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |
| Anticipated Project Disturbance (excluding access road): | 400 acres |

The study area for vegetation resources is shown on **Figure 13, Terrestrial Vegetation Study Area and Permit Area**.

Vegetation in the study area is a typical, cold-desert type. Vegetation communities include big sagebrush/bunchgrass community, crested wheatgrass/annual community, annual grassland community, and wetland area(s). Much of the area has been affected by extensive grazing, fire, and range reseeding programs.

### 3.5.3 Regulatory Framework

This environmental baseline data methodology for terrestrial vegetation resources is prepared to meet the requirements of Oregon Administrative Rules (OAR) 632-037-0055, 632-037-0040 and OAR 635, Division 420.

- The federal program to control the spread of noxious weeds as addressed in the Federal Noxious Weed Act of 1974, as amended in 1990 by the U.S. Fish and Wildlife Service (USFWS). BLM Manual 9011 (2007), BLM Handbook H-9011-1 (1994), and BLM Manual 9014 (1990) provide policy for the planning and implementation of biological controls within an integrated pest management program. These policies further require that all ground disturbing projects are evaluated to determine the risk of introducing or spreading noxious weeds.
- The National Environmental Policy Act (NEPA) is expected to be employed in components or all of the mining and processing operations. This work plan is intended to meet all applicable federal guidelines, as described in the BLM NEPA Handbook H-1790-1 (2008).
- OAR 635, Division 420: “These rules prescribe the standards for Department review of proposed chemical process mining operations for the purpose of developing conditions for protection of wildlife and their habitat, to further the Wildlife Policy (ORS [Oregon Revised Statutes] 496.012 and Food Fish Management Policy (ORS 506.109) of the State of Oregon.”

#### 3.5.3.1 Oregon Administrative Rules

- OAR 632, Division 037, Section 0130 Reclamation and Mine Closure Standards that pertain to revegetation include:
    - Surface reclamation of a chemical process mine shall require certification by the Department of Fish and Wildlife and the Department of Agriculture that a self-sustaining ecosystem, comparable to undamaged ecosystems in the area, has been established in satisfaction of the permittee's habitat restoration obligations.
    - Native species shall be established unless the use of non-native species is justified and approved by the Technical Review Team.
    - Seed mixtures, fertilizer rates and other requirements will be derived from departmental experience and advice from such sources as the Oregon Department of Agriculture, U.S. Soil Conservation Service, Oregon State University Extension Service, the Oregon Department of Transportation, the Bureau of Land Management, the Forest Service, local soil conservation districts and private sector experts.

- Establishment of a self-sustaining ecosystem, comparable to undamaged ecosystems in the area of the mine.
- Revegetation shall be considered successful if it is consistent with the establishment of a self-sustaining ecosystem, comparable to undamaged ecosystems in the area of the mine. Vegetation test plots and chemical/physical soil and subsoil analysis may be required to insure establishment feasibility.

#### 3.5.3.2 Oregon Biodiversity Information Center

The Oregon Biodiversity Information Center (OBDIC) maintains a computerized inventory of the wildlife, plant, and ecological community resources of Oregon. As part of the Natural Heritage Network and NatureServe, OBDIC contributes to a better understanding of global biodiversity and provides tools for managers and the public to better protect plant and animal species and communities.

The Oregon Natural Heritage Program (ORNHP) works to establish natural areas in Oregon and manages the Oregon Natural Heritage Databank, which contains comprehensive information on ecologically and scientifically significant natural areas in the state. ORNHP's mission statement is "to acquire, maintain and distribute information on the organisms and ecosystems that constitute Oregon's natural heritage, and to ensure, through a public planning process and through voluntary public and private efforts, that the full range of Oregon's natural heritage resources is represented within a statewide system of recognized natural areas."

The Oregon Natural Heritage Act (ORS 273.563-273.591) provides:

- A natural heritage data management system for Oregon, with an office to manage the system and the other parts of the act;
- A Natural Heritage Advisory Council, with nine citizens appointed by the governor, and a representative from each of the state's natural resources agencies;
- An ORNHP, outlining strategies for protecting examples of Oregon's natural heritage and the natural heritage program;
- An Oregon register of natural heritage areas, a voluntary program which recognizes important natural areas in Oregon; and
- A system of dedicated and protected natural areas, including state natural heritage conservation areas, private reserves, and federal research natural areas.

#### 3.5.3.3 U.S. Fish and Wildlife Service Threatened, Endangered and Sensitive Species

USFWS is responsible for administering and implementing the endangered species act to conserve, protect, and recover federally-listed species. One plant species is protected under the endangered species act for Malheur County, Oregon. Howell's spectacular thelypody (*Thelypodium howellii spectabilis*) was listed as a federally-threatened species by USFWS on May 26, 1999. Habitat for this species is found in moist alkaline meadow habitats, typically adjacent to streams that experience springtime flooding (USFWS 2013).

#### 3.5.3.4 Bureau of Land Management Special Status Species (BLM Manual, Section 6840)

Management of Oregon BLM special status species follows agency policy documented in Section 6840 of the BLM manual. Section 6840 defines sensitive species as follows:

> *"... [T]hose species not already included as BLM special status species under (1) federal listed, proposed, or candidate species, or (2) State of Oregon listed species. Native species may be listed as 'sensitive' if one of the following applies: (1) could become endangered or extirpated from a state or significant portion of its range; (2) is under review by the USFWS; (3) numbers or habitat capability are declining so rapidly that federal listing may become necessary; (4) has typically small and widely dispersed populations; (5) inhabits*

> *ecological refugia, specialized, or unique habitats; or (6) is state-listed; although, is better conserved through application of the BLM sensitive species status."*

It is BLM policy to provide sensitive species with the same level of protection that is given to federal candidate species. The major objective of this protection is to preclude the need for federal listing. The federal land management plans and the BLM resource management plans provide management direction for the many multiple uses, including outdoor recreation, range, timber, watershed, fish and wildlife, minerals, wilderness, roadless areas, and cultural resources. These plans were amended by the *Northwest Forest Plan* on the west side of the state and the *Interior Columbia Basin Strategy* on the east side of the state. Interior Columbia Basin Ecosystem Management Project developed a framework for ecosystem management and a scientific assessment of the ecological, biophysical, social, and economic conditions of the Columbia basin, including all of eastern Oregon. Instead of a formal, basin-wide decision from the project, federal decision makers adopted a strategy of incorporating the science into ongoing BLM land management plans.

A total of 139 plant species are considered special status for the Vale District of BLM.

#### 3.5.3.5 Oregon Endangered Species Act

The Oregon Department of Agriculture states the following:

> *Native plants that are listed as threatened or endangered in Oregon are protected on all non-federal public lands (state, county, city, etc.) under the Oregon Revised Statute (ORS) 564, commonly known as the Oregon Endangered Species Act. The Oregon Department of Agriculture is given the responsibility for conservation of native plants under the Oregon Administrative Rules (OAR) 603-073-0001. These rules outline the list of activities that require a listed plant permit in Oregon.*

There are no non-federal public lands within the terrestrial vegetation study area; therefore, the Oregon Endangered Species Act does not apply to this project.

### 3.5.4 Study Methodology

#### 3.5.4.1 Literature Review

- BLM, Vale District Office. 1983. *Draft Report, Southern Malheur Grazing Management Program. Environmental Impact Statement*.
- BLM. 2001. *Environmental Impact Statement and Related Appendices (Vegetation and Grazing)*.
- Cedar Creek Associates Inc. 1991. *Vegetation Technical Memorandum*.
- Conquist, Arthur, Arthur H. Holmgren, Noel H. Holmgren, James L. Reveal, Patricia K. Holmgren. 1977. *Intermountain Flora, Vascular Plants of the Intermountain West, U.S.A.* Volume Six. Published by Columbia University Press, New York. 584pp.
- Daubenmire, Rexford. 1959. *A Canopy Coverage Method of Vegetational Analysis. Northwest Science.*
- HDR Engineering, Inc. (HDR). 2012. *Draft Terrestrial Vegetation Report, Grassy Mountain Exploration Project*.
- HDR Engineering, Inc. (HDR). 2014. *Draft Terrestrial Vegetation Baseline Study, Grassy Mountain Exploration Project.*
- HDR Engineering, Inc. (HDR). 2015. *Draft Terrestrial Vegetation Baseline Study Addendum #1, Grassy Mountain Exploration Project.*
- IMS, Inc. 1989. *Final Report: Soil, Vegetation, and Wildlife Resources of the Grassy Mountain Project Area*.

- U.S. Forest Service (USFS) and Bureau of Land Management (BLM) Pacific Northwest Interagency. 2012. Federally Threatened, Endangered & Proposed, and Sensitive & Strategic Species List. Website: http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/.
- U.S. Fish and Wildlife Service (USFWS). Threatened and Endangered Species List for Malheur County, Oregon.
- Whitson, Tom D., Larry C. Burrill, Steven A. Dewey, David W. Cudney, B.E. Nelson, Richard D. Lee, Robert Parker. Weeds of the West. January 1991. University of Wyoming. 630 pp.
- Wright, Caroline E. 1991. *Grassy Mountain Project Botanical Survey*.
- Wright, Caroline E. 1989. *Preliminary Grassy Mountain Botanical Report*.


Additional key references include:


- Adrian Brown Consultants, Inc. 1992. *Draft Grassy Mountain Environmental Impact Statement.*
- BLM. 1999. Overview of BLM's NEPA Process.
- 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
- BLM. 2008. *NEPA Handbook*, H-1790-1.
- BLM. 2012. Manual Section, "6840 – Special Status Species."
- Consolidated State Agency Response. 1993. *Consolidated State Agency Response to Newmont Grassy Mountain Corporations Environmental Baseline Proposed Work Plan.*
- Grassy Mountain Oregon Department of Geology and Mineral Industries (DOGAMI) Technical Review Team (TRT). 2012. *Suggested Baseline Data Methodologies Submittal – Oregon Chemical Processing Mining.*
- Newmont Grassy Mountain Corporation (NMC). 1993. *Vegetation Baseline Study for Newmont Grassy Mountain Mine Project*.
- Oregon Natural Heritage Database. 1989. Rare, Threatened and Endangered Plants and Animals of Oregon.
- Pacific Northwest Interagency. 2013. *Final Oregon / Washington State Director Special Status Species List.*


To address potential direct and residual environmental impacts and to form the basis for reclamation planning at the Grassy Mountain site, the contractor will:

1) Review the TRT-approved *Grassy Mountain Terrestrial Vegetation Work Plan*. The review will assess DOGAMI/BLM requirements and the ability to meet those requirements within the scope of the work. Potential necessary additions, emissions, and/or modifications to the work scope and schedule will be addressed in a technical memorandum to involved agencies and Calico.

2) Review existing reports, mapping and other materials relative to the site, which address terrestrial vegetation resources. This will include reports prepared by NMC and Atlas Precious Metals (Atlas), their contractors, Oregon Department of Fish and Wildlife (ODFW), USFWS, BLM, Malheur County Weed Control Board, and other related documents.

#### 3.5.4.2 Field Studies

A terrestrial vegetation survey will be conducted in the study area shown in **Figure 13** to characterize the terrestrial vegetation and search for any federally-listed TES plant species. The contractor will obtain a list of sensitive plant species for the state of Oregon and from BLM, and review the study area for BLM and Oregon sensitive plant species. Those species found during field studies will be recorded.

The contractor will obtain a list of noxious weeds for Malheur County, Oregon, from the Malheur County Weed Advisory Board website. Malheur County has prioritized control and/or eradication of noxious weeds by A, B and C classes, with category A having the highest priority. Potential noxious weeds will be recorded for use in preparing the overall upland vegetation resources report. This inventory will be the basis for Calico developing a noxious weeds control strategy and plan, as a key component of the overall plan of operations (Plan) to also be submitted as part of the Division 37 process. The contractor will identify mitigation measures that could re-establish or maintain important vegetative communities and species. These should address mining, grazing and other disturbance activities.

### 3.5.5 Timing and Duration of Baseline Data Collection and Verification

#### 3.5.5.1 Timing

Plant surveys will be conducted between mid-May and the first week of June, depending on snowmelt, and will be completed no later than 2018. Specific timing within this period will be determined based on seasonal conditions.

#### 3.5.5.2 Duration

Plant surveys will be conducted over a one to two day period.

#### 3.5.5.3 Verification

- The vegetation field survey will adhere to the following protocols:
  - The vegetation field studies will be conducted by qualified/experienced personnel familiar with the regional ecosystem;
  - The Daubenmire data collection form will be used to document field data to ensure consistent data collection;
  - Vegetation transect locations will be recorded with a handheld Trimble global positioning system (GPS); and
  - Any identified TES or state, BLM sensitive species locations will be recorded with a handheld Trimble GPS and mapped using the ArcPad 10.0 computer mapping program or AutoCAD®.
- Equipment needed to perform the plant survey includes the following:
  - Plant reference books
  - Daubenmire frame
  - Compass
  - Hammer
  - Stakes
  - Magnifying glass
  - 100-foot measuring tape
  - Digital camera
  - Baggies for plant collection
  - Shovel
  - List of TES and BLM and Oregon sensitive plants
  - Noxious weed list
  - Field data forms
  - Daubenmire forms and Daubenmire summary forms
  - Field book
- All field data will be located in EM Strategies' office, and submitted to Calico electronically on a CD.

### 3.5.6 Further Anticipated Studies

No additional terrestrial vegetation studies are anticipated. If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies.

### 3.5.7 Baseline Characterization

The baseline characterization report for terrestrial (upland) vegetation will include:

- Introduction
- Project area description and map
- Regulatory framework
- Study methodology
- Baseline characterization
    - Plant community description and condition
    - Vegetation transects
- Sensitive plant species descriptions
    - TES species (federal)
    - Sensitive species (state)
    - Noxious weed species
- Description of competing land uses (e.g., livestock grazing, cultivated agriculture)
- Revegetation reclamation considerations/opportunities
- References

### 3.5.8 Bibliography

Adrian Brown Consultants, Inc. (ABC). 1992. *Draft Grassy Mountain Environmental Impact Statement.*

Bureau of Land Management (BLM), Vale District Office. 1983. *Draft Report, Southern Malheur Grazing Management Program. Environmental Impact Statement*.

Bureau of Land Management (BLM). 1999. Overview of BLM's NEPA Process.

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

Bureau of Land Management (BLM). 2008. *NEPA Handbook*, H-1790-1.

BLM. 2012. *BLM Manual Section 6840*. http://www.blm.gov/pgdata/etc/medialib/blm/ca/pdf/pdfs/pa_pdfs/biology_pdfs.Par.9d22a8ee.File.dat/6840_ManualFinal.pdf

Cedar Creek Associates, Inc. 1991. *Vegetation Technical Memorandum.*

Conquist, Arthur, Arthur H. Holmgren, Noel H. Holmgren, James L. Reveal, Patricia K. Holmgren. 1977. *Intermountain Flora, Vascular Plants of the Intermountain West, U.S.A.* Volume Six. Published by Columbia University Press, New York. 584pp.

Consolidated State Agency Response. 1993.*Consolidated State Agency Response to Newmont Grassy Mountain Corporations Environmental Baseline Proposed Work Plan.*

Daubenmire, Rexford. 1959. *A Canopy Coverage Method of Vegetational Analysis. Northwest Science.*

Grassy Mountain DOGAMI TRT. 2012. *Suggested Baseline Data Methodologies Submittal – Oregon Chemical Processing Mining*.

HDR Engineering, Inc. (HDR). 2012. *Draft Terrestrial Vegetation Report, Grassy Mountain Exploration Project*.

HDR Engineering, Inc. (HDR). 2014. *Draft Terrestrial Vegetation Baseline Study, Grassy Mountain Exploration Project.*

HDR Engineering, Inc. (HDR). 2015. *Draft Terrestrial Vegetation Baseline Study Addendum #1, Grassy Mountain Exploration Project.*

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

Newmont Grassy Mountain Corporation (NMC). 1993. *Vegetation Baseline Study for Newmont Grassy Mountain Mine Project.*

U.S. Forest Service (USFS) and Bureau of Land Management (BLM) Pacific Northwest Interagency. 2012. Federally Threatened, Endangered & Proposed, and Sensitive & Strategic Species List. Website: http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/.

U.S. Fish and Wildlife Service (USFWS). Threatened and Endangered Species List for Malheur County, Oregon.

Whitson, Tom D., Larry C. Burrill, Steven A. Dewey, David W. Cudney, B.E. Nelson, Richard D. Lee, Robert Parker. Weeds of the West. January 1991. University of Wyoming. 630 pp.

Wright, Caroline E. 1989. *Preliminary Grassy Mountain Botanical Report*.

Wright, Caroline E. 1991. *Grassy Mountain Botanical Survey*.

### 3.5.9 Contacts

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

Kris Kuyper
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
kris@emstrats.com

## 3.6 Wetlands

WETLANDS ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.6.1 Purpose and Objectives

This wetlands environmental baseline work plan is intended to provide pre-project vegetation, soil, and hydrology data that will serve to do the following:

- Describe wetland delineation methods used to conduct a field survey at that Grassy Mountain site, including characterization of the site topography, drainages, water features, soil and vegetation;
- Describe the general landscape and site alterations that exist prior to any mining activities occurring;
- Survey the project area using standards set forth in the U.S. Army Corps of Engineers (USACE) *Wetlands Delineation Manual* (Environmental Laboratory 1987) and *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (Environmental Laboratory 2008) to determine wetlands occurrence and coverage;
- Map and identify any ephemeral, intermittent, or perennial streams;
- Prepare the wetlands delineation report in accordance with the standards set forth in Oregon Administrative Rule (OAR) 141-090-0035;
- Overlay the proposed project impacts on delineated waters of the state as defined in OAR 141-085-0510;
- Coordinate with the aquatic species work plan component to identify and record potential aquatic species and amphibians;
- Produce a wetlands map showing any wetlands boundaries that were delineated;
- Produce a wetland delineation/determination report form for any identified wetlands; and
- Produce draft and final wetlands delineation reports for the Grassy Mountain Project.

### 3.6.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or

re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |

Anticipated Project Disturbance (excluding access road): 400 acres

The wetland study area is shown in **Figure 14, Wetland Study Area and Permit Area**.

### 3.6.3 Regulatory Framework

A jurisdictional wetland review will be requested from Oregon Department of State Lands (DSL). If required, a wetland delineation will be performed according to the standards set forth in the USACE *Delineation Manual* (Environmental Laboratory 1987) and *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (Environmental Laboratory 2008).

If a wetland functional assessment is determined to be necessary because there is a potential to impact wetlands or other waters, the following protocol will be used: Adamus, P., J. Morlan, and K. Verble. 2010, Oregon Rapid Wetland Assessment Protocol (ORWAP): calculator spreadsheet, databases, and data forms. Oregon Dept. of State Lands, Salem, OR.

This information will be used to complete the Division 37 permit application. It will also be required for Section 404 permitting, any related National Environmental Policy Act (NEPA) requirements, DSL removal-fill permitting, and any future monitoring and mitigation needs.

The wetland delineation report will be prepared to conform to DSL requirements. DSL has a checklist that summarizes the requirements for wetland delineation reports and a wetland delineation/determination report cover form: http://www.oregon.gov/DSL/PERMITS/docs/wetland_delin_rpt_chklist.pdf. This form is included in Appendix D.

**Oregon Administrative Rules**

- OAR Division 85, Oregon rules governing removal-fill activities, and governing the issuance and enforcement of removal-fill authorizations within waters of Oregon, including wetlands.
- OAR Division 90, Oregon rules for wetland delineation report requirements and for jurisdictional determinations for the purpose of regulating fill and removal within waters of the state.

Oregon rules for administering the Removal-Fill Law require a functional assessment for all projects permanently affecting wetlands, except for those which provide mitigation through the purchase of credits from a mitigation bank or through payment to provide mitigation (PTP) (OAR 141-085-0212(9)). A wetland functional assessment will be conducted if it is determined that wetlands or streams would be impacted by project activities.

DSL regulations require that a wetland functional assessment include existing wetland functions of the entire wetland at the proposed project impact site, and functional attributes reasonably expected to be adversely impacted by the proposed project [OAR 141-085-0121(7)]. The level of effort involved and the level of detail provided in determining and describing functions at the impact site should be commensurate with the size of the impact.

### 3.6.4 Study Methodology

#### 3.6.4.1 Literature Review


- Adamus, P., J. Morlan, and K. Verble. 2010. *Manual for the Oregon Rapid Wetland Assessment Protocol (ORWAP).* Version 2.0.2. Oregon Dept. of State Lands, Salem, OR.
- Environmental Laboratory (U.S. Army Corps of Engineers). 1987. "Corps of Engineers wetlands delineation manual," Technical Report Y-87-1. el.erdc.usace.army.mil/elpubs/pdf/wlman87.pdf. Accessed March 20, 2012.
- Environmental Laboratory (U.S. Army Corps of Engineers). 2008. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0).* el.erdc.usace.army.mil/elpubs/pdf/trel08-28.pdf. Accessed March 20, 2012.
- HDR Engineering, Inc. (HDR). 2012. *Draft Wetland Delineation Report, Grassy Mountain Project*.
- HDR Engineering, Inc. (HDR). 2015. *Wetland Delineation and Stream Assessment Report, Grassy Mountain Exploration Project.*
- Nadeau, T-L. 2011 Streamflow Duration Assessment Method for Oregon, U.S. Environmental Protection Agency, Region 10, Document No. EPA 910-R-11-002.
- Rempel, M., P. Adamus, and J. Kagan. 2009. Oregon Wetlands Explorer: an internet tool for ORWAP wetland assessment support and data archiving. Oregon State University Library and Institute for
- U.S. Army Corps of Engineers (USACE). 2005. Information Paper. Wetland Delineation Requirement. nww.usace.army.mil/html/offices/op/rf/Requirements_for_Wetland_Delination.pdf. Accessed March 20, 2012.
- U.S. Environmental Protection Agency (USEPA). 2003. EPA and Hardrock Mining: A Source Book for Industry in the Northwest and Alaska. yosemite.epa.gov/R10/WATER.NSF/Sole+Source+Aquifers/hardrockmining. Accessed March 20, 2012.
- U.S. Environmental Protection Agency (USEPA). 2008. Wetlands Compensatory Mitigation Rule. epa.gov/owow/wetlands/pdf/MitigationRule.pdf. Accessed March 29, 2012.


#### 3.6.4.2 Field Studies

The delineation will include identifying, delineating, and mapping the boundaries of wetlands and the ordinary high water mark (OHWM) of streams in the study area so that the quantity of fill material to be placed below the OHWM and within the wetland boundaries can be calculated for completion of the joint permit application. Streams, seeps and springs will be reviewed for potential wetland characteristics. The field delineation will also include gathering all the information required for the wetland delineation report and collecting baseline data to describe the affected environment as it relates to wetlands, streams, seeps and springs. The wetland delineation will be conducted in accordance with USACE's 1987 *Wetlands Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (Environmental Laboratory 2008). These methods require evidence of three parameters - a dominance of hydrophytic vegetation, hydric soil, and wetland hydrology - to be simultaneously present for state jurisdiction and simultaneously present with a connection to traditional navigable water for federal jurisdiction. In order to identify and delineate hydric soil in the field, staff will reference the Munsell Soil Color Charts and the *Field Indicators of Hydric Soils in the United States*, which was developed by soil scientists of the Natural Resources Conservation Service (NRCS) in cooperation with the U.S. Fish and Wildlife Service (USFWS), USACE, U.S. Environmental Protection Agency (USEPA), and various regional, state, and local agencies.

### 3.6.5 Timing and Duration of Baseline Data Collection and Verification

#### 3.6.5.1 Timing and Duration

The wetland delineation will be completed no later than 2018.

#### 3.6.5.2 Verification

1. The wetland delineation will follow the documented/agreed to protocols described in the approved wetland work plan.
2. The wetland delineation will be conducted by qualified/experienced personnel.
3. Wetland soil pits will be recorded with a handheld Trimble global positioning system (GPS).
4. Wetland boundaries will be recorded with a handheld Trimble global positioning system. Wetland boundaries will be mapped using the ArcPad 10.0 computer mapping program or AutoCAD®.
5. The mapped areas will be checked with field notes.
6. All field data will be recorded on the Wetland Determination Data Form – Arid West Region (see Appendix D).
7. Equipment needed to perform the wetland delineation includes:
    a. Plant reference books
    b. Munsell Soil Color Charts
    c. Water spray bottle
    d. Tape measure
    e. Magnifying glass
    f. Digital camera
    g. Baggies for plant collection
    h. Shovel
    i. Wetland determination data forms
    j. Field book
    k. Handheld Trimble GPS unit
    l. Small dry erase board for naming soil pits

### 3.6.6 Further Anticipated Studies

No additional wetland field studies are anticipated. If additional information is determined to be necessary or additional areas are identified that need to be delineated, the work will be conducted using approved methodologies.

### 3.6.7 Baseline Characterization

The baseline characterization report for wetlands will also be closely coordinated with the wildlife mitigation component to meet the requirements of OAR 635-420-0030. General information for each wetland will be recorded, including size, hydro-geomorphic classification, and Cowardin classification. The report will include all site data forms for routine wetland determination for those areas with potential wetland characteristics. The report will also describe any potential effects the proposed project may have on these wetland resources. The baseline characterization report for wetlands will include:

- Wetland Delineation/Determination Report Cover Form (see Appendix D)
- Introduction
- Landscape setting and land use
- Site alterations
- Precipitation data and analysis
- Methodology

- Description of all wetlands and other non-wetland waters
- Deviation from Local Wetlands Inventory (LWI) or National Wetlands Inventory (NWI)
- Mapping method
- Additional information
- Results and conclusions
- Disclaimer
- References
- Appendices
    - Location map and study area maps
    - Wetland delineation maps
    - Aerial photos
    - Site data forms
    - List of plant species observed
    - Site photographs
    - USFWS NWI mapping
    - NRCS/Malheur County soil map
    - Tax lot map

Stream corridors, springs, and seeps in the study area will also be investigated, and a description of these will be included in the baseline characterization report. Streams will be described as perennial, intermittent, or ephemeral. The Streamflow Duration Assessment Method for Oregon will be used to help determine if a stream is perennial, intermittent, or ephemeral.

### 3.6.8 Bibliography

Adamus, P., J. Morlan, and K. Verble. 2010. Oregon Rapid Wetland Assessment Protocol (ORWAP): calculator spreadsheet, databases, and data forms. Oregon Dept. of State Lands, Salem, OR.

Environmental Laboratory. 1987. "Corps of Engineers wetlands delineation manual," Technical Report Y-87-1. el.erdc.usace.army.mil/elpubs/pdf/wlman87.pdf. Accessed March 20, 2012.

Environmental Laboratory. 2008. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0).* el.erdc.usace.army.mil/elpubs/pdf/trel08-28.pdf. Accessed March 20, 2012.

HDR Engineering, Inc. (HDR). 2012. *Draft Wetland Delineation Report, Grassy Mountain Project*.

HDR Engineering, Inc. (HDR). 2015. *Wetland Delineation and Stream Assessment Report, Grassy Mountain Exploration Project.*

Nadeau, T-L. 2011 Streamflow Duration Assessment Method for Oregon, U.S. Environmental Protection Agency, Region 10, Document No. EPA 910-R-11-002.

Rempel, M., P. Adamus, and J. Kagan. 2009. Oregon Wetlands Explorer: an internet tool for ORWAP wetland assessment support and data archiving. Oregon State University Library and Institute for

U.S. Army Corps of Engineers (USACE). 2005. Information Paper. Wetland Delineation Requirement. nww.usace.army.mil/html/offices/op/rf/Requirements_for_Wetland_Delination.pdf. Accessed March 20, 2012.

U.S. Environmental Protection Agency (USEPA). 2003. EPA and Hardrock Mining: A Source Book for Industry in the Northwest and Alaska. yosemite.epa.gov/R10/WATER.NSF/Sole+Source+Aquifers/hardrockmining. Accessed March 20, 2012.

U.S. Environmental Protection Agency (USEPA). 2008. Wetlands Compensatory Mitigation Rule. epa.gov/owow/wetlands/pdf/MitigationRule.pdf. Accessed March 29, 2012.

### 3.6.9 Contacts

Bethany Harrington
Oregon Department of State Lands
541-325-6171
Bethany.Harrington@state.or.us

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

Kris Kuyper
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
kris@emstrats.com

## 3.7 Wildlife Resources

WILDLIFE RESOURCES ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.7.1 Purposes and Objectives

The purpose of the wildlife baseline study will be to collect sufficient information to characterize the affected environment for terrestrial wildlife and terrestrial wildlife habitat in qualitative and quantitative discussions for the proposed Grassy Mountain Project area. (Amphibians are addressed in the *Aquatic Resources Baseline Study Work Plan* (2017).) Considerable data have been collected for the study area as a result of the Atlas Precious Metals, Inc. (Atlas) and Newmont Mining Company (NMC) environmental baseline programs in 1990 and 1991. These studies will be used as reference documents to show past use and current conditions will be documented through the collection of additional baseline data on current wildlife use in the project area. Per Oregon Administrative Rule (OAR) 632-037-0055, Oregon Department of Geology and Mineral Industries (DOGAMI) requires baseline data to be collected on state or federally-listed threatened or endangered (T&E) species and habitat and state sensitive species and habitat.

As outlined in OAR 635-037-0125, the baseline data collection will help determine the wildlife protection standards consistent with Oregon Department of Fish and Wildlife (ODFW) policies, including the following:

(1) Protective measures to maintain an objective of zero wildlife mortality;
(2) All chemical processing solutions and associated wastewater shall be covered or contained to preclude access by wildlife or maintained in a condition that is not harmful to wildlife;
(3) Onsite and offsite mitigation insuring there is no overall net loss of habitat value;
(4) No loss of existing critical habitat of any state or federally-listed threatened or endangered fish or wildlife species; and
(5) Any other standard adopted by rule by ODFW applicable to a chemical process mine.

### 3.7.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |

Anticipated Project Disturbance (excluding access road): 400 acres

Outside of the project study area (Permit Area), two distinct wildlife study areas have been developed through discussions and correspondence with the U.S. Fish and Wildlife Service (USFWS) (letter dated November 6, 2012) and ODFW (personal communication Philip Milburn, ODFW) based on species presence and life history information. The wildlife study areas are defined as follows: 1) Permit Area plus a 2-mile buffer area, and 2) Permit Area plus a 0.5-mile buffer area. See **Figure 15, Wildlife Study Area and Permit Area** for a map representation of the two distinct wildlife study areas.

Depending on the outcome of hydrological testing, any spring or wetland affected by project water use will be included regardless of distance. This could affect both of the above-referenced wildlife study areas. When the testing is complete, each of the above-referenced wildlife study areas will be reviewed, any changes will be incorporated into this work plan, and appropriate agency contact will be completed.

### 3.7.3 Regulatory Framework

#### 3.7.3.1 Oregon Laws

The State of Oregon has threatened, endangered, and sensitive (TES) species provisions that protect native vertebrates and plants on state lands (Oregon Revised Statutes [ORS] sections 496.172 to 496.192; 498.026; 564.100 to 564.135), and requires consideration of the impacts of any action on private land, in this case chemical mining, on T&E species (ORS sections 517.956. 496.012, and 506.109).

ORS section 517.956 establishes standards and protection measures that all chemical mining operations will follow that ensure protection measures for fish and wildlife are consistent with ODFW policies, including the following:

(a) Protective measures to maintain an objective of zero wildlife mortality;

(b) On-site and off-site mitigation ensuring that there is no overall net loss of habitat value;

(c) No loss of existing critical habitat of any state or federally-listed threatened or endangered species;

(d) Fish and wildlife mortality shall be reported in accordance with a monitoring and reporting plan approved by ODFW;

(e) ODFW shall establish by rule standards for review of a proposed chemical process mining operation for the purpose of developing conditions for fish and wildlife habitat protection that satisfy the terms of this section for inclusion in a consolidated permit by DOGAMI; and

(f) Surface reclamation of a chemical process mine site shall ensure environmental protection and that a self-sustaining ecosystem, comparable to undamaged ecosystems in the area, has been established in satisfaction of the operator's habitat restoration obligations.

The purpose of OAR Chapter 635 Division 420 is to prescribe the standards for ODFW review of proposed chemical process mining operations for the purpose of developing conditions for protection of wildlife and their habitat, to further the Wildlife Policy (ORS 496.012) and Food Fish Management Policy (ORS 506.109) of the State of Oregon. Baseline data collection will be consistent with what is required in developing a wildlife protection plan in accordance with OAR 635-420-0010, standards to protect wildlife in accordance with OAR 635-420-0015-0025, a habitat mitigation plan in accordance with OAR 635-420-

0030, and wildlife mitigation plan in accordance with 635-420-0060. Species to be addressed include all species listed under the Oregon Endangered Species Act (OAR 635-100-0100 to 0130) and Oregon Sensitive Species Rule (OAR 635-100-040).

The wildlife mitigation plan shall include the information required in OAR 635-415-0020(5). Affected wildlife habitats shall be evaluated using methodologies approved by ODFW, which are well-documented, measurable and verifiable. Examples of habitats that shall be addressed in the mitigation plan include, but are not limited to the following:

(a) Surface waterways, streams, springs, seeps, wetlands and other aquatic habitats;
(b) Riparian areas;
(c) Big game habitat;
(d) Bird habitat;
(e) Habitat for state or federally-listed T&E species, and state sensitive species;
(f) Reproduction and nursery areas;
(g) Fish spawning areas;
(h) Geomorphic and edaphic habitats including cliffs, caves, sand dunes, play as and local distinctive soils that, along with their vegetation, contrast markedly with the surrounding area; and
(i) Wildlife migration and movement corridors.

In addition, ODFW manages wildlife species populations through management objectives specified in their respective management plans; BLM manages adequate habitat to support these numbers. BLM and ODFW work cooperatively to benefit the management of wildlife and wildlife habitat as described in the 2001 memorandum of understanding (MOU) between the two agencies. BLM species are discussed further in the federal law section of this work plan.

#### 3.7.3.2 Federal Laws

The Council on Environmental Quality (CEQ) regulations discuss "human environment" at 40 Code of Federal Regulations (CFR) 1508.14. This term broadly relates to the biological, physical, social and economic elements of the environment. It includes the wildlife resources category. Relevant data is to be used in describing the affected environment as the basis for determining the effects (direct and indirect) of a proposed action. The 2008 BLM *NEPA Handbook* (H-1790-1) describes potential National Environmental Policy Act (NEPA)-related federal requirements.

Other federal requirements, such as the Endangered Species Act (ESA) consultations, and critical habitat procedural requirements are discussed in Chapter 175, "Wildlife and Vegetation Protection; Environmental Regulation of the American Law of Mining" (2010 Holland and Hart). These primarily involve USFWS. The following sections provide a list of relevant federal regulations.

##### 3.7.3.2.1 Federal Endangered Species Act

Section 7 of the ESA (19 United States Code [USC] § 1536(c)), as amended, states that any action authorized, funded, or carried out by a federal agency does not jeopardize the continued existence of a federally-listed T&E species, or result in the destruction or adverse modification of federally-listed designated critical habitat. The action agencies are required to consult with USFWS and/or the National Oceanic and Atmospheric Administration (NOAA) to determine whether federally-listed T&E species or designated critical habitat are found within the vicinity of the proposed project, and to determine the proposed action's potential effects on those species or critical habitats.

##### 3.7.3.2.2 Bald and Golden Eagle Protection Act

When first enacted in 1940, the Bald and Golden Eagle Protection Act (16 U.S.C.§ 668) (BGEPA) prohibited the take, transport or sale of bald eagles, their eggs, or any part of an eagle except where expressly

allowed by the secretary of interior. The Act was amended in 1962 to extend the prohibitions to the golden eagle.

#### 3.7.3.2.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (16 U.S.C. §§ 703-712) (MBTA) implements various treaties and conventions for the protection of migratory birds. Under this act, taking, killing, or possessing migratory birds (including any part, nest, or egg) is unlawful.

#### 3.7.3.2.4 Bureau of Land Management (Manual 6840) – Special Status Species

BLM Manual 6840 defines sensitive species as *"... those species not already included as BLM special status species under (1) federal listed, proposed, or candidate species, or (2) State of Oregon listed species. Native species may be listed as 'sensitive' if one of the following applies: (1) could become endangered or extirpated from a state or significant portion of its range; (2) is under review by the USFWS; (3) numbers or habitat capability are declining so rapidly that federal listing may become necessary; (4) has typically small and widely dispersed populations; (5) inhabits ecological refugia, specialized, or unique habitats; or (6) is state-listed; although, is better conserved through application of the BLM sensitive species status."*

### 3.7.4 Study Methodology

The following section outlines the specific wildlife baseline studies that will be completed within the two distinct wildlife study areas. The wildlife resources project study area is shown in **Figure 15.**

The wildlife studies have been developed in coordination with BLM and ODFW biologists to ensure that all required information is obtained and documented in the baseline report and that wildlife surveys are conducted according to acceptable protocols.

#### 3.7.4.1 Literature Review

- State Regulations
  - OAR 635, Division 420. *"These rules prescribe the standards for Department review of proposed chemical process mining operations for the purpose of developing conditions for protection of wildlife and their habitat, to further the Wildlife Policy (ORS 496.012 and Food Fish Management Policy (OAS 506.109) of the State of Oregon."*
  - OAR 635, Division 415. *"The purpose of these rules is to further the Wildlife Policy (ORS 496.012) and the Food Fish Management Policy (506.109) of the State of Oregon through the application of consistent goals and standards to mitigate impacts to fish and wildlife habitat caused by land and water development actions."*
- Previous Documentation
  - 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
  - HDR Engineering, Inc. (HDR). 2012. *Draft Terrestrial Vegetation Report, Grassy Mountain Exploration Project.*
  - HDR Engineering, Inc. (HDR). 2014. *Draft Terrestrial Vegetation Baseline Study, Grassy Mountain Exploration Project*.
  - HDR Engineering, Inc. (HDR). 2015. *Draft Terrestrial Vegetation Baseline Study Addendum #1, Grassy Mountain Exploration Project.*
  - Newmont Grassy Mountain Corporation (NMC). (1993). *Grassy Mountain Gold Project Environmental Baseline Studies Work Plan*. Information compiled in this report includes a characterization of wildlife habitats, description of results from previous wildlife field surveys,

list of mammals, bird species, amphibian, and reptile species occurring or expected to occur in the project area.

- Northwest Wildlife Consultants, Inc. (NWC). (2014). *Wildlife Resources Baseline Study for the Grassy Mountain Gold Project.* Prepared for Calico Resources USA Corp. and HDR Engineering, Inc. September 30, 2014.
- IMS, Inc. (1989). *Final Report: Soil, Vegetation, and Wildlife Resources of Grassy Mountain Project Area*.
- Western Technologies, Inc. (1988). *Environmental Baseline Work Plan, Grassy Mountain Gold Min, Malheur County, Oregon* (vegetation resources; wildlife habitat; endangered, threatened and sensitive species).
- Cedar Creek Associates, Inc. (1991). *Terrestrial Wildlife Technical Memorandum* (see this report for additional references)
- Cedar Creek Associates, Inc. (1991). *Vegetation Technical Memorandum*.
- Wright, Carolyn E. (1991). *Grassy Mountain Botanical Survey*.
- Isaacs, F. B. (2011). *Golden eagles (Aquila chrysaetos) nesting in Oregon, 2011*. 1st Annual Report, Revised, 16 April 2012.

- State and Federal ESA and Sensitive Species listings
  - Oregon Natural Heritage Database (1989). *Rare, Threatened and Endangered Plants and Animals of Oregon.*
  - Oregon Biodiversity Information Center (ORBIC). (2012). List of Rare, Threatened, and Endangered Species.
  - U.S. Forest Service (USFS) and BLM Pacific Northwest Interagency. Federally Threatened, Endangered & Proposed, and Sensitive & Strategic Species List. Website: http://www.fs.fed.us/r6/sfpnw/issssp/agency-policy/. Obtained: 09-11-2012.
  - BLM (Manual 6840) http://www.blm.gov/pgdata/etc/medialib/blm/ca/pdf/pdfs/pa_pdfs/biology_pdfs.Par.9d22a8ee.File.dat/6840_ManualFinal.pdf
  - BLM Special Status Species, Vale District BLM (BLM 2008).
- Geographical Information System (GIS) Data layers
  - ODFW Core and Low Density Greater sage-grouse shape files (2011)
  - ODFW Winter Range for Eastern Oregon, elk and deer (2013)
  - ORBIC database (2012)
- Survey Methodologies
  - *Greater Sage-Grouse Conservation Assessment and Strategy for Oregon: A Plan to Maintain and Enhance Population and habitat* (Hagen 2011)
  - *The Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance* provides guidance to conduct informed impact analyses and mitigation during the National Environmental Policy Act (NEPA) process (USFWS 2010).
  - *Handbook of Field Methods for Monitoring Landbirds*, USFS General Technical Report PSW-GTR_144 (Ralph et al 1993)
  - *Inventory Methods for Raptors: Standards for Components of British Columbia Biodiversity*. (Ministry of Sustainable Resource Management 2001)

- *Surveying for Pygmy Rabbits (Brachylagus idahoensis),* Fourth Draft – June 3, 2004 Helen Ulmschneider, Boise District, ID BLM (Ulmschneider, Helen 2004).
- *Using Echo Locations to Model Bat Occupancy and Inform Mitigations at Wind Energy Facilities 2011* (Weller T.J. and Baldwin J.A. 2011)
- *Multiple species inventory and monitoring technical guide*. Gen. Tech. Rep. WO-73. Washington, DC: U.S. Department of Agriculture, Forest Service, Washington Office. 204 p. Manley, P.N.; Van Horne, B.; Roth, J.K.; Zielinski, W.J.; McKenzie, M.M.; Weller, T.J.; Weckerly, F.W.; Vojta, C. 2006.
- *Quality assurance standards for wildlife inventory projects* [electronic resource] / prepared by Ministry of Environment, Ecosystems Branch for the Resources Information Standards Committee. -- Version 2.0. The Province of British Columbia. Ministry of Environment, Ecosystems Branch. March 2009.

#### 3.7.4.2 Existing Information

Wildlife species and habitats occurring within and adjacent to the project study are consistent with desert areas of the Great Basin and consist of desert-rangeland type habitat where sagebrush and grasses are the dominant species. The area has been extensively grazed for a number of years. Portions of the study area appear to have been re-seeded at one time with a crested wheatgrass (*Agropyron cristatum*) dominated seed mix. Three vegetation community types were identified within the study area: sagebrush/bunchgrass, crested wheatgrass/annual grass, and annual grass. Cheatgrass (*Bromus tectorum*) and/or medusahead (*Taeniatherum caput-medusae*) were often the most dominant species in nearly every plant community.

The sagebrush/bunchgrass plant community type is characteristic of the native sagebrush community found throughout much of Eastern Oregon. This plant community typically occurs on rocky slopes. The shrub stratum is typically dominated by big sagebrush (Artemisia tridentata), rubber rabbitbrush (*Chrysothamnus nauseosus*) and green rabbitbrush (*Chrysothamnus viscidiflorus*). The understory typically includes Sandberg's bluegrass (*Poa secunda*), Idaho fescue (*Festuca idahoensis*), and bluebunch wheatgrass (*Agropyron spicatum*) with a cheatgrass and/or medusahead mat.

The crested wheatgrass/annual grass plant community occurs throughout portions of the study area. Soils in these areas were typically less rocky with 25 to 50 percent bare ground. The crested wheatgrass is likely a result of past re-seeding. Grazing is common in these areas and a cheatgrass and/or medusahead mat is prevalent throughout.

As noted in the previous baseline documentation (NMC 1993), the project provides habitat for a number of wildlife species. Mule deer and pronghorn are present in the area year round, but in low densities. ODFW does not map important winter range for deer, pronghorn, or elk in the area. The site is very dry, dictating its use of water-dependent species. This includes many of the migratory waterfowl and shorebirds that travel within the Pacific Flyway. Lake Owyhee, located 6 miles to the southeast of the site, attracts several species of migrating waterfowl, shorebirds, and passerines. Many of these birds cross the project site in transit.

Sage-dependent species, like greater sage-grouse and sage sparrow, may occur in the area but in low numbers due to the high degree of impact to the existing habitat and the invasion of noxious weeds. Raptor use is common with nine documented species, including golden eagle, red-tailed hawk, northern harrier, sharp-shinned hawk, American kestrel, prairie falcon, great horned owl, burrowing owl, and short-eared owl. Other species not documented previously include Swainson's hawk, ferruginous hawk, rough-legged hawk, and long-eared owl (NMC 1993). Nest sites for multiple raptor species have been documented in the area, including, currently, three golden eagle nests.

### 3.7.4.3 Field Studies

The following field studies will begin in the spring and conclude in the fall, and will be performed in accordance with state and federal regulations. Field studies will be completed no later than 2018. These studies will be performed as outlined above, and will include two distinct wildlife study areas; 1) Permit Area plus a 2-mile buffer area, and 2) Permit Area plus a 0.5-mile buffer area. The regulatory species that will be surveyed in these areas follow:

- **Permit Area plus 2-mile buffer area**: Greater sage-grouse, golden and bald eagle, and all other nesting raptor species will have defined baseline studies within this area. General observation (encounters) of other threatened, endangered, and candidate (TEC) species listed under state and federal ESAs, sensitive species listed by the State of Oregon and BLM, and non-listed species will also occur.
- **Permit Area plus 0.5-mile buffer area**: All other species listed as TEC species under state and federal ESAs and sensitive species listed by the State of Oregon and BLM will be studied using various methods. General observations of non-listed species will also occur in order to generate a species list of the area.

Table 18 summarizes the sensitive species documented or expected to occur in the wildlife study areas of the project area.

**Table 18. Federal and State Listed Threatened, Endangered, Candidate, Species of Concern, and Special Status Species (Sensitive) Potentially Occurring within the Vicinity of the Proposed Project Study Area**

| Species | Federal Status | State Status |
|---|---|---|
| Greater sage-grouse | BLM SSS | Sensitive |
| Golden eagle | Regulated under BGEPA | N/A |
| Ferruginous hawk | BLM SSS | Sensitive |
| Swainson's hawk | BLM SSS | Sensitive |
| Western burrowing owl | BLM SSS | Sensitive |
| White-tailed jack rabbit | BLM SSS | Sensitive |
| Pygmy Rabbit | BLM SSS | Sensitive |
| Townsend's big-eared bat | BLM SSS | Sensitive |
| Spotted bat | BLM SSS | Sensitive |
| Fringe myotis | BLM SSS | Sensitive |
| Grasshopper sparrow | BLM SSS | Sensitive |

[1]Aquatic sensitive species are addressed in the *Aquatic Resources Baseline Study Work Plan* (2013).

#### 3.7.4.3.1 Habitat Categorization

Baseline vegetation data collection will need to provide sufficient detail to facilitate habitat characterization in accordance with the ODFW *Fish and Wildlife Habitat Mitigation Policy* (OAR 635-415). Selection of appropriate mitigation for impacts has followed guidance provided by ODFW in "Mitigation Goals and Standards" (OAR 635-415-0020 through 0025), which specifies general mitigation goals and standards for six categories of habitat value. The ODFW mitigation goals and standards are similar to the USFWS's "Resource Categories and Mitigation Goals," as described in the USFWS *Mitigation Policy* (USFWS 1981). The ODFW mitigation goals and implementation standards are summarized in **Table 19**.

**Table 19. Oregon Department of Fish and Wildlife Mitigation Goals and Implementation Standards by Habitat Category**

| Habitat Category | Mitigation Goal | Achieved by |
|---|---|---|
| Category 1 | No loss of habitat quantity or quality | Avoidance |
| Category 2 | No net loss of habitat quantity or quality and to provide a net benefit of habitat quantity or quality | In-kind, in-proximity mitigation |
| Category 3 | No net loss of habitat quantity or quality | In-kind, in-proximity mitigation |
| Category 4 | No net loss of habitat quantity or quality | In-kind or out-of-kind, in-proximity or off-proximity mitigation |
| Category 5 | Net benefit in habitat quantity and quality | Actions that improve habitat conditions |
| Category 6 | Minimize impacts | Conscientious Project design |

Source: ODFW, 2006.

The habitat categories in the wildlife study areas will be qualitatively categorized based on their importance to fish and wildlife, in accordance with the ODFW *Fish and Wildlife Habitat Mitigation Policy*. Habitat categorization will be developed using a combination of the results of the terrestrial vegetation survey of the project area and Northwest Regional Gap land cover classifications and species occurrence modeling. Using these as a foundation, habitat types will be categorized for the development of a wildlife habitat mitigation plan.

Mapping will be conducted using a combination of aerial photograph interpretation and on-the-ground verification. The mapping effort will be used to characterizes the range of habitat types present within the project area from the perspective of potential and existing wildlife use for both general (i.e., shrub-steppe obligates) and specific (i.e., special status species) vertebrate taxa.

These data will then be used to develop habitat categories based on vegetation type and species use. Additional GIS layers, including ODFW core and low density and lek location and known raptor nest shape files will be used to further refine the habitat category of a habitat type and area.

In regards to greater sage-grouse, specific habitat categorizations methods have been developed by ODFW (Hagen 2011) and will be employed as part of this project.

Habitat characterization and mapping will also be used to define and refine survey areas for wildlife species within Mine and Process Area parcel plus 2-mile and 0.5-mile buffer areas, and the Access Road Area parcel.

These standards do not preclude mitigation required for compliance with federal and state laws and policies such as the ESA or the Clean Water Act (CWA), for example. In the context of the project, however, they are intended to serve as goals for avoiding or minimizing impacts to both special and non-special-status species.

#### 3.7.4.3.2 Permit Area Plus 2-mile Buffer Area

**Greater Sage-grouse**. Greater sage-grouse surveys, including lek searches and counts and presence/absence and/or use surveys for summer brooding and winter seasons, will be completed following protocols outlined in the greater sage-grouse population monitoring procedures in ODFW's *Greater-sage-grouse Conservation Assessment and Strategy for Oregon* (Hagen 2011). These surveys will occur within the Permit Area, plus 2-mile buffer wildlife study area. Survey protocols are summarized below. See Section 3.7.5 for specific protocols, quality assurance/quality control (QA/QC) procedures, data forms, data entry procedures, and data delivery procedures.

Greater-sage-grouse habitat will be categorized using Hagen 2011 protocols. Habitat characterization will include habitat quality, condition, and composition within the Permit Area, plus 2-mile buffer wildlife study area. ODFW GIS data layers for core and low density areas will be used as the foundation for habitat mapping and categorization. Delineated greater sage-grouse habitat will be surveyed for summer and winter use. Lek surveys will occur throughout the wildlife study area within suitable habitat.

Surveys for new and existing leks will be conducted as follows:

1. Searches will be conducted in April. Survey season corresponds to peak male attendance.
2. Surveys for new leks will be conducted a minimum of two times (with subsequent surveys 7 to 10 days apart).
3. Surveys for new leks will be conducted throughout suitable habitat. New leks can be located by the discovery of concentrated tracks/droppings/feathers at all times of the day when conducting other field activities. Return visits to such sites during the morning strutting hours must be made to confirm the location is a lek.
4. Surveys to confirm the activity of a lek may require only one visit if grouse are identified on the lek.

   **Note**: To designate a known lek as inactive requires either an absence of birds on the lek during multiple ground visits under ideal conditions throughout the strutting season, or a ground check of the exact lek site late in the strutting season that fails to find any sign (droppings/feathers) of strutting activity.
5. Lek surveys will be conducted via helicopter or from the ground by driving along roads in suspected or known breeding habitat and stopping every 0.5 mile to listen for sounds of breeding grouse. Ground searches will be conducted from an hour before to an hour after sunrise. In less accessible areas, searches can be made from a mountain bike, trail motorcycle, four-wheel all-terrain vehicle, horseback, or on foot. On a calm morning, breeding sage-grouse may be heard at a distance of about 1 mile (1.5 kilometers). All openings or areas of less dense sagebrush will be searched for breeding birds with binoculars or a spotting scope.
6. If a new lek is identified, the location will be accurately determined and recorded in Universal Transverse Mercators (UTMs) using North American Datum 1983 (NAD83). It is advisable to record/map the perimeters of new leks. Surveyor(s) should not disturb grouse to record global positioning system (GPS) information at lek locations. If a lek is active, the surveyor(s) should make the best estimate of the lek location and return later to confirm.

*Brood Rearing Surveys (summer use)*

1. Surveys will be conducted in suitable habitat at least twice during the period of June 15 to July 30 (with subsequent surveys 7 to 10 days apart). Key habitats to survey include meadows, springs, and riparian areas within or adjacent to sagebrush cover. Surveys will not be completed during inclement weather.
2. Surveys to be completed via helicopter or on foot via access by four-wheel vehicle to get to habitat areas.
3. Observations will be documented on forms and signs of use will be documented via GPS.
4. All birds observed will be counted.
5. Birds will be classified as male, female, juvenile, and unknown. Classification information will be used to calculate chicks per brood, chicks per adult, and chicks per female. The following characteristics will be used to help the observer separate chicks from females or other adults during brood classification:
   a. Pronounced stripe through the eye of chicks.
   b. Smaller size of chicks (usually noted with late hatches; however, if counts are done late, chicks may be as large as adult females).

c. Lack of black patch on chest of chicks as compared to adults.
d. Uneven lengths in tail feathers; on younger birds, which are early in their molt
e. Sequence (adults have an even outer margin resulting in a more "pointed" tail).

*Brood Rearing Surveys (winter use)*

1. Surveys will be conducted in suitable habitat at least twice during periods of snow (if possible) and cold temperatures from December 1 to January 30 (with subsequent surveys 7 to 10 days apart).
2. Surveys to be completed via helicopter or on foot via access using 4-wheel vehicle or snowmobiles to get to habitat areas.
3. Observations (tracks/sign) will be documented on forms and signs of use will be documented via GPS.
4. All birds observed will be counted.
5. Birds will be classified as male, female, juvenile, and unknown. Additional detail of collected data provided on the data sheet.

*Equipment List*

Equipment needed to perform the greater sage grouse surveys includes the following:

- Bird reference books (specific greater sage grouse ID guide that includes juvenile, female, and male comparisons)
- Compass
- GPS
- Camera
- Binoculars
- Spotting scope
- Hammer
- Stakes
- Flagging
- Plastic bags
- 100-foot measuring tape
- Digital camera
- Field data forms
- 4x4 vehicle

**Golden Eagle.** Nest search and monitoring for golden eagles will be conducted in accordance with Interim Golden Inventory and Monitoring Protocols (USFWS February 2010). There are three known golden eagle nest territories that may be potentially impacted by project related disturbance. Survey protocols are summarized below. See Section 3.7.5 for specific protocols, QA/QC procedures, data forms, data entry procedures, and data delivery procedures.

*Golden Eagle Nest Surveys*

1. Nest searches will be conducted by searching habitat suitable for most aboveground nesting species, such as cottonwood, ponderosa pine, tall shrubs, and cliffs or rocky outcrops and transmission lines. These areas will be refined base on terrestrial vegetation habitat types.
2. Surveys will be conducted during the nesting season between April 15 and June 15. Surveys will be conducted during morning hours when weather allows. Surveys will not be completed in inclement weather.
3. Observation posts (OPs) will be established during initial reconnaissance of potential or known nest cliffs, and established in locations that are far enough from the potential nest site to effectively

observe the behavior of the adults (if present) without disturbing nesting behavior. Observation posts for monitoring known territories will be no closer than 300 meters for extended observations, and generally no further than 700 meters, where terrain allows. Maximum OP distance would be 1600 meters.

4. Ground observers will survey from observation points for a minimum of 4 hours, unless observations yield golden eagle presence, or golden eagle behavior indicates eggs or young, or observation suggests the observer is disturbing the birds.
5. Data will be collected at two separate periods at least 30 days apart during the nesting season.
6. Data would be recorded on the standardized form, and summarized for project reports in a table format; data will be provided to the land management agency in a digital format.
7. Locations of all raptor nests will be recorded with a hand-held GPS unit. To determine whether a nest was active or inactive, the biologist will rely on clues that include behavior of adults and presence of eggs, young, or whitewash. Attempts will be made to identify the species of raptor associated with each active nest.

**Nesting Raptors**. The department recommends raptor nest searches in accordance with the protocols in *Inventory Methods for Raptors: Standards for components of British Columbia Biodiversity* (2001). Emphasis will be placed on sensitive species: American peregrine falcon, ferruginous hawk, Swainson's hawk, and burrowing owl. Nesting raptor surveys will follow the general protocol outlined for the golden eagle. Burrowing owl surveys will follow the call-broadcast methods (Conway and Simon 2003). Specific protocols for other identified sensitive species will be employed as necessary.

*Equipment List*

Equipment needed to perform the golden eagle and raptor surveys includes the following:

- Bird reference books (specific to raptor ID for juvenile and adults)
- Compass
- GPS
- Camera
- Binoculars
- Spotting scope
- Hammer
- Stakes
- Flagging
- Plastic bags
- 100-foot measuring tape
- Digital camera
- Field data forms
- 4x4 vehicle

#### 3.7.4.3.3 Permit Area Plus 0.5-mile Buffer Area

**Pygmy Rabbits and White-tailed Jackrabbit.** If habitat characterization indicates potential pygmy rabbit habitat in the project area, surveying protocols will follow *Surveying for Pygmy Rabbits (Brachylagus idahoensis)* (Fourth Draft – June 3, 2004, Helen Ulmschneider, Boise District, ID BLM). There are two main features of pygmy rabbit habitat: relatively taller and denser big sagebrush (*Artemisia tridentata)* (but see below) and deep soils.

Survey protocols are summarized below. See Section 3.7.5 for specific protocols, QA/QC procedures, data forms, data entry procedures, and data delivery procedures.

*Pygmy Rabbit Patch Survey Procedures*

1. Using the *Draft Terrestrial Vegetation Report* (HDR 2012) and *Draft Terrestrial Vegetation Baseline Study Addendum #1*(HDR 2015) surveys, and the additional mapping effort using the same methodologies, pygmy rabbit habitat will be determined and patches developed.
2. Surveys will be performed in the late spring when pygmy rabbits are using burrows extensively. Surveys patches will all be surveyed once for use.
3. Using a meandering approach, the patch will be surveyed.
    a. If done in tandem, the meandering pattern will be no closer than 100 feet. It is simpler and faster to walk a meandering line through a habitat patch, targeting the most likely looking places (instead of the edge), and then continue on to the next swale or habitat patch.
    b. If alone, walk in a loop or triangle, targeting patches of taller, denser sage, looking for pygmy rabbit burrows and pellets.
    c. In patchy habitat and where patches are small and follow the contours of the land, following the landforms and targeting the taller sagebrush clumps will be most effective. This means the survey line will be meandering, not straight.
    d. If the habitat is uniform or on extensive flats straight transect lines arranged in a triangle, or a spiral pattern may be appropriate. For a spiral transect, walk directly to the center of a large, dense sagebrush patch, and then spiral out, gradually increasing the diameter of the circle until the habitat is no longer appropriate.
4. All routes will be documented with GPS for repeatability.
5. Any evidence of use or pellet detection will be documented on data forms and GPS.
6. When an area is found to contain current burrows or active sign of pygmy rabbit use (or if you have not yet seen a pygmy rabbit in the area) an additional half-hour search of the area will be conducted looking for pygmy rabbits. This will help confirm whether you have pygmy rabbits. GPS active and inactive nest locations and high use areas. If able, note behavior and other information.

*White-tailed Jackrabbit Patch Survey Procedures*

The same protocol will be followed to collect white-tailed jackrabbit data. Data will be collected along transects in applicable habitat.

*Equipment List*

Equipment needed to perform the pygmy rabbit and white-tailed jackrabbit includes the following:

- Mammal reference books
- Compass
- GPS
- Camera
- Binoculars
- Spotting scope
- Hammer
- Stakes
- Flagging
- Plastic bags
- 100-foot measuring tape
- Digital camera
- Field data forms
- 4x4 vehicle

**Bats**. Bats are a strategy species for the northern basin and range ecosystem identified in the *Oregon Conservation Strategy* (2001). Baseline information will be collected on bat use in the area using echo location. The protocol in Weller T.J. and Baldwin J.A., *Using Echo Locations to Model Bat Occupancy and Inform Mitigations at Wind Energy Facilities (*2011), will be used. Special attention will be placed on sensitive bat species, including Townsend's bug-eared bat, spotted bat, and fringe myotis.

Regarding bat monitoring, in addition to the echolocation monitoring, ODFW recommends all potential caves and mine sites be surveyed for bat use. The study method is listed below.

Survey protocols are summarized below. See Section 3.7.5 for specific protocols, QA/QC procedures, data forms, data entry procedures, and data delivery procedures.

*Echolocation Detector Surveys*

1. Detectors will be placed at both the mine and plant site locations to determine bat use.
2. Detector locations will be document with GPS.
3. Additional detectors will be placed in high risk areas if needed.
4. Detectors will be operational from April 1 through October 15 (minimum effort of two separate data collection periods, including beginning of May and end of August) to determine bat use in the area.
5. Recordings will occur at a minimum of two separate dates, as listed above, from one half hour prior to sunset until one half hour after sunrise.
6. Data recorded during observation periods will be stored on a flash card. Pettersson detectors or an equivalent—with time expansion capabilities—and laptop computers equipped with analysis software will be used for this investigation.
7. Recorded (and time-expanded) call files will be analyzed with SonoBat™ analysis software. Calls will be sorted by quality of recording. Calls without sufficient diagnostic characteristics will not be analyzed further, and the remaining calls will be compared with previously recorded calls from bats of known species at other sites (library files within SonoBat™).
8. Raw data will be submitted to the agencies on disc.

*Bat Use of All Potential Mines and Caves*

1. Area within 0.5 mile will be surveyed for mine shafts and caves.
2. If determined to have bat presence, an echolocation detector will be installed to determined species use and abundance and a bat roost count will be performed if allowable.
3. Detectors will be operational from April 1 through October 15 (minimum effort of two separate data collection periods, including beginning of May and end of August) to determine bat use in the area.
4. Recordings will occur at a minimum of two separate dates, as listed above, from one half hour prior to sunset until one half hour after sunrise.
5. Data recorded during observation periods will be stored on flash card. Pettersson detectors or an equivalent—with time expansion capabilities—and laptop computers equipped with analysis software will be used for this investigation.
6. Recorded (and time-expanded) call files will be analyzed with SonoBat™ analysis software. Calls will be sorted by quality of recording. Calls without sufficient diagnostic characteristics will not be analyzed further, and the remaining calls will be compared with previously recorded calls from bats of known species at other sites (library files within SonoBat™).
7. Raw Data will be submitted to the agencies on disc.

*Equipment List*

Equipment needed to perform the golden eagle and raptor surveys includes the following:

- Bat reference books (specific to raptor ID for juvenile and adults)
- Compass
- GPS
- Camera
- Echolocation Detector
- SonoBat analysis software (or equivalent)
- Flash card
- Binoculars
- Spotting scope
- Hammer
- Stakes
- Flagging
- Plastic bags
- 100-foot measuring tape
- Digital camera
- Field data forms
- 4x4 vehicle

**Landbirds**. Point counts to determine specific bird use in the project area will be performed. Point count procedures described in the *Handbook of Field Methods for Monitoring Landbirds* (USFS, Technical Report PSW-GTR-144) will be used, as will both large and small plot avian use surveys (point surveys)

Survey protocols are summarized below. See Section 3.7.5 for specific protocols, QA/QC procedures, data forms, data entry procedures, and data delivery procedures.

*Avian Use Surveys (large-plot)*

1. A determined number of plots will be established based on habitat. It is suggested a minimum of five locations be developed. Each location will be documented via GPS.
2. Plots will be 800-meter-radius, non-overlapping avian use study plots. Plot placement will be designed to maximize viewing and provide excellent coverage of the area.
3. Surveys will be conducted weekly during a set period in the spring (March-May), summer (June-August), fall (September-October), and winter (November-March) seasons. Surveys will be done at a minimum of weekly intervals for 4 weeks during each season.
4. An experienced avian ecologist will be positioned at the center of the plot and will collect data on all wildlife seen or heard during a 20-minute observation period. This includes observations both within and outside the 800-meter radius.
5. A full set of surveys (five plots) will generally be completed on the same survey day, weather permitting, and plots are surveyed equally during different times of day (morning, mid-day, and afternoon), to the extent feasible, to reduce temporal bias.
6. General data recorded will include date, time, weather, and wildlife observed. Data collected on birds detected will include species, number of individuals, habitat association, and behavior, including flight height and direction. In addition, flight paths of raptors and other species of interest will be hand-plotted in the field at the time of observation. Whenever special status species and species of interest (including raptors, sage-grouse, and big game) are observed while in-transit near the study plots, these observations will also be recorded.

*Avian Use Surveys (small-plot)*

These surveys will follow the above methodology but will occur within a 100-meter radius plot. The small-plot surveys will focus on smaller birds (passerines) using the habitats of proposed developments during the breeding season. A total of eight plots will be established. Plots will be surveyed for 10 minutes and all surveys between sunrise and five hours after sunrise (during peak passerine use). The same seasons apply and these surveys should be done in conjunction with the large plot surveys.

*Equipment List*

Equipment needed to perform the golden eagle and raptor surveys includes the following:

- Bird and mammal reference books
- Compass
- GPS
- Camera
- Binoculars
- Spotting scope
- Hammer
- Stakes
- Flagging
- Plastic bags
- 100-foot measuring tape
- Digital camera
- Field data forms
- 4x4 vehicle

**Reptile.** General reptile use will be collected during general encounter surveys.

**General Wildlife Encounter Surveys**. All wildlife species of concern, uncommon species, and big game observed while field observers are conducting various surveys will be recorded on incidental/in-transit data sheets. Data recorded with incidental observations (primarily mammals and reptiles) will include:

- Species encountered
- Sex
- number of species counted
- date
- time
- UTM coordinates datum
- weather at the time of survey
- photographs
- activity
- habitat description
- nest or other breeding activity

It may be problematic to determine the sex of some species. During visual encounter surveys, sex will be recorded when feasible.

General observations of wildlife migrations will be completed with the assistance of ODFW staff, who have an understanding of the project and wildlife migration corridors.

Observations of big game (mule deer, pronghorn, etc.) and other mammals will be recorded whenever observed during all types of surveys and while in-transit to survey locations. No surveys will be conducted specifically for deer, elk, or pronghorn, but their presence and numbers will be documented for assessing

the importance of the project habitats to these game species. Deer, elk and pronghorn use the project area occasionally, but ODFW has not designated the area as important winter or summer range.

*Equipment List*

Equipment needed to perform the golden eagle and raptor surveys includes the following:

- Bird and mammal reference books
- Compass
- GPS
- Camera
- Binoculars
- Spotting scope
- Hammer
- Stakes
- Flagging
- Plastic bags
- 100-foot measuring tape
- Digital camera
- Field data forms
- 4x4 vehicle

### 3.7.5 Timing and Duration of Baseline Data Collection and Verification

These standards outline QA/QC procedures for the purpose of ensuring a minimum level of quality and consistency in data handling for all data collected during the wildlife baseline studies. They will be stored where they can be made accessible to scientists, resource managers, and members of the public. The aim of QA/QC is to prevent problems through all stages of data collection and reporting. Early detection of errors is a preventative step in obtaining quality data.

The QA/QC procedures outlined in this section follow *Quality assurance standards for wildlife inventory projects [electronic resource] / prepared by Ministry of Environment, Ecosystems Branch for the Resources Information Standards Committee. -- Version 2.0.* (2009). The QA/QC procedures include assessing the study design and pre-field planning, field checking to ensure data are collected and recorded properly, and checking the quality of deliverable products. QA/QC of both the wildlife work plan and fieldwork are important to the QA/QC process and the data viability. This section contains forms for QA/QC of each phase of work. All QA/QC results must be approved before the next phase begins. The QA/QC process is carried out at three separate phases during the project: pre-field QA/QC, field QA/QC, and reporting QA/QC.

#### 3.7.5.1 Pre-Field QA/QC

Pre-field QA/QC is conducted on deliverables submitted before the start of field survey data collection efforts for wildlife baseline reporting. Prior to field surveys, a wildlife work plan is submitted. This document contains a summary of existing information, as well as the study design, data compilation and reporting aspects of the wildlife baseline report. The intent of QA/QC at this stage is to ensure the existing data review is complete and accurate, and to approve the study design. The data forms are broken down by study design, personnel and equipment, data form preparation, pre-field QA/QC summary, and pre-field QA sign-off.

The following survey protocols will be used for this project and will be part of the above listed QA/QC process for this project:

- *Greater Sage-Grouse Conservation Assessment and Strategy for Oregon: A Plan to Maintain and Enhance Population and habitat (Hagan 2011)*

- The *Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance* provides guidance to conduct informed impact analyses and mitigation during the National Environmental Policy Act (NEPA) process (USFWS 2010).
- *Handbook of Field Methods for Monitoring Landbirds USFS General Technical Report PSW-GTR_144 (Ralph et al 1993)*
- *Inventory Methods for Raptors: Standards for components of British Columbia Biodiversity.* (Ministry of Sustainable Resource Management 2001)
- *Surveying for Pygmy Rabbits (Brachylagus idahoensis) Fourth Draft – June 3, 2004 Helen Ulmschneider*, Boise District, ID BLM (Ulmschneider, Helen 2004).
- *Using Echo Locations to Model Bat Occupancy and Inform Mitigations at Wind Energy Facilities* 2011 (Weller T.J. and Baldwin J.A. 2011)
- *Manley, P.N.; Van Horne, B.; Roth, J.K.; Zielinski, W.J.; McKenzie, M.M.; Weller, T.J.; Weckerly, F.W.; Vojta, C. 2006. Multiple species inventory and monitoring technical guide. Gen. Tech. Rep. WO-73. Washington, DC: U.S. Department of Agriculture, Forest Service, Washington Office. 204 p.*
- *Ministry of Environment, Ecosystems Branch. March 2009. Quality assurance standards for wildlife inventory projects [electronic resource] / prepared by Ministry of Environment, Ecosystems Branch for the Resources Information Standards Committee. -- Version 2.0. The Province of British Columbia*

Data forms were developed for the listed protocols and have been provided in Appendix D. They include the following:

- Greater Sage-grouse Lek Survey Data Form
- Greater Sage-grouse Encounter Transect Data Form
- Golden Eagle Nest Location Data Form
- Raptor Nest Location Data Form
- Bat Detection and Roost Data Forms
- Pygmy Rabbit Transect Data Form
- White-tailed Rabbit (and other hares) Transect Data Form
- Avian Observation Data Sheet
- General Encounter (Visual Encounter) Data form

Equipment and personnel qualifications are listed in each of the protocols and require QA/QC sign-off prior to field surveys. The pre-field QA/QC must be signed-off by the QA/QC auditor before any surveys can begin (See Appendix D, Wildlife Inventory QA forms 1 – 3).

#### 3.7.5.2 Field QA/QC

Field QA/QC is conducted during field surveys to ensure that field data is collected and recorded following standards in the approved wildlife work plan. Field audits of each field crew will occur to ensure individual field crews are collecting data consistently and as intended by the standards developed in the wildlife work plan. These audits will be performed early and at random during the field season to ensure problems are detected and corrected before a significant amount of data is collected.

The field QA/QC must be signed-off by the QA/QC auditor before reporting beings (See Appendix D, Wildlife Inventory QA forms 4 and 6).

#### 3.7.5.3 Reporting QA/QC

Upon survey and project completion, reporting QA/QC is conducted on final deliverable products. Deliverables typically include complete Excel data capture templates, data forms, shape files of study area

boundaries, shape files of design components (i.e., transects or blocks), agency transferred data (ORBIC database), and final reports. The QA/QC auditor will consult the original survey protocol for the specific wildlife baseline inventory to determine the complete description of deliverables and if the data met the intent of the survey. The QA/QC procedures will include checking the digital data entered into GIS. These templates contain pre-defined fields and codes that can be loaded into the database that need to be checked for accuracy and repeatability.

Routine errors, such as missing data, data falling outside of acceptable ranges, and using incorrect fields and codes, are to be detected through the QA/QC process. Inventory data entered into the appropriate data form and associated database must be carefully checked by the QA/QC auditor before the data is finalized and the baseline characterization report is completed. The intent of QA/QC at this stage is to ensure that all products are prepared to acceptable standards, and that all data is provided in standard formats as outlined and defined within each of the survey protocols used for the project.

The report QA/QC must be signed-off before data delivery and finalization of the baseline characterization report and subsequent project completion (See Appendix D, Wildlife Inventory QA forms 5-7).

#### 3.7.5.4 Qualifications for Primary Investigators

Field surveys will be conducted by qualified/experienced personnel familiar with the regional ecosystem who have conducted wildlife surveys using the survey protocols described in this work plan.

### 3.7.6 Further Anticipated Studies

No additional wildlife studies are anticipated. If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies.

### 3.7.7 Baseline Characterization Report

The baseline characterization report for wildlife resources will include:

- Introduction
- Regulatory environment
- Study area description (map of study area)
- Data sources
- Methodology
  - Literature review
  - Field surveys
- Existing or affected habitat description
  - Wildlife habitat definitions and descriptions
  - Description of wildlife habitat (figure displaying habitat types based on vegetation communities) based on ODFW Wildlife Habitat Mitigation Policy.
- Existing endangered, threatened, candidate, and sensitive species and associated habitats addressed in the baseline study will be summarized, including the following:
  - Greater-sage grouse (candidate)
  - Golden eagle (as covered under BGEPA)
  - Raptors (including sensitive species: ferruginous hawk, Swainson's hawk, and Western burrowing owl)
  - Terrestrial mammals (including sensitive species: white-tailed rabbit, pygmy rabbit)
  - Bats (including sensitive species: Townsend's big-eared bat, spotted bat, fringe myotis)
  - Landbirds (including sensitive species: grasshopper sparrow)
- Existing general wildlife species and associated habitats collected during general encounter surveys will be included, as well as summarizing use and developing a species list.

  - Terrestrial Mammals
  - Big Game Habitat
  - Birds
  - Reptiles
- Appendices
  - GPS data presented in hardcopy form of survey areas/transects/points and wildlife species per field study
  - Completed data sheets for all surveys
  - Completed QA/QC forms

### 3.7.8 Bibliography

Arnett, E.B., J. P. Hayes, and M.M.P. Huso. 2006. *Patterns of pre-construction bat activity at a proposed wind facility in south-central Pennsylvania*. An annual report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA.

Blickley, J. L. and G. L. Patricelli. 2012. *Potential acoustic masking of greater sage-grouse (Centrocercus urophasianus) display components by chronic industrial noise*. Ornithological Monographs 74: 23-35.

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

Bureau of Land Management (BLM). 2008 *NEPA Handbook.*

Cedar Creek Associates, Inc. 1991. *Terrestrial Wildlife Technical Memorandum.*

Cedar Creek Associates, Inc. 1991. *Terrestrial Wildlife Technical Memorandum*.

Conway, C.J. and J.C. Simon. 2003. *Comparison of Detection Probability Associated with Burrowing Owl Survey Methods*. Journal of Wildlife Management 67(3):501-511.

Crompton, B., R. Thacker, and T. Wright. 2006. *Beer level answers for champagne level questions: quantifying the impacts of coal bed methane development on mule deer (Odocoilius hemionus) and greater sage-grouse (Centrocercus urophasianus).* Utah Chapter of the Wildlife Society Annual Meeting, Moab, Utah.

Dooling, R. J. and Popper, A. N. 2007. *The Effect of Highway Noise on Birds*. Environmental BioAcoustics LLC, Rockville, Maryland.

Hagen, C. A. 2011. *Greater sage-grouse conservation assessment and strategy for Oregon: a plan to maintain and enhance populations of habitat*. Oregon Department of Fish and Wildlife, Salem, Oregon.

HDR Engineering, Inc. (HDR). 2012. *Draft Terrestrial Vegetation Report, Grassy Mountain Exploration Project.*

HDR Engineering, Inc. (HDR). 2014. *Draft Terrestrial Vegetation Baseline Study, Grassy Mountain Exploration Project*.

HDR Engineering, Inc. (HDR). 2015. *Draft Terrestrial Vegetation Baseline Study Addendum #1, Grassy Mountain Exploration Project.*

Holland & Hart. 2010. *Wildlife and Vegetation Protection; Environmental Regulation of the American Law of Mining*.

Holloran, M. J. and Anderson, S. H. 2005. Greater Sage-grouse Research in Wyoming: An Overview of Studies Conducted by the Wyoming Cooperative Fish and Wildlife Research Unit. Between 1994 and 2005 (Appendix C in Holloran PhD Dissertation Dec 2005).

Hunt, J. L. 2004. *Investigation into the decline of populations of lesser prairie-chickens in southeastern New Mexico*. Dissertation. Auburn University, Auburn, Alabama.

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

Isaacs, F. B. 2011. Golden eagles (*Aquila chrysaetos*) nesting in Oregon, 2011. 1st Annual Report, Revised, 16 April 2012. Oregon Eagle Foundation, Inc., Klamath Falls, Oregon, USA.

Ministry of Sustainable Resource Management. 2001. *Inventory Methods for Raptors: Standards for components of British Columbia Biodiversity.* Environment Inventory Branch for the Terrestrial Ecosystems Task Force. Resources Inventory Committee. October 2011. Version 2.0.

Monsen, Stephen B.; Stevens, Richard; Shaw, Nancy L., comps. 2004. *Restoring western ranges and wildlands*. Gen. Tech. Rep. RMRS-GTR-136-vol-2. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Pages 295- 698 plus index.

Northwest Wildlife Consultants, Inc. (NWC). (2014). *Wildlife Resources Baseline Study for the Grassy Mountain Gold Project.* Prepared for Calico Resources USA Corp. and HDR Engineering, Inc. September 30, 2014.

Newmont Grassy Mountain Corporation (NMC). 1993. *Grassy Mountain Gold Project Environmental Baseline Studies Work Plan.*

Oregon Biodiversity Information Center (ORBIC). (2012). List of Rare, Threatened, and Endangered Species.

Oregon Department of Fish and Wildlife (ODFW). 2012. *Implementing habitat mitigation for greater sage-grouse under the core area approach*. Salem, Oregon.

Oregon Department of Fish and Wildlife (ODFW). 2013. ODFW Winter Range for Eastern Oregon (Deer and Elk). GIS shape file. https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?p=202&XMLname=885.xml

Oregon Natural Heritage Database (1989). *Rare, Threatened and Endangered Plants and Animals of Oregon.*

Pagel, J.E., D.M. Whittington, and G.T. Allen. 2010. *Interim Golden Eagle technical guidance: inventory and monitoring protocols; and other recommendations in support of eagle management and permit issuance*. Division of Migratory Bird Management, U.S. Fish and Wildlife Service.

Pater, L. L., Grubb, T. G., Delaney, D. K. 2009. *Recommendations for Improved Assessment of Noise Impacts on Wildlife*. The Journal of Wildlife Management 73(5):788-795; 2009.

Ralph, C.J., Geupel, G.R., Tyle, P., Martin, T.E., Sante, D.F., 1993. Handbook of Field Methods for Monitoring Landbirds. USDA Forest Service General Technical Report PSW-GTR-144.

Ulmschneider, Helen. Boise District, ID BLM. 2004. *Surveying for Pygmy Rabbits (Brachylagus idahoensis)*. Fourth Draft – June 3, 2004.

U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS). 2006. *Crested wheatgrass plant guide*. USDA NRCS Idaho State Office, Boise, Idaho.

U.S. Forest Service (USFS). *Handbook of Field Methods for Monitoring Landbirds.* USFS General Technical Report PSW-GTR_144.

U.S. Fish and Wildlife Service (USFWS). February 2010. Nest search and monitoring for Golden eagles will be conducted in accordance with Interim Golden Inventory and Monitoring Protocols. Vonhof, M. 2002. Handbook of Inventory Methods and Standard Protocols for Surveying Bats in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, Edmonton, Alberta. Revised 2005.

U.S. Fish and Wildlife Service USFWS. January 1981. *U.S. Fish and Wildlife Service Mitigation Policy*. Federal Register. Volume 46, No. 15, January 23, 1981.

Walker, B. L., D. E. Naugle, and K. E. Doherty. 2007. *Greater sage-grouse population response to energy development and habitat loss*. Journal of Wildlife Management 71: 2644-2654.

Weller T.J. and Baldwin J.A. 2011. *Using Echo Locations to Model Bat Occupancy and Inform Mitigations at Wind Energy Facilities*.

Western Technologies, Inc. (1988). *Environmental Baseline Work Plan, Grassy Mountain Gold Mine, Malheur County, Oregon* (vegetation resources; wildlife habitat; endangered, threatened and sensitive species).

Wright, Carolyn E. 1991. *Grassy Mountain Botanical Survey*.

### 3.7.9 Contacts

Philip Milburn
Malheur District Wildlife Biologist
Oregon Department of Fish & Wildlife
3814 Clark Blvd.
Ontario, OR 97914
541-889-6975
Philip.j.milburn@state.or.us

Thomas Segal
Malheur District Wildlife Biologist
Oregon Department of Fish & Wildlife
3814 Clark Blvd.
Ontario, OR 97914
541-889-6975
thomas.p.segal@state.or.us

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

Kris Kuyper
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
kris@emstrats.com

## 3.8 Aquatic Resources

AQUATIC RESOURCES ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.8.1 Purposes and Objectives

Aquatic species occurring in or near the proposed Grassy Mountain Project area may include fish, amphibians, and invertebrates. The purpose of the aquatic resources baseline study is to collect sufficient information to characterize the affected environment for aquatic resources and related habitat in a qualitative and quantitative field program design for the proposed project area. Considerable data has been collected for the study area as a result of the Atlas Precious Metals, Inc. (Atlas) and Newmont Mining Company (NMC) environmental baseline programs. These studies will be augmented to show current conditions for aquatic resources and habitat.

Oregon Department of Geology and Mineral Industries (DOGAMI), Oregon Administrative Rule (OAR) 632-037-0055 requires baseline data to be collected on state or federally-listed threatened or endangered species and habitat and state sensitive species and habitat. As outlined in OAR 635-037-0125, the baseline data collection will help determine the wildlife protection standards consistent with Oregon Department of Fish and Wildlife (ODFW) policies, including the following:

(1) Protective measures to maintain an objective of zero wildlife mortality;

(2) All chemical processing solutions and associated wastewater shall be covered or contained to preclude access by wildlife or maintained in a condition that is not harmful to wildlife;

(3) Onsite and offsite mitigation insuring there is no overall net loss of habitat value;

(4) No loss of existing critical habitat of any state or federally-listed threatened or endangered fish or wildlife species; and

(5) Any other standard adopted by rule by ODFW applicable to a chemical process mine.

### 3.8.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |

Anticipated Project Disturbance (excluding access road): 400 acres

The aquatic resources study area is shown in **Figure 16, Aquatic Resources Study Area and Permit Area** and **Figure 17, Aquatic Resources Study Area**. The area can generally be described as having an eastern boundary defined by the Grassy Mountains; a southern boundary of the northern Township 23 South and Range 43 East; a western boundary of the Sourdough Mountains and Hoodoo Creek; and a northern boundary defined by an east-west line two miles north of production well 4 (PW-4).

The study area occurs within a sagebrush/bunchgrass landscape that is characteristic of the native sagebrush community found throughout much of eastern Oregon. Much of the landscape is dominated by invasive species such as cheatgrass (*Bromus tectorum)* and/or medusahead *(Taeniatherum caput-medusae)*. Elevations within the study area range from 3,400 to 3,900 feet mean sea level. Generally, slopes range from 2 to 8 percent.

Surface water in the immediate project area is limited. Several drainages contain intermittent or ephemeral surface flow in the spring. Flows are erratic in response to snowmelt and/or heavy, short-term rainfall. The Owyhee River and Owyhee Lake are adjacent to the southeastern boundary of the water resources study area. The aquatic resources study area (**Figure 17**) and the water resources study area (**Figure 9**) are the same. The surface water work plan proposes two sampling sites – one at the upstream end of the reservoir (Leslie Gulch), and a second site downstream of the Owyhee Dam. This site is consistent with the Oregon Department of Environmental Quality (ODEQ) sampling station 11048. These two sites are outside of the official water resources study area and are being monitored by Calico as "background" stations.

It is unlikely that fish are present in the water resources study area. However, fish presence surveys of flowing streams in the study area will be conducted if the geographical information system (GIS) datasets for the area shown on ODFW's Natural Resources Information Management Program (https://nrimp.dfw.state.or.us/nrimp/default.aspx?p=259) indicate possible presence of fish species, or the BLM database indicates this potential to exist.

In addition, amphibian species may occur in the study area. The following species will be surveyed for in terms of their possible occurrence in springs and the one wetland identified by HDR Engineering, Inc. (HDR 2012) as part of the Lower Sourdough Spring (0.12-acre land parcel shown on **Figure 10**):

- Blotched Tiger Salamander – BLM special status (tracking)
- Columbia Spotted Frog – U.S. Fish and Wildlife Service (USFWS) candidate species
- Northern Leopard Frog – BLM sensitive, ODFW sensitive (critical)
- Western Toad – BLM special status (tracking), ODFW sensitive (vulnerable)
- Woodhouse Toad – BLM special status (tracking)

Protocols for the amphibian presence survey for the active springs and one wetland parcel are also listed in the field studies section of this work plan. Macroinvertebrate survey protocols for the wetlands reconnaissance are also provided.

### 3.8.3 Regulatory Framework

ODFW manages fish and wildlife populations through objectives specified in various management plans. ODFW has direct responsibility for fish protection, and manages and protects amphibians primarily through the Oregon Conservation Strategy. In the project area, BLM manages habitat to support fish and wildlife. ODFW does not have jurisdiction over invertebrates in the project area. Surveys for invertebrates will meet guidelines developed by ODEQ. The Oregon Department of State Lands (DSL) has jurisdiction over waters of the state, including wetlands, springs, seeps, perennial streams, and intermittent streams that flow during a portion of every year and which provide spawning, rearing, or food-producing areas for food and game fish.

**Oregon Administrative Rules**

- Oregon Administrative Rule (OAR) 635-415.
- OAR Division 37, Chemical Process Mining Rules, including fish and wildlife standards (OAR 632-037-0125). Reclamation plans include provisions for long-term ecosystem sustainability.
- OAR Division 420, Chemical Process Mining Consolidated Application and Permit Review Standards, require a wildlife protection plan and prescribe specific standards to achieve protection.
- OAR Division 85, Oregon rules governing removal-fill activities, and governing the issuance and enforcement of removal-fill authorizations within waters of Oregon, including wetlands.
- OAR Division 90, Oregon rules for wetland delineation report requirements and for jurisdictional determinations for the purpose of regulating fill and removal within waters of the state.

The State of Oregon has threatened, endangered, and sensitive (TES) species provisions that protect native vertebrates and plants on state lands (Oregon Revised Statutes [ORS] sections 496.172 to 496.192; 498.026; 564.100 to 564.135) and requires consideration of the impacts of any action on private land, in this case chemical mining, on threatened and endangered (T&E) species (ORS Section ORS 517.956. 496.012, and 506.109).

ORS Section 517.956 establishes standards and protection measures that all chemical mining operations will follow that ensure protection measures for fish and wildlife are consistent with ODFW policies, including the following:

(a) Protective measures to maintain an objective of zero wildlife mortality;

(b) On-site and off-site mitigation ensuring that there is no overall net loss of habitat value;

(c) No loss of existing critical habitat of any state or federally-listed threatened or endangered species;

(d) Fish and wildlife mortality shall be reported in accordance with a monitoring and reporting plan approved by ODFW;

(e) ODFW shall establish by rule standards for review of a proposed chemical process mining operation for the purpose of developing conditions for fish and wildlife habitat protection that satisfy the terms of this section for inclusion in a consolidated permit by DOGAMI; and

(f) Surface reclamation of a chemical process mine site shall ensure environmental protection and that a self-sustaining ecosystem, comparable to undamaged ecosystems in the area, has been established in satisfaction of the operator's habitat restoration obligations.

The purpose of OAR Chapter 635 Division 420 is to prescribe the standards for ODFW review of proposed chemical process mining operations for the purpose of developing conditions for protection of wildlife and their habitat, to further the Wildlife Policy (ORS 496.012) and Food Fish Management Policy (ORS 506.109) of the State of Oregon. Baseline data collection will be consistent with what is required in developing a wildlife protection plan in accordance with OAR 635-420-0010, standards to protect wildlife in accordance with OAR 635-420-0015-0025, a habitat mitigation plan in accordance with OAR 635-420-0030 and wildlife mitigation plan in accordance with OAR 635-420-0060. Species to be addressed include

all species listed under the Oregon Endangered Species Act (OAR 635-100-0100 to 0130) and Oregon Sensitive Species Rule (OAR 635-100-040).

The wildlife mitigation plan shall include the information required in OAR 635-415-0020(5). Affected wildlife habitats shall be evaluated using methodologies approved by the ODFW which are well-documented, measurable and verifiable. Examples of habitats that shall be addressed in the mitigation plan include, but are not limited to the following:

(a) Surface waterways, streams, springs, seeps, wetlands and other aquatic habitats;
(b) Riparian areas;
(c) Big game habitat;
(d) Bird habitat;
(e) Habitat for state or federally-listed threatened or endangered species, and state sensitive species;
(f) Reproduction and nursery areas;
(g) Fish spawning areas;
(h) Geomorphic and edaphic habitats including cliffs, caves, sand dunes, play as and local distinctive soils that, along with their vegetation, contrast markedly with the surrounding area; and
(i) Wildlife migration and movement corridors.

In addition, ODFW manages wildlife species populations through management objectives specified in their respective management plans; BLM manages adequate habitat to support these numbers. BLM and ODFW work cooperatively to benefit the management of wildlife and wildlife habitat as described in the memorandum of understanding (MOU) of 2001 between the two agencies. BLM species are discussed further in the federal law section of the document.

#### 3.8.3.1 Federal Laws

The Council on Environmental Quality (CEQ) regulations discuss “human environment” at 40 Code of Federal Regulations (CFR) 1508.14. This term broadly relates to the biological, physical, social and economic elements of the environment. It includes the category aquatic resources. Relevant data is to be used in describing the affected environment as the basis for determining the effects (direct and indirect) of a proposed action. The 2008 BLM *NEPA Handbook* (H-1790-1) describes potential National Environmental Policy Act (NEPA)-related federal requirements.

Other federal requirements, such as the Endangered Species Act (ESA) consultations, and critical habitat procedural requirements are discussed in Chapter 175, “Wildlife and Vegetation Protection; Environmental Regulation of the American Law of Mining” (2010 Holland and Hart). These primarily involve USFWS. The following sections provide a list of relevant federal regulations.

##### 3.8.3.1.1 Federal Endangered Species Act

Section 7 of the ESA (19 United States Code [USC] § 1536(c)), as amended, states that any actions authorized, funded, or carried out by a federal agency does not jeopardize the continued existence of a federally-listed endangered or threatened species, or result in the destruction or adverse modification of federally-listed designated critical habitat. The action agencies are required to consult with USFWS and/or National Oceanic and Atmospheric Administration (NOAA) to determine whether federally-listed endangered or threatened species or designated critical habitat are found within the vicinity of the proposed project, and to determine the proposed action’s potential effects on those species or critical habitats.

##### 3.8.3.1.2 Bureau of Land Management (Manual 6840) – Special Status Species

BLM Manual 6840 defines sensitive species as *"... those species not already included as BLM special status species under (1) federal listed, proposed, or candidate species, or (2) State of Oregon listed species. Native species may be listed as "sensitive" if one of the following applies: (1) could become endangered or*

*extirpated from a state or significant portion of its range; (2) is under review by the USFWS; (3) numbers or habitat capability are declining so rapidly that federal listing may become necessary; (4) has typically small and widely dispersed populations; (5) inhabits ecological refugia, specialized, or unique habitats; or (6) is state-listed; although, is better conserved through application of the BLM sensitive species status.*"

### 3.8.4 Study Methodology

#### 3.8.4.1 Literature Review

Available reports, maps, and data addressing aquatic resources will be reviewed. This includes reports and previous work plans by Atlas, NMC, and Calico contractors; and reports by ODFW, ODEQ, USFWS, BLM (current land management plan), and Malheur County. A technical memorandum report, which summarizes all related information, will be prepared. A jurisdictional wetland review by DSL will be performed and the conclusions will be incorporated into this report. The previous Grassy Mountain environmental work plans and the 1992 *Draft Environmental Impact Statement* will provide particularly relevant background information. Recent local environmental assessments (EAs) and/or environmental impact statements (EISs) will also be reviewed.

#### 3.8.4.2 Field Studies

Surveys will be conducted in the project area and potentially affected waters for fish, amphibians, and aquatic macroinvertebrates by qualified biologists. Standard field procedures and methodologies will be used to ensure accurate and reliable field data collection, including the following:

- Fish surveys will follow protocols for operation-specific surveys as outlined by ODFW and the Oregon Department of Forestry (1995) in *Surveying Forest Streams for Fish Use*.
- Amphibian surveys in springs and wetlands will follow protocols for visual encounter surveys (VES) described by Heyer, W.R., M.A. Donnelly, R.W. McDiarmid, L.C. Hayek and M.S. Foster (1994) in *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians.*
- Amphibian surveys in flowing water will follow protocols from the U.S. Forest Service's *USFS General Technical Report 1991: Methods for Amphibians in Streams in the Pacific Northwest.*
- Aquatic invertebrate surveys will follow protocols described by ODEQ (2009) in *Water Monitoring Assessment Mode of Operations Manual*. Surveys will follow standard ODEQ protocol for targeted sampling.
- Amphibian presence will be conducted using HDR's (2012) *Draft Wetland Delineation Report* and HDR's (2015) *Wetland Delineation and Stream Assessment Report.*
- The Streamflow Duration Assessment Method (SDAM) for Oregon will be followed to assess spawning, rearing, or food producing areas for food and game fish, as outlined by DSL.

Surveys will be done in a phased approach. Initially, the wetland(s) and spring(s) within the wildlife study area boundary (see **Figure 15**), and those areas that receive runoff from the project, will be surveyed for amphibians. As additional baseline data on ground water and linkages is developed, other potentially impacted springs will be surveyed by the approved protocol as they are identified. The technical review team's (TRT) ground water committee will be relied upon to provide the technical expertise to determine impacted springs for future survey needs.

Calico does not intend to monitor aquatic species at the two Owyhee River "background" sites. This was agreed to by the TRT water resources subcommittee and representatives of ODFW.

Streams and waterways will be characterized and reported under the wetland baseline study. These waters will be characterized using SDAM for Oregon.

### 3.8.5 Timing and Duration of Baseline Data Collection and Verification

#### 3.8.5.1 Fish

It is unlikely that fish are present in the water resources study area. However, fish presence surveys of flowing streams in the study area will be conducted if the GIS datasets for the area shown on the ODFW's Natural Resources Information Management Program indicate possible presence of fish species, or the BLM database indicates this potential to exist. If possible presence of fish is indicated, two fish surveys of the sites described in the Field Studies section above will be conducted over a one-year period. These will occur between May 1-June 30 and September 30-October 31. Fish surveys will follow the protocols described by ODFW and the Oregon Department of Forestry (1995).

A crew of three (one shocker and two netters) will start at the downstream extent of each stream to be sampled and work upstream. A stream length equivalent to 40 wetted-widths will be surveyed, and at least six pools at least 1 foot deep will be included. All fish collected will be identified to species and measured. The October sampling will occur for the same sites provided steady-state flow and wetlands-like habitat exists.

#### 3.8.5.2 Amphibians

**Springs and Wetlands**. The project will use VES, including egg masses, in all potentially affected wetlands following the methods described in *Heyer, W.R., M.A. Donnelly, R.W. McDiarmid, L.C. Hayek and M.S. Foster (Eds). 1994. Measuring and monitoring biological diversity: standard methods for amphibians. Smithsonian Institution Press* and specifically applied to Northwestern habitats and species by Olson et al. (1997).

VES will consist of two qualified surveyors walking slowly and visually searching in a systematic way (e.g., transects) for a designated amount of time. Time and length of transects will be determined by the size of the wetland or spring and expanse of potential habitat adjacent to the site. The number and type of amphibians encountered will be noted along with the time elapsed during the survey. Individuals will be identified to species. Surveys will be conducted in summer (July-August) to detect tadpoles and recently metamorphosed adults. Survey sites will include potential habitat for each species of interest identified using GIS and aerial photography.

With the small size of the wetlands involved, a complete survey for presence/absence will be completed. If the hydrologic testing or modeling indicates impact to any flowing water sources, the department recommends *Sampling Methods for Amphibians in Streams in the Pacific Northwest USFS General Technical Report 1991* instead of the wetland survey protocol. In both cases, time constraint surveys will be employed as the preferred methodology. Particular attention will be placed on the Columbia spotted frog because of its sensitive status listing.

Description of survey protocols are summarized below. See Section 3.8.5.4 for specific protocols, QA/QC procedures, data forms, data entry procedures, and data delivery procedures.

*Time constraint surveys*

1. All applicable habitats will be surveyed. This includes all wetlands and streams affected by the project.
2. Surveyor will perform survey for the entire habitat or 1 hour of time. Habitats to be surveyed are expected to be small in sample size and it is expected the entire area will be surveyed.
3. Sample specimen are either collected by hand or photographed for identification if needed. If species can be identified without touching, it is advised. Specimen could include egg masses or individual frogs.
4. Surveys will be done twice during the spring (breeding season) and fall.

5. Surveyors will search surfaces, vegetation, turn over objects, and look in crevices of rocks and logs, replacing all surface objects after exanimation.
6. The following information is recorded for every detection: observer, time, search time elapsed, species, detection type (e.g., visual, auditory, capture, sign), age class of captures (adult/subadult/juvenile), snout-vent length, substrate type (e.g., rock, log, and bare ground), and location using a global positioning system (GPS) device.

**Flowing Water**. None of the amphibian species identified as special status species by the BLM is likely to reproduce or forage in flowing water, but can occur in slow-moving backwater areas of streams. If flowing water is present in the project area, surveys for amphibians will generally follow the standard methods for surveying amphibians in streams described in the USFS general technical report (1991).

Sampling in streams will consist of a single 10-meter-long survey using a hand-collecting technique. Streams are typically sampled in summer because of reduced flow and to avoid sampling of intermittent or ephemeral waters. Hand collecting requires approximately 10 staff-hours of effort for each 10 meters of stream surveyed. Crews will consist of one recorder and two collectors. Collectors will visually survey moist streambanks prior to performing any in-stream work. Once streambanks have been surveyed, streams will be visually surveyed in 1-meter increments at a standard distance from the edge of the stream (25 to 50 centimeters), beginning at the downstream end of the stream survey. Once visual surveys have been completed, all moveable objects (e.g., rocks, small boulders, downed woody debris) will be turned, removed, and placed on the stream bank while substrate is searched for amphibians. Amphibians will be captured in large dip nets and held in plastic buckets until the survey is complete, to avoid possible recapture. Following the completion of the survey, all objects will be returned to the stream channel and amphibians will be released. Individuals will be identified to species.

#### 3.8.5.3 Aquatic Macroinvertebrates

Surveys for aquatic macroinvertebrates will follow the protocols described by ODEQ (2009), as summarized by Pacific Northwest Aquatic Monitoring Partnership (PNAMP) in *Methods for the Collection and Analysis of Benthic Macroinvertebrate Assemblages in Wadeable Streams of the Pacific Northwest* (2007). Surveys will be conducted only in flowing water, between July 1 and October 15 (coinciding with amphibian surveys).

Survey crews will use either a D-frame kick net or Surber sampler, the most commonly-used gear types in the Pacific Northwest. The D-shaped frame is 1 foot wide along the spine and 1 foot tall where the widest part of the "D" attaches to a long pole. The Surber frame is approximately 1 foot by 1 foot. The net is attached to a vertical section of the frame and captures the dislodged organisms from the sampling area. The use of the Surber is generally restricted to depths of less than 1 foot.

Beginning at the downstream end of the survey area, 40 times the wetted width of the stream will be surveyed. This length is adequate to ensure that the repeating patterns of variation that are associated with riffle-pool sequences and meander bend morphology are encountered.

Sampling will be limited to riffles, the primary habitat type recommended for sampling macroinvertebrates in the Pacific Northwest. Samples will be taken from one of the following:

- *Four different riffle habitats.* Two separate 1-square-foot, fixed-area samples taken from each habitat unit for a total of eight samples (a total of 8 square feet of stream bottom sampled); **or**
- *Eight different riffle habitats.* One 1-square-foot, fixed-area sample taken from each habitat unit for a total of eight samples, (a total of 8 square feet of stream bottom sampled); **or**
- *Four different riffle habitats.* One 2-foot by 1-foot, fixed area sample taken from each habitat unit for a total of four samples (a total of 8 square feet of stream bottom sampled); **or**
- *Eight evenly-spaced transects along the reach.* One 1-square-foot, fixed-area sample taken at eight evenly-spaced transects along the entire reach (a total of 8 square feet of stream bottom sampled).

The specific sampling method will be chosen upon visual inspection of the survey area. The four or eight individual samples will be composited into a single sample for each stream for taxonomic identification and enumeration that will be used to represent the sample reach. Collected specimens will be identified to at least genus when practical.

#### 3.8.5.4 Quality Assurance/Quality Control

These standards outline the procedures for quality assurance/quality control (QA/QC) for the purpose of ensuring a minimum level of quality and consistency in data handling for all data collected during the aquatic resources baseline studies. They will be stored where they can be made accessible to scientists, resource managers, and members of the public. The aim of QA/QC is to prevent problems through all stages of data collection and reporting. Early detection of errors is a preventative step in obtaining quality data.

The QA/QC procedures outlined in this section follow *Quality assurance standards for wildlife inventory projects [electronic resource] / prepared by Ministry of Environment, Ecosystems Branch for the Resources Information Standards Committee. -- Version 2.0.* (2009). The QA/QC procedures include assessing the study design and pre-field planning, field checking to ensure data are collected and recorded properly and checking the quality of deliverable products. QA/QC of both the aquatic resources work plan and fieldwork are important to the QA/QC process and the data viability. This section contains forms for QA/QC of each phase of work. All QA results must be approved before the next phase begins. The QA process is carried out at three separate phases during the project: pre-field QA/QC, field QA/QC, and reporting QA/QC.

**Pre-Field QA/QC**. Pre-field QA/QC is conducted on deliverables submitted prior to the start of field survey data collection efforts for the aquatic resources baseline reporting. Prior to field surveys, an aquatic resources work plan is submitted. This document contains a summary of existing information, as well as the study design, data compilation and reporting aspects of the aquatic resources baseline report. The intent of QA/QC at this stage is to ensure the existing data review is complete and accurate, and to approve the study design. The data forms are broken down by study design, personnel and equipment, data form preparation, pre-field QA/QC summary, and pre-field QA sign-off.

The following survey protocols will be used for this project and will be part of the above listed QA/QC process for this project,

- *Measuring and monitoring biological diversity: standard methods for amphibians. Smithsonian Institution Press* (Heyer, W.R. et al 1994).
- *Methods for the Collection and Analysis of Benthic Macroinvertebrate Assemblages in Wadeable Streams of the Pacific Northwest* (PNAMP 2007).
- *Surveying Forest Streams for Fish Use* (ODFW and Oregon Department of Forestry 1995).
- *General Technical Report 1991: Methods for Amphibians in Streams in the Pacific Northwest* (USFS 1991).
- *Water Monitoring Assessment Mode of Operations Manual* (ODEQ 2009).

Data forms were developed for the listed protocols and have been provided in Appendix D. They include the following:

- DSL Streamflow Duration Field Assessment Form
- Time-constrained Collecting Data Form
- General Encounter (Visual Encounter) Data form

Listed equipment and personnel qualifications are listed in each of the protocols and require QA/QC sign-off prior to field surveys. The pre-field QA/QC must be signed-off by the QA/QC auditor before any surveys can begin (See Appendix D, Wildlife Inventory QA forms 1 – 3).

**Field QA/QC**. Field QA/QC is conducted during field surveys to ensure that field data is collected and recorded following standards in the approved aquatic resources work plan. Field visits and overview with

each field crew will occur to ensure individual field crews are collecting data consistently and as intended by the standards developed in the aquatic resources work plan. These field audits will be performed early and random during the field season, to ensure problems are detected and corrected before a significant amount of data is collected.

The field QA/QC must be signed-off by the QA/QC auditor before reporting beings (See Appendix D, Wildlife Inventory QA forms 4 and 6).

**Reporting QA/QC**. Reporting QA/QC is conducted on final deliverable products upon survey and project completion. Deliverables typically include complete Excel data capture templates, data forms, shape files of study area boundaries, shape files of design components (i.e., transects or blocks), agency transferred data (ORBIC database), and final reports. The QA/QC auditor will consult the original survey protocol for the specific aquatic resources baseline inventory to determine the complete description of deliverables and if the data met the intent of the survey. The QA/QC procedures will include checking the digital data that has been entered into the GIS. These templates contain pre-defined fields and codes that can be loaded into the database that need to be checked for accuracy and repeatability.

Routine errors such as missing data, data falling outside of acceptable ranges, and using incorrect fields and codes are to be detected through the QA/QC process. Inventory data entered in the appropriate data form and associated database must be carefully checked by the QA/QC auditor before the data is finalized and the report is completed. The intention of QA/QC at this stage is to ensure that all products are prepared to acceptable standards, and that all data is provided in standard formats as outlined and defined within each of the survey protocols used for the project.

The report QA/QC must be signed-off before data delivery and finalization of the baseline characterization report and subsequent project completion (See Appendix D, Wildlife Inventory QA forms 5-7).

### 3.8.6 Further Anticipated Studies

No additional studies are anticipated. If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies.

### 3.8.7 Baseline Characterization

The baseline characterization report for aquatic resources will include:

- Introduction
- Regulatory environment
- Study area delineation/water resources interface
- Data sources
- Methodology
  - Literature review
  - Field surveys
- Existing aquatic species and associated habitats
  - Fish
  - Amphibians
  - Aquatic macroinvertebrates
- Completed data sheets and maps of surveyed areas/transects

### 3.8.8 Bibliography

Adrian Brown Consultants, Inc. (ABC). 1992. *Physical Resources Technical Memorandum for Atlas Precious Metals Inc. Grassy Mountain Project. Environmental Impact Statement.* Prepared for U.S. Department of Interior, Bureau of Land Management. 30 June 1992.

Adrian Brown Consultants, Inc. (ABC). 1992. *Water Resources Technical Memorandum for Atlas Precious Metals Inc. Grassy Mountain Project. Environmental Impact Statement, Vol II & Vol III*. Prepared for USDI Bureau of Land Management. 29 June 1992.

HDR Engineering, Inc. (HDR). 2012. *Draft Wetland Delineation Report, Calico Resources Grassy Mountain Project*.

HDR Engineering, Inc. (HDR). 2015. *Aquatic Resources Baseline Study, Grassy Mountain Exploration Project.*

HDR Engineering, Inc. (HDR). 2015. *Wetland Delineation and Stream Assessment Report, Grassy Mountain Exploration Project.*

Heyer, W.R., M.A. Donnelly, R.W. McDiarmid, L.C. Hayek and M.S. Foster. 1994. *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians.*

Olson, D. H., W. P. Leonard, and R. B. Bury, editors. 2007. *Sampling amphibians in lentic habitats*. Society for Northwestern Vertebrate Biology, Northwest Fauna 4, Olympia, Washington, USA.

Oregon Department of Environmental Quality (ODEQ). 2009. *Water Monitoring Assessment Mode of Operations Manual*.

Oregon Department of Fish & Wildlife (ODFW). 1995. Forest Practices Section. *Surveying Forest Streams for Fish Use*.

Oregon Department of State Lands (DSL). Streamflow Duration Assessment Method for Oregon. http://www.oregon.gov/DSL/PERMITS/Pages/streamflow.aspx. Accessed February 13, 2013.

Pacific Northwest Aquatic Monitoring Partnership (PNAMP). 2007. *Methods for the Collection and Analysis of Benthic Macroinvertebrate Assemblages in Wadeable Streams of the Pacific Northwest.*

U.S. Forest Service (USFS). 1991. *USFS General Technical Report 1991: Methods for Amphibians in Streams in the Pacific Northwest.*

### 3.8.9 Contacts

Philip Milburn
Malheur District Wildlife Biologist
Oregon Department of Fish & Wildlife
3814 Clark Blvd.
Ontario, OR 97914
541-889-6975
Philip.j.milburn@state.or.us

Bethany Harrington
Oregon Department of State Lands
541-325-6171
Bethany.harrington@state.or.us

For specific questions related to reptile and amphibian surveys:
Simon Wray
Conservation Strategy Biologist
Oregon Department of Fish & Wildlife
541-633-1116
Simon.n.wray@state.or.us

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

Kris Kuyper
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
kris@emstrats.com

## 3.9 Grazing Management

GRAZING MANAGEMENT ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.9.1 Purposes and Objectives

The purpose of the grazing management baseline study is to describe existing Bureau of Land Management (BLM) grazing allotments, active grazing preferences, the current grazing practices, and management strategies within the Grassy Mountain Project area. While grazing is not a specific category addressed under the existing environment section for baseline data (Oregon Administrative Rule [OAR] 632-037-0055), it is considered important under the National Environmental Policy Act (NEPA), particularly as related to vegetation surveys and requirements to develop a wildlife mitigation plan as described in OAR 635-420-0030.

Grazing allotments are areas of public and unfenced private land used by permittees for livestock grazing. Grazing within these allotments is permitted and administered by BLM. The information generated by this task will be used to determine if there would be any impacts to range conditions or grazing activities, and whether there would be any conflicts with existing grazing management strategies.

### 3.9.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |
| Anticipated Project Disturbance (excluding access road): | 400 acres |

The grazing management project study area is shown in **Figure 18, Grazing Management Study Area and Permit Area**. The study area includes the Permit Area and a two-mile buffer.

Much of the BLM-administered rangeland in eastern Oregon is grazed by livestock. There are nearly 14 million acres of rangeland in Oregon. The Vale District of BLM is the largest grazing district.

### 3.9.3 Regulatory Framework

The secretary of the interior approved *Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands* administered by the BLM in Oregon and Washington on August 12, 1997. The purpose of these standards and guidelines is to ensure that BLM's grazing management helps preserve or restore rangeland function and health (43 Code of Federal Regulations [CFR] 4180). BLM NEPA regulations also address direct and indirect impacts and the need to discuss measures to mitigate adverse environmental impacts (42 United States Code [U.S.C.] Section 4332(2)(C) [elec.2010], involving both environmental assessments [EAs] and environmental impact statements [EISs]).

### 3.9.4 Study Methodology

Information will be obtained from BLM to determine the number of existing grazing allotments within the project area. The existing condition of BLM grazing allotments will be determined by using the BLM, Vale District's geographical information system (GIS) data and through discussions with the BLM grazing manager.

#### 3.9.4.1 Literature Review

- BLM, 2008. *National Environmental Policy Act Handbook H-1790-1*.
- 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
- BLM, Vale District Office. 2009. *Rangelands/Grazing*. http://www.blm/or/resources/rangeland/index,php
- BLM, Vale District Office. 2012. *Invasive Week Management Website (Oregon/Washington*) http://www.blm.gov/or/resources/weeds/index.php
- Federal Land Policy Management Act (FLPMA) of 1976.
- HDR Engineering, Inc. (HDR). 2012. *Draft Terrestrial Vegetation Report Grassy Mountain Exploration Project.*
- HDR Engineering, Inc. (HDR). 2014. *Draft Terrestrial Vegetation Baseline Study Grassy Mountain Exploration Project.*
- HDR Engineering, Inc. (HDR). 2015. *Draft Terrestrial Vegetation Baseline Study Addendum #1 Grassy Mountain Exploration Project.*
- HDR Engineering, Inc. (HDR). 2015. *Grazing Management Baseline Study, Grassy Mountain Exploration Project.*
- Holland and Hart. 2010. *Environmental Regulation; from the Second Edition of The American Law of Mining.*
- IMS, Inc. December, 1989. *Final Report: Soil, Vegetation, and Wildlife Resources of the Grassy Mountain Project Area*
- Oregon Department of Agriculture. 1997. *Noxious Weed Policy and Classification System.* Link: http://www.oregon.gov/ODA/PLANT/WEEDS/Pages/lists.aspx

#### 3.9.4.2 Field Studies

No specific field studies are planned, however grazing effects to terrestrial vegetation will be documented in the terrestrial vegetation baseline study.

### 3.9.5 Timing and Duration of Baseline Data Collection and Verification

The grazing management baseline study will be completed no later than 2018. BLM information will be collected and used to determine grazing management within the permit and study area.

### 3.9.6 Further Anticipated Studies

No additional studies are anticipated. If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies.

### 3.9.7 Baseline Characterization

The baseline characterization for grazing management will include:

- A description of existing grazing allotments and a map showing allotments within the project area.
- A description of active grazing preferences in the project area.
- A discussion of current grazing practices and management strategies within the project area of impact.
- A discussion of the existing conditions of the grazing allotments and potential direct and indirect effects of the mining proposal on the current status of grazing.
- A discussion of water supply considerations as they relate to grazing and potential effects of mining water use.
- Potential monitoring and mitigation measures.
- Summary of residual effects to grazing management following reclamation of the mine site.

### 3.9.8 Bibliography

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

Bureau of Land Management (BLM), Vale District Office. 2009. *Rangelands/Grazing*. http://www.blm/or/resources/rangeland/index,php

Bureau of Land Management (BLM), Vale District Office. 2012. *Invasive Week Management Website (Oregon/Washington*) http://www.blm.gov/or/resources/weeds/index.php

HDR Engineering, Inc. (HDR). 2012. *Draft Terrestrial Vegetation Report Grassy Mountain Exploration Project.*

HDR Engineering, Inc. (HDR). 2014. *Draft Terrestrial Vegetation Baseline Study Grassy Mountain Exploration Project.*

HDR Engineering, Inc. (HDR). 2015. *Draft Terrestrial Vegetation Baseline Study Addendum #1 Grassy Mountain Exploration Project.*

HDR Engineering, Inc. (HDR). 2015. *Grazing Management Baseline Study, Grassy Mountain Exploration Project.*

Holland and Hart. 2010. *Environmental Regulation; from the Second Edition of The American Law of Mining.*

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

Oregon Department of Agriculture. 1997. *Noxious Weed Policy and Classification System.* Link: http://www.oregon.gov/ODA/PLANT/WEEDS/Pages/lists.aspx

### 3.9.9 Contacts

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

## 3.10 Visual Resources

VISUAL RESOURCES ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.10.1 Purposes and Objectives

Visual resources are a composite of basic topography, geologic features, water features, vegetative patterns, and land use effects that typify an area and influence the visual appeal that an area may have to viewers. Effects to visual resources are evaluated to address such issues as the type and extent of actual physical contrast resulting from implementation of the Proposed Action and the level of visibility of a specific feature, activity or structure from areas such as primary travel routes, residences, and recreation facilities.

The purpose of the visual resource baseline study is to characterize existing scenic values and describe the characteristic landscape. The baseline study will be used to support a National Environmental Policy Act (NEPA) evaluation for the future mine site activities.

### 3.10.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |
| Anticipated Project Disturbance (excluding access road): | 400 acres |

The visual resources project study area is shown in **Figure 19, Visual Resources Study Area and Permit Area** and **Figure 20, Visual Resources Study Area**.

### 3.10.3 Regulatory Framework

Scenic quality is a measure of the visual appeal of a parcel or parcels of land. Section 102(a)(8) of the Federal Land Policy and Management Act (FLPMA) places an emphasis on the protection of the quality of scenic resources on public lands. Section 101(b) of NEPA of 1969 requires that measures be taken to ensure that aesthetically pleasing surroundings be retained for all Americans.

To ensure that these objectives are met, BLM developed the Visual Resources Management (VRM) system. The VRM system provides a method to identify visual resource values, establishes objectives for managing these values, and provides information to evaluate the visual effects of proposed projects on public lands. The inventory of visual values combines evaluations of scenic quality, sensitivity levels, and distance zones to establish visual resource inventory classes, which are "informational in nature and provide the basis for considering visual values in the land use planning process. They do not establish management direction and should not be used as a basis for constraining or limiting surface disturbing activities" (BLM 1986).

VRM classes are typically assigned to public land units through the use of the visual resource inventory classes in the BLM's land use planning process. One of four visual resource management classes is assigned to each unit of public lands. The specific objectives of each visual resource management class are presented in the following table:

**Table 20. BLM Visual Resource Management Classes (BLM 1986)**

| VRM Class | Class Description |
|---|---|
| I | The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention. |
| II | The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any change must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape. |
| III | The objective of this class is to partially retain the existing character of the landscape. The level of change to the character should be moderate. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape. |
| IV | The objective of this class is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. Management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements. |

Landscapes are divided into three distance zones: foreground-middleground, background, and seldom seen. The distance zones are based on relative visibility from travel routes or observation points. Details are more visible to the viewer in the foreground-middleground and are less visible in the seldom seen zone. Lands in the foreground-middleground may, therefore, be more sensitive to landscape changes. Distance zones are defined by BLM as follows:

- Foreground-middleground generally from 3 to 5 miles
- Background visibility generally from 5 to 15 miles
- Seldom seen visibility defined as greater than 15 miles

### 3.10.4 Study Methodology

#### 3.10.4.1 Literature Review

- 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
- BLM 2012 Manual H-8410-1 – *Visual Resource Inventory*. www.**blm**.gov/pgdata/etc/medialib/**blm**/wo/.../**blm**.../H-8410.pdf . Access by September 2012.
- HDR Engineering, Inc. (HDR). 2014. *Draft Visual Resources Baseline Study, Grassy Mountain Exploration Project.*
- HDR Engineering, Inc. (HDR). 2015. *Draft Visual Resources Baseline Study Addendum #1, Grassy Mountain Exploration Project.*

#### 3.10.4.2 Field Studies

During field investigations, photos of the visible landscape will be taken from several locations. Photos will be taken from areas called key observation points (KOPs). KOPs for this project may include views from the main access route through the project area. KOPs will be identified in consultation with BLM. The photos obtained during the field investigations will be used to describe the existing visual values of the study area in the context of form, line, color, and texture associated with the characteristic landscape.

### 3.10.5 Timing and Duration of Baseline Data Collection and Verification

#### 1.1.2.1 Timing

Field investigations of visual resources will occur during the spring to early summer months when vegetation is fully leaved-out and grasses/wildflowers have emerged. During this time of year, the study area is most easily accessible, and would be typical of that viewed by persons traveling through the study area.

#### 3.10.5.1 Duration

The field visit to select KOPs and inventory the characteristic landscape will be conducted over a one to two-day period. The field inventory will be a one-time event.

#### 3.10.5.2 Verification

Collected data will be compared with the methodology described in the BLM 2012 Manual H-8410—1, Visual Inventory to ensure that the baseline conditions are adequately characterized. The BLM Visual Contrast Rating Worksheet (see Appendix D) will be used to make sure all parameters are covered in the characterization.

If available, information will be collected from BLM as to how the visuals resources inventory interfaces with the cultural resources inventory.

### 3.10.6 Further Anticipated Studies

No additional studies are anticipated. If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies.

### 3.10.7 Baseline Characterization

#### 3.10.7.1 Visual Characterization

It is estimated that three to four KOPs will be selected within the study area. The existing visual condition and scenic value will be evaluated from each KOP. The scenic value assessment establishes the baseline

condition and describes the character of the affected landscape. Landscape character includes the elements of form, color, texture, pattern, and scale. The baseline conditions will provide a description of the characteristic landscape from each distance zone; foreground (within 0.5 miles from viewer), middleground (between 0.5 miles and 3 miles from viewer), and background (distance beyond middleground). For the NEPA effects analysis, each alternative will be evaluated against the visual quality objectives (VQOs) outlined in the BLM's resource management plan.

The baseline characterization report for visual resources will include:

- Introduction
- Regulatory environment
- Study area and permit area description
- Data sources
- Methodology
- Existing environment
  - Description of the existing scenic values associated with the characteristic landscape
  - Identification of KOPs
  - Map showing the BLM VRM classes within the project area
  - Photographs of the view sheds from each identified KOP
  - Description of the existing characteristic landscape
    - Vegetation
    - Vegetative patterns
    - Soils
    - Landforms
    - Textures
    - Man-made features

### 3.10.8 Bibliography

Bureau of Land Management (BLM). 2012. Manual H-8410-1 – *Visual Resource Inventory*. www.**blm**.gov/pgdata/etc/medialib/**blm**/wo/.../**blm**.../H-8410.pdf. Accessed September 2012.

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

HDR Engineering, Inc. (HDR). 2014. *Draft Visual Resources Baseline Study, Grassy Mountain Exploration Project.*

HDR Engineering, Inc. (HDR). 2015. *Draft Visual Resources Baseline Study Addendum #1, Grassy Mountain Exploration Project.*

### 3.10.9 Contacts

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

## 3.11 Air Quality Resources

AIR RESOURCES ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.11.1 Purposes and Objectives

Mining-related activities at the Grassy Mountain Project site would be a potential source of particulate and gaseous pollutants. Fugitive dust emissions would be generated by mining, loading, hauling, and placing waste rock in storage facilities. Mineral processing and power generation, if on-site diesel generators are used, would also generate pollutants. The electrical load of the mine and processing plant is expected to be on the order of 4 megawatts (MW), with about 80 percent of that load at the processing plant and the remainder at the mine. The processing plant would be approximately 3 miles away from the mine, with ore transport taking place via a haul truck road on Bureau of Land Management (BLM) land.

Existing environmental conditions at the proposed Grassy Mountain Project study area will be characterized as part of this work plan. This will establish the baseline from which the Division 37 permit application and other air quality permits will be prepared, as well as the affected environment discussion for potential related National Environmental Policy Act (NEPA) analysis.

The objective of the baseline data collection work plan for air quality is to collect sufficient air quality and climatology data necessary for modeling site-specific conditions and potential impacts to air quality at the Grassy Mountain Project site. The following sections of this work plan will do the following:

- Describe the study area for air quality and predominant upwind and downwind areas;
- Define climatological characteristics of areas upwind and downwind of the proposed mining and processing areas, including wind speed, direction, barometric pressure, precipitation and evaporation;
- Conduct air quality sampling and analysis for particulates, particulate size distribution, and elemental analysis of particulates;
- Describe the applicable regulatory environment; and
- Describe the information to be presented in the affected environment section of the Division 37 permit application, and any related NEPA analysis, which may be required.

### 3.11.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South,

Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |
| Anticipated Project Disturbance (excluding access road): | 400 acres |

The local air quality study area is shown in **Figure 21, Local Air Quality Study Area and Permit Area**. For purposes of impact assessment on regional Class I areas (certain national parks and wilderness areas), a regional air quality study area is defined as extending 200 kilometers in all directions from the project site.

The immediate project area is subject to significant daily temperature fluctuations, low relative humidity, and limited cloud cover, typical of a cold, desert environment. Annual precipitation is less than ten inches. Annual pan evaporation exceeds 40 inches. July through October are the driest months, with over 80 percent of the annual precipitation distributed fairly evenly from November through June. Average annual snowfall is approximately ten inches (Western Regional Climate Center [WRCC] 2013). Predominant winds are from the west, based on wind data summarized for the Ontario, Oregon municipal airport. The average annual temperature for the most recent climate normal period (1981-2010) is 50.7 degrees Fahrenheit (°F). For the 1935-2012 period of record at Ontario, Oregon, the extreme minimum and maximum temperatures were -22 °F and 112 °F (WRCC 2013).

Prior monitoring by Air Sciences, Inc. in 1989-1990, determined that total evaporation in the general project area was 41.51 inches. This is approximately four times the total precipitation at the site. The study area is a net evaporation locale.

Air Sciences, Inc., collected air quality data for the study area for total suspended particulate (TSP) and PM (particulate matter). The highest TSP concentration for the monitoring was 63 micrograms per meter cubed ($ug/m^3$). The average TSP for the year was 23 $ug/m^3$. The highest $PM_{10}$ particulate concentration was recorded in August 1990; the recorded concentration was 37 $ug/m^3$. The average $PM_{10}$ concentration for the year was 12.5 $ug/m^3$.

The following historic air quality and climate studies are available for the study area:

- Air Sciences, Inc. (August 1989). *Air-quality Monitoring Plan, Grassy Mountain Gold Project*.
- Air Sciences, Inc. (September 1990). *Meteorological and Air Quality Data Annual Report, Grassy Mountain Gold Project, October 1989-September 1990.*
- Bison Engineering, Inc. (Bison) 2015. *Calico Resources Grassy Mountain Exploration Project Vale, Oregon Ambient Air Monitoring Program Final Summary Report July 31, 2014 – September 30, 2015*.
- National Oceanographic and Atmospheric Administration (NOAA), 1982. *Mean Monthly, Seasonal and Annual Pan Evaporation for the United States. U.S. Department of Commerce, Washington, DC.*
- National Climatic Center, 1960-1964. Boise, Idaho Start Data, Station ID 24131. Asheville, North Carolina.

- U.S. Department of Energy. 2009. *U.S. Geothermal Neal Power Plant Environmental Assessment.*
- Western Regional Climate Center, Data for Owyhee Dam Coop Weather Station, downloaded 1/18/2013 from http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?or6405
- Other more recent BLM environmental assessments and environmental impact statements, including the *U.S. Geothermal Neal Power Plant Environmental Assessment*.

### 3.11.3 Regulatory Framework

The regulatory framework for air quality includes:

- Clean Air Act of 1970 (As Amended)
- CFR
    - 40 CFR 52 Approval and Promulgation of Implementation Plan
    - 40 CFR 81 Designation of Areas for Air Quality Planning Purposes
- Oregon Administrative Procedures Act (OAPA)
    - Rules for the Control of Air Pollution in Oregon.

Most large emission sources and some smaller sources of air pollution require construction and operating permits under the Clean Air Act (CAA).

#### 3.11.3.1 Construction Permits

Construction permits for major sources of certain pollutants must be issued in accordance with federal prevention of significant deterioration (PSD) permitting requirements in areas meeting National Ambient Air Quality Standards (NAAQS) and nonattainment new source review (NSR) permitting requirements in NAAQS nonattainment areas. The Oregon Department of Environmental Quality (ODEQ) is delegated by the U.S. Environmental Protection Agency (USEPA) to issue construction permits under the PSD/NSR rules for facilities in Oregon. For many facilities that fall below PSD/NSR major thresholds, ODEQ requires an air contaminant discharge permit (ACDP) be issued prior to construction of these minor facilities. Oregon does allow some support facilities to be constructed prior to a minor permit being issued, but infrastructure containing the emissions units must not be constructed until a permit is received.

Also, a unique aspect of Oregon PSD rules is that they require fugitive emissions from a facility to be included in the determination of whether the facility is a major source for PSD/NSR purposes, regardless of the facility type. Federal rules specify that fugitive emissions are to be included only for certain listed facility types in making the major source determination.

#### 3.11.3.2 Operating Permits

Operating permits for major sources, also known as Title V or Part 70 permits, are issued in accordance with the Title V of the 1990 CAA amendments, and in accordance with rules provided in 40 Code of Federal Regulations (CFR) 70, and in accordance with state rules implementing Title V. For minor sources of sufficient size, ODEQ also requires a state operating permit. For both major and minor sources, an application for an operating permit must be submitted to ODEQ within 1 year after startup of a given facility. When the Title V permit is issued, all applicable requirements from the ACDP would be rolled into the Title V permit and the ACDP would become dormant. The facility would operate only under the Title V permit.

The Oregon Title V program addresses administration, applicable requirements, pollution control, emissions data, and monitoring and testing. Division 37 also addresses air quality requirements. These include the requirement to collect pre-mining climatological and air quality data necessary to define existing air quality, and to model the site to determine potential impacts of the proposed mining operation. In summary, the following is required:

- Describe the study area and upwind/downwind areas;
- Characterize climatological conditions in the study area;
- Sample particulates, size distribution and elemental makeup;
- Describe the sampling methods used, which shall meet ODEQ requirements in "Guidance to Applicants for New Source Review."

Detailed information about mining equipment and magnitude of the emissions under normal operating conditions at the Grassy Mountain Project site are not yet available. These will be part of a preliminary feasibility study that is in development. Therefore, it is not yet possible to determine the type of air quality permit(s) needed for the project.

#### 3.11.3.3 Federal Ambient Air Quality Standards

Pursuant to the federal CAA, USEPA Office of Air Planning and Standards has established NAAQS for six "criteria" air pollutants:

- carbon monoxide (CO)
- sulfur dioxide ($SO_2$)
- nitrogen dioxide ($NO_2$)
- ozone ($O_3$)
- lead (Pb)
- particulate matter (PM)

There are separate NAAQS for two size ranges of PM: particles less than ten micrometers (µm) in diameter ($PM_{10}$), and particles less than 2.5 µm in diameter ($PM_{2.5}$). For each criteria pollutant, the federal standards include a maximum concentration above which adverse effects on human health may occur.

There are two types of standards: primary and secondary. Primary standards set limits to protect public health, including the health of sensitive populations, such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damaged animals, vegetation, and buildings.

In addition to the NAAQS, some states have established State Ambient Air Quality Standards (SAAQS) that are at least as stringent as the NAAQS. Oregon has established state-specific SAAQS.

#### 3.11.3.4 General Conformity

The CAA requires USEPA to classify areas as either attainment or non-attainment with respect to these air pollutants. The CAA requires any entity of the federal government that engages in, supports, or in any way provides financial support for, licenses, or permits or approves any activity to demonstrate that the action conforms to the applicable state implementation plan (SIP) designed to bring nonattainment areas back in compliance, and sustain compliance for maintenance areas (former nonattainment areas). Before any federal approval is given for such a proposed action in a non-attainment or maintenance area, the regulating federal agency must determine the regional significance of the action and its general conformity with the SIP on a pollutant-by-pollutant basis. However, the project area is classified as an attainment area (it is in attainment with the NAAQS), and therefore, federal conformity regulations do not apply.

#### 3.11.3.5 New Source Review and Prevention of Significant Deterioration

NSR rules are triggered by proposed construction, which adds a new source or modifies an existing source of air pollutants. The two components of NSR rules are non-attainment NSR and PSD. The project site is located in an attainment area; therefore, nonattainment NSR would not apply.

PSD rules are applicable when a major source or a major modification of a major source would be constructed in an attainment area and are intended to keep areas in compliance with the NAAQS. Those

PSD regulations applicable to the Grassy Mountain Project are contained in 40 CFR Part 52, Subpart A, Section 52.21 – *Prevention of Significant Deterioration of Air Quality* (Holland & Hart 2010).

If applicable, a PSD permit application would require an air quality analysis to demonstrate that emissions emitted from a proposed major stationary source, in conjunction with other applicable emissions increases and decreases from existing sources, will not cause or contribute to a violation of any applicable NAAQS or PSD increment. The PSD increments are maximum allowable concentration increases for each pollutant. There are very low allowable increments set for Class I areas and higher allowable increments set for all other classes (Class II areas) that are in attainment with the NAAQS. Consumption of the PSD allowable increments for each pollutant ($SO_2$, $NO_2$, $PM_{10}$ AND $PM_{2.5}$) is estimated through dispersion modeling of new emissions occurring after a baseline date set for each geographic area (e.g., county) as established pursuant to PSD rules. PSD increments prevent the air quality in clean areas from deteriorating to the level set by the NAAQS.

The air quality analysis will involve the following:

1) Assessment of existing air-quality, which may include ambient monitoring data and air quality dispersion modeling results.
2) Predictions, using dispersion modeling, of ambient concentrations that will result from the applicant's proposed project and future growth associated with the project.

These types of analyses may require specific types of ambient background and meteorological data collection to be able to provide modeling results that conform to USEPA and ODEQ requirements for obtaining PSD permits.

Congress has designated some federal wilderness areas in the region as Class I areas under the PSD rules. The federal agencies in charge of these areas (federal land managers) have determined that visibility is an important value (40 CFR 81.410) in each of the Class I areas within 200 kilometers of the facility location, which includes those areas listed in **Table 21**. Where applicable, SIPs address visibility within the federally-designated Class I areas, where good visibility is deemed to be of national importance (Section 162 of the CAA defines Class I areas).

**Table 21. USEPA Class I Federal Wilderness Areas with Visibility of National Importance**

| CLASS I AREAS WITHIN 200 km |
|---|
| Hells Canyon Wilderness |
| Strawberry Mountain Wilderness |
| Eagle Cap Wilderness |
| Sawtooth Wilderness |

PSD rules require an analysis of PSD Class I increment consumption by major emission sources proposing to locate in proximity to Class I areas. However, ODEQ also requires minor sources needing a permit and located within 200 kilometers of a Class I area to model the concentration impacts at the Class I area in comparison to Class I increments.

### 3.11.3.6 Air Quality Impact Assessment Requirements

An air quality modeling analysis is generally required with each permit application for new construction or a modification that results in an increase in emissions of pollutants above the significant emission rate (SER) threshold defined in PSD rules, regardless of whether a source is a major source for PSD purposes, or a minor source subject only to an ACDP. Applicable rules basically state that a construction permit (PSD/NSR or state ACDP) will not be granted unless the applicant shows to the satisfaction of ODEQ that

the new source, modification, or facility would not cause or significantly contributed to the violation of any air quality standards, and that the emissions increase in toxic air pollutants would not "injure or reasonably affect human or animal or vegetation."

An air quality modeling analysis requires, among other things, emissions source data, meteorological data for input to the dispersion model, and background pollutant concentrations for addition to the modeled impacts of a facility. The primary purposes of a baseline air quality study are to measure meteorological parameters to be used for model input, and to measure background concentrations of the pollutants of greatest concern for a given facility.

The closest existing ODEQ meteorological networks are located in La Grande/Burns, Oregon. Monitoring includes, among other parameters, meteorological, $PM_{10}$ and $PM_{2.5}$. This is part of the national monitoring strategy, which directs states and local agencies to operate continuous monitors and to collect real-time air quality data. This monitoring is not close enough to the proposed project location to provide representative meteorological and background concentration data for the project vicinity.

If background $NO_2$ data are needed for site impact studies in connection with the air permit, background data from the Boise, Idaho area (Meridian station) will be used in the analysis. It is anticipated that these data will provide a very conservatively high estimate of potential background $NO_2$ concentrations in the project area.

### 3.11.4 Study Methodology

Early coordination with ODEQ will be required to obtain the concurrence on meteorological and ambient pollutant collection methods to support Division 37 and related air quality permit applications, particularly because the project description is not clear at this time. It is possible that Calico will require state air quality construction and operating permits for potential air emissions. The type of permits will depend on the type of equipment in the level of pollutants they will emit during mining operations.

There is a reasonable likelihood that air quality analyses using dispersion-modeling will be required to support air quality permit applications, and in support of a related NEPA evaluation, should it be necessary. The monitoring program would include measurement of meteorological parameters, and would be designed to meet USEPA PSD guidelines to produce data sufficient for dispersion modeling studies.

The contractor will provide the following services to procure, install, maintain and download data collected by the monitoring program. This monitoring will be conducted for a 1-year period, or what may be deemed to be the "critical meteorological season" by ODEQ. One meteorological data collection system and four co-located particulate samplers will be installed. Meteorological data to be collected from a ten-meter tower will include wind speed, wind direction, barometric pressure, solar radiation, temperature, delta temperature (between two and ten meters above ground), relative humidity, and rainfall. The four co-located federal reference particulate samples stationed at a single site will ensure data quality. Particulate monitoring will be performed according to standard USEPA protocol, which directs $PM_{2.5}$ 1 in 3-day monitoring and $PM_{10}$ 1 in 3-day monitoring. It is likely the samplers would be powered by 12 volt (V) direct current (DC) power from solar panels. The plan will specifically address the following topics:

- Project description, including likely sources
  - Topography and climate
  - Existing pollutant sources and air-quality levels (pre-project baseline conditions)
- Monitoring program description
- Monitoring site descriptions
- Systems design, specifications, methodology
- Data acquisition and reporting
- Quality assurance/quality control
  - Calibration

- Audits
- Data processing and validations
- Personnel training

The contractor will prepare quarterly data reports for the one-year program. These reports will include the following information:

- All hourly meteorological data values to be listed
- All 24-hour integrated $PM_{2.5}$ and $PM_{10}$ monitoring results to be listed
- Monthly and quarterly wind roses are to be graphically portrayed
- Summary of data collection efficiency rates and a discussion of loss data and corrective action(s) to be taken to minimize future losses
- Precision and accuracy overview required
- Calibration and audit results to be listed
- Narrative discussion of pertinent findings during the period

The monitoring contractor will provide a detailed ambient air and meteorological monitoring plan for ODEQ approval prior to implementation.

### 3.11.5 Timing and Duration of Baseline Data Collection and Verification

The tentative initiation of meteorological monitoring would be in May, with meteorological data collection continuing through the following May or long enough to meet the federal PSD data completeness criteria for dispersion model (AMS/EPA Regulatory Model Improvement Committee [AERMIC] Model, AERMOD) input. The monitoring contractor would conduct quality control on the data, prepare quarterly reports for ODEQ review and approval in support of pending air permitting activities, and support other project studies as needed.

### 3.11.6 Further Anticipated Studies

No additional studies are anticipated. If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies.

### 3.11.7 Baseline Characterization

The following list outlines the topics the contractor will address in the air quality affected environment write-up.

#### 3.11.7.1 Introduction

An introduction to the affected environment section will provide a general background discussion of ambient air quality in the study area and project area to provide local context for the reader.

#### 3.11.7.2 Regulatory Environment

Air quality regulations applicable to the project will be identified. These will include Division 37 permit interface and state/federal permits for construction and operation. As discussed earlier in this work plan, sufficient information about the types of equipment and air quality controls to be employed that is necessary to determine the types of air pollutant operating permits are not yet available. However, a discussion of the state and federal permit types and requirements will be provided.

#### 3.11.7.3 Study Area

The study area and the rationale for setting the boundary of the study area will be described. The rationale will be based on a discussion of the types of data that would likely be required to support air-quality analyses and permitting in future stages of the project.

#### 3.11.7.4 Data Sources

Data sources used in the preparation of the affected environment section of the Division 37 permit application and related NEPA analysis will be presented. The proposed approach for characterizing the baseline air quality conditions will be through the use of ambient air pollutant concentration in meteorological measurements taken in support of the project.

#### 3.11.7.5 Methods

A detailed discussion of the ambient monitoring sites, the measurement protocols and equipment used to collect ambient air quality data, and the supporting meteorological data collection methods will be presented.

#### 3.11.7.6 Existing Environment

The existing air quality environment in the study area will be presented based on monitor data. A summary of the range of air quality pollutant concentrations measured at the site will be tabulated and presented in the text.

Monitored air quality level data will be discussed in relation to federal and state air permitting regulations.

#### 3.11.7.7 Most Probable Permitting Needs Assessment

The contractor will describe the most likely state and federal permits Calico will be required to obtain. This description will be based on the most current project description available at the time of report preparation. This description will be provided by Calico and include the following:

- mining methods and location(s)
- tons of produce ore and waste rock
- power requirements for mine location of access road to processing facilities
- type of road and all mileage
- type of trucks were ore and waste hauling
- crushing facility and planned air quality controls
- location and distance for waste rock storage sites
- type of processing facility
- power requirements for the operation
- planned dust abatement measures
- concurrent reclamation activities

The information will be used to determine the most likely permitting scenario for air quality, involving both construction and operation.

### 3.11.8 Bibliography

Air Sciences, Inc. (August 1989). *Air-quality Monitoring Plan, Grassy Mountain Gold Project*.

Air Sciences, Inc. (September 1990). *Meteorological and Air Quality Data Annual Report, Grassy Mountain Gold Project, October 1989-September 1990.*

Bison Engineering, Inc. (Bison) 2015. *Calico Resources Grassy Mountain Exploration Project Vale, Oregon Ambient Air Monitoring Program Final Summary Report July 31, 2014 – September 30, 2015*.

National Oceanographic and Atmospheric Administration (NOAA), 1982. *Mean Monthly, Seasonal and Annual Pan Evaporation for the United States. U.S. Department of Commerce, Washington, DC*.

National Climatic Center, 1960-1964. Boise, Idaho Start Data, Station ID 24131. Asheville, North Carolina.

U.S. Department of Energy. 2009. *U.S. Geothermal Neal Power Plant Environmental Assessment.*

Western Regional Climate Center, Data for Owyhee Dam Coop Weather Station, downloaded 1/18/2013 from http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?or6405

### 3.11.9 Contacts

Mark Bailey
Air Quality Manager
Oregon Department of Environmental Quality
541-633-2006
Bailey.Mark@deq.state.or.us

Doug Welch
Air Quality
Oregon Department of Environmental Quality
541-278-4063
Welch.doug@deq.state.or.us

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

## 3.12 Noise

NOISE ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.12.1 Purposes and Objectives

The purpose of this work task is to document existing ambient noise levels at representative locations in the project study area.

### 3.12.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |
| Anticipated Project Disturbance (excluding access road): | 400 acres |

The noise project study area is shown in **Figure 22, Noise Study Area**.

### 3.12.3 Regulatory Framework

Oregon Revised Statutes (ORS) Chapter 467, Noise Control, describes state policy for noise emissions. ORS 467.120 describes the state policy regarding agricultural, forestry, mining, or rock processing operations. Mining or rock processing noise sources are not exempt from state enforcement within one half mile of noise-sensitive areas.

Oregon Administrative Rules (OAR) Chapter 340, Division 35, contains the noise control regulations and programs applicable to mining operations (OAR 340-035-0035). The rules establish statewide maximum

permissible environmental noise levels for new industrial uses at the nearest noise-sensitive property. A noise-sensitive property means real property normally used for sleeping, or normally used as schools, churches, hospitals or public libraries. Property used for industrial or agricultural activities is not considered noise-sensitive property unless it meets the state criteria in more than an incidental manner. Because human hearing is not equally sensitive to all frequencies of sound, certain frequencies are typically given more or less "weight" in environmental noise analyses and measurements. The A-weighted dBA scale corresponds to the sensitivity range for human hearing and will be used for all measurements made and presented in the baseline study report, except where specifically indicated.

The limits presented in OAR 340-035-0035 apply only to noise generated on the project site. Noise generated by vehicles entering or leaving the project site on public highways is exempt from this requirement. However, all vehicles must comply with the noise standards for road vehicles. The maximum permissible statistical noise levels at noise-sensitive properties from the project's operations are shown in **Table 22**.

**Table 22. Maximum Permissible Project Noise Levels at Noise-sensitive Properties**
(from Table 8, OAR 340-35-035)

| Noise Level Statistic | Day (7 AM to 10 PM) | Night (10 PM to 7 AM) |
|---|---|---|
| $L_{50}$ | 55 dBA | 50 dBA |
| $L_{10}$ | 60 dBA | 55 dBA |
| $L_1$ | 75 dBA | 60 dBA |

The maximum permissible environmental noise levels for new industrial facilities as measured at nearby quiet areas are more restrictive (lower) than the levels shown in **Table 22**. Quiet areas include wilderness areas, state parks, game reserves, wildlife breeding areas, and outdoor amphitheaters. For this project, Lake Owyhee State Park (located approximately 6.5 miles from the permit site, and approximately seven miles from the fee surface and mineral site), which offers outdoor camping sites, would be considered a quiet area. The maximum permissible noise levels from the proposed project noise levels in quiet areas are shown in **Table 23**.

**Table 23. Maximum Permissible Project Noise Levels in Quiet Areas**
(from Table 9, OAR 340-35-035)

| Noise Level Statistic | Day (7 AM to 10 PM) | Night (10 PM to 7 AM) |
|---|---|---|
| $L_{50}$ | 50 dBA | 45 dBA |
| $L_{10}$ | 55 dBA | 50 dBA |
| $L_1$ | 60 dBA | 55 dBA |

The noise limits specified in **Table 22** and **Table 23** must not be exceeded in any 1-hour period of the day. In addition to meeting the maximum permissible project noise levels specified in **Table 22** and **Table 23**, OAR 340-35-035 also requires that noise generated by the project not cause the ambient noise levels ($L_{50}$ and $L_{10}$) to increase by more than 10 dBA in any 1 hour. As a result, determining the pre-existing ambient noise levels is very important to show compliance with OAR 340-35-035.

OAR 340-35-035 also imposes special noise limits on impulsive noise. The noise level limits for impulsive noise are not A-weighted, are lower at night than during the day, and the limits apply equally to noise-sensitive properties and quiet areas. **Table 24** presents the maximum permissible project impulsive noise levels at nearby noise-sensitive properties and quiet areas. Note that the level, frequency weighting, and time weighting are different for blasting noise when compared to other impulsive sounds. For blasting

noise, the C-weighting filter is used with a slow time response. For other impulsive sounds, there is no frequency weighting (sometimes called linear weighting).

**Table 24. Maximum Permissible Project Impulsive Noise Levels**
(from paragraph (1)(d) of OAR 340-35-035)

| Source | Noise Level Statistic | Day (7 AM - 10 PM) | Night (10 PM - 7 AM) |
|---|---|---|---|
| Blasting | $L_{max,slow}$ | 98 dBC | 93 dBC |
| Other Impulsive | $L_{peak}$ | 100 dB | 80 dB |

## 3.12.4 Study Methodology

### 3.12.4.1 Literature Review

One recent noise survey is known to have occurred in the vicinity of the Grassy Mountain Project area (HDR 2015).

### 3.12.4.2 Field Studies

The existing noise environment in the study area will be characterized through noise monitoring at three sites. Noise measurements will be taken in accordance with American National Standards Institute (ANSI) procedures for environmental noise measurements (ANSI 1992). The measurement location will be at least 20 feet from any solid structure to prevent acoustical reflections and at a height of five feet. Noise measurements will be made using a Larson Davis Model 820 sound level meter (SLM) with a valid annual calibration certificate, in conjunction with a protective environmental noise monitoring system for short-term measurements in moderate weather conditions. The SLM will be used in conjunction with a Larson Davis CAL 200 calibrator with a valid annual calibration certificate to calibrate the SLM before and after each measurement.

The SLM will be checked for self-noise limit prior to starting the measurements by running the meter in a sealed container in a quiet area. The results of the self-noise limit check will be presented in the baseline study report along with the results of the noise monitoring at each site.

## 3.12.5 Timing and Duration of Baseline Data Collection and Verification

Ambient noise measurements will be completed no later than 2018. Noise monitoring will entail hourly measurements for a period of 48 hours at each site to capture diurnal, as well as typical day-to-day variations in ambient noise levels. The following noise metrics will be measured:

- Hourly average levels ($L_{eq}$)
- Hourly maximum Levels ($L_{max}$)
- Hourly minimum levels ($L_{min}$)
- Noise levels exceeded for 1% of each hour ($L_1$)
- Noise levels exceeded for 10% of each hour ($L_{10}$)
- Noise levels exceeded for 33% of each hour ($L_{33}$)
- Noise levels exceeded for 50% of each hour ($L_{50}$)
- Noise levels exceeded for 67% of each hour ($L_{67}$)
- Noise levels exceeded for 90% of each hour ($L_{90}$)

$L_{eq}$ noise levels for residential sites will also be used to calculate the existing day-night noise levels ($L_{dn}$).

Proposed sites for conducting 48-hour noise monitoring are as follows:

- A site at the Lake Owyhee State Park, 1298 Lake Owyhee Dam Road, Adrian, Oregon, on the south side of the lake away from campgrounds and roads. A site here would characterize background noise levels at the state park quiet area. The park is open to the public from April 15

through October 31, and it offers a boat ramp and 71 overnight camping sites on the south shore of the lake. Monitoring would occur while the state park is open, but avoiding all holidays and weekends.

- A residence adjacent to Russell Road, Vale, Oregon, to characterize residential background noise levels on the proposed transportation access route to the mine site. The project would be accessed via Highway 20, west from Vale, and south on Russell Road, which becomes Twin Springs Road. The residences on Russell Road represent the only known residential land uses along the proposed transportation access route. The monitoring site would be selected to be at a distance that is representative of residences in the area.
- A site within the Grassy Mountain mine permit area to characterize undeveloped rural background noise levels. The site within the mine permit area would be selected to be at least 100 feet from any road and at least 25 feet from any trail.

A global positioning system (GPS) device will be used to record the coordinates of each monitoring site, and the site will be photographed to document the location and its surroundings. A field data sheet shall be completed at each site to document the site, observed noise sources present at the start of each measurement, and potential sources of noise present at the site.

Data will be downloaded via an electronic connection and converted into an Excel spreadsheet for analysis and presentation. Electronic download will be used to ensure accurate transfer of the data between the data logger and the results spreadsheet. All formulae used in the presentation and analysis of the data shall be subject to a quality control review by a qualified noise analyst prior to release in the baseline study report.

The baseline study report shall be stamped by an Oregon-registered professional engineer (P.E.).

### 3.12.6 Further Anticipated Studies

No additional studies are anticipated. If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies.

### 3.12.7 Baseline Characterization

The baseline characterization report for noise will include:

- Introduction
- Regulatory environment
- Study area description
- Data sources
- Methodology for determining noise levels
- Existing noise environment

The existing noise environment in the study area will be presented based on monitored data. A summary of the range of noise levels measured at each site will be tabulated and presented in the text; a full description of hourly data metrics (including statistical noise levels $L_1$, $L_{10}$, $L_{33}$, $L_{50}$, $L_{67}$, and $L_{90}$) will be tabulated and graphed in an appendix as a function of time for each individual site. The baseline study report will provide a map showing the monitoring locations, photographs of each monitoring site showing the noise monitoring equipment in place, and the field data sheets for each site.

A description of the noise environments in which data were collected will be presented, as well as a discussion of how each of these sites can be used as a proxy for other areas of the study area. Current noise

sources observed in the study area will be described. Noise-sensitive land uses in surrounding areas will also be described, if any.

The monitored noise level data will be discussed in relation to state of Oregon noise regulations presented in OAR 340-035-0035. This information will also be used in preparing the Division 37 permit application, and potential related National Environmental Policy Act (NEPA) requirements.

### 3.12.8 Bibliography

HDR Engineering, Inc. (HDR). 2015. *Noise Baseline Study, Grassy Mountain Exploration Project.*

### 3.12.9 Contacts

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

## 3.13 Cultural Resources

CULTURAL RESOURCES ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.13.1 Purposes and Objectives

The cultural resource baseline study will provide information on the occurrences and significance of cultural resources in and near the project area. All services discussed herein are in compliance with Section 106 of the National Historic Preservation Act (NHPA) and Oregon BLM requirements.

### 3.13.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |
| Anticipated Project Disturbance (excluding access road): | 400 acres |

The cultural resources study area is the Cultural Area of Potential Effects (APE) shown in **Figure 23, Cultural Resources Study Area and Permit Area.**

### 3.13.3 Regulatory Framework

In cooperation with the federal Advisory Council on Historic Preservation (ACHP), the Oregon State Historic Preservation Office (SHPO) works with federal agencies and those agencies receiving federal funds to assist them in complying with Section 106 of the NHPA of 1966. Oregon SHPO is also responsible for assisting local governments in compliance with Oregon Revised Statutes (ORS) 358.653. Also,

archaeological resources are protected on non-federal, public land and private land under ORS 358.905. ORS 97.740 protects Native American graves, burial items, and items of cultural patrimony. Excavation of archaeological sites requires an Oregon archaeological permit as per ORS 390.235 and Oregon Administrative Rule (OAR) 736-051-0080 and OAR 736-051-0080.

The location of cultural resources will be maintained as confidential and exempt from the Oregon Public Records Law under ORS 192.501(11).

Oregon State Historic Preservation Office
725 Summer Street NE, Salem, OR 97301
www.oregonheritage.org

Matt Diederich
Archaeologist
(503) 986-0577
Matthew.diederich@state.or.us

### 3.13.4 Study Methodology

A preliminary online search of the Oregon Archaeological Records Remote Access (OARRA) system indicates that at least ten previous cultural resource studies have been performed for the Cultural APE (see Literature Review, below). Most recently, in 2016 Archaeological Services, LLC (ASCC) performed a Class III cultural resources inventory encompassing most Mine and Process Area and a 100-foot corridor along Twin Springs Road (see Smith et al. 2016). The remaining inventories primarily cover small sections of the proposed Access Road Area. The study methodology for the Grassy Mountain Project involves the following:

- A literature review of the Cultural APE and a one-mile radius, consisting of an online records search using the OARRA system and an in-person search at the BLM Vale District Office in Vale, Oregon. The literature search will provide information about known cultural resources within the Cultural APE. EM Strategies personnel will also review available historic topographic and General Land Office (GLO) maps, and a Mining Claim Geographic Report will be generated using the BLM's LR2000 System, which provides a list of both active and closed mining claims in the area by Section.
- A Class III cultural resource inventory of the Cultural APE will be conducted on the Permit Area to assess the effects of the proposed Project on cultural resources. The intensive pedestrian survey will be carried out in accordance with applicable agency guidelines, and will be accomplished by archaeologists walking 30-meter interval transects across the Cultural APE. All previously recorded and newly identified archaeological sites, features, and isolates encountered during the survey will be appropriately mapped, documented, and photographed in accordance with BLM guidelines. SHPO field survey forms will be completed in the field; these forms are included in Appendix D. The survey crew will use Trimble GeoXT Global Positioning System (GPS) units to map cultural resources and important geographic features using customized data dictionaries that conform to the BLM standards. There will be no collection of cultural resources from BLM-administered land.
- Information will be obtained from BLM as to how the visual resources protection plan matches with the cultural resources inventory.

#### 3.13.4.1 Literature Review

- Archaeological Services. 2016. *Cultural Resource Reconnaissance Survey of the Twin Springs Road and Grassy Mountain Processing Parcel Project Areas.*

- 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
- Ferguson Daryl E., and David A. Harder.1997. Archaeological Survey of the Cow Hollow Fire Rehabilitation Area in Malheur County, Oregon. In *Contributions in Cultural Resource Management*, No. 58. Prepared by Center for Northwest Anthropology for BLM. Report No. 15961 on file at BLM Vale District, Vale, Oregon.
- Harding, William M. 2006. *Cultural Resource Inventory of the Double Mountain Fire*. Report No. 20421 on file at BLM Vale District, Vale, Oregon.
- Holschuh, Dana L.2015.*Cultural Resource Reconnaissance Survey of the Grassy Mountain Mine Project Area, Malheur County, Oregon.* Prepared by Archaeological Services LLC for HDR Engineering. Report No. 27108 on file at BLM Vale District, Vale, Oregon.
- Oregon State Historic Preservation Office (SHPO). 2011. *State of Oregon Archaeological Reporting Guidelines.* http://www.oregon.gov/oprd/HCD/ARCH/docs/state_of_oregon_archaeological_survey_and_reporting_standards.pdf
- Oregon State Historic Preservation Office (SHPO). 2013. *Guidelines for Conducting Field Archaeology in Oregon.* Oregon State Historic Preservation Office, Salem. Electronic document, http://www.oregon.gov/oprd/HCD/ARCH/docs/final_field_guidelines%202013.pdf, accessed February 27, 2017.
- Peterson, Robert R. 1991. *A Class III Cultural Resources Inventory of the Atlas Precious Metals Project, Malheur County, Oregon*. Prepared by Western Cultural Resource Management, Inc. for Atlas Precious Metals, Inc. Report No. 12112 on file at BLM Vale District, Vale, Oregon.
- Plew, Mark G. 1984. *Sagebrush Burn and Seeding*. Report No. 6485 on file at BLM Vale District, Vale, Oregon.
- Pritchard, Diane H. 1996. *A Cultural Resource Inventory of Cow Hollow Seeding, Malheur County, Oregon*. Report No. 18220 on file at BLM Vale District, Vale, Oregon.
- Senco-Phenix (September 1989). *Cultural Resource Survey – Grassy Mountain Site.*
- Senulis, John A.1989. *Intensive Cultural Resource Block Survey and Inventory of the Proposed Grassy Mountain Mine Addendum Adjacent Exploration Areas, Malheur County, Oregon*. Prepared by Senco-Phenix for Atlas Precious Metals. Report No. 11906on file at BLM Vale District, Vale, Oregon.
- Smith, Michael, Dana Holschuh, Julie Wilt, and Alexander Gall. 2016. *Cultural Resource Reconnaissance Survey of the Twin Springs Road and Grassy Mountain Processing Parcel Project Areas, Malheur County, Oregon*. Prepared by Archaeological Services LLC for HDR Engineering. Report on file at BLM Vale District, Vale, Oregon.
- State of Oregon. 2011. *State of Oregon Archaeological Reporting Guidelines*. Oregon State Historic Preservation Office, Salem.
- Stoner, Edward, and Robert Peterson.1990. *A Cultural Resource Inventory of Proposed Access Roads and Shovel Testing of Previously Recorded Sites in the Grassy Mountain Project Area, Malheur County, Oregon.* Prepared by Western Cultural Resource Management, Inc. for Atlas Precious Metals, Inc. Report No. 11905 on file at BLM Vale District, Vale, Oregon.
- Western Cultural Resource Management, Inc. (MY 15, 1991). *A Cultural Resource Inventory of Proposed Access Roads and Shovel Testing of Previously Recorded Sites in the Grassy Mountain Project Area*. http://www.oregon.gov/oprd/HCD/ARCH/Pages/index.aspx


The previous field work and subsequent documentation (see Literature Review, above) will be reviewed to determine the number and type of archaeological sites that have been identified within the Cultural APE. Field work will be conducted per the 2013 *Oregon SHPO Guidelines for Conducting Field Archaeology in Oregon* (or most current version at the time the field work is conducted)

### 3.13.5 Timing and Duration of Baseline Data Collection and Verification

The cultural resources field work will be completed no later than 2018. The appropriate SHPO field survey protocols and reporting guidelines will be followed per the 2011 *State of Oregon Archaeological Reporting Guidelines*, and SHPO field forms will be used.

### 3.13.6 Further Anticipated Studies

If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies, including Oregon SHPO.

### 3.13.7 Baseline Characterization

Cultural resource baseline data will provide information on past human location, activity, occupation, and use, and historic and prehistoric cultural resources reflect past human activities on the landscape. A cultural resources assessment will be conducted to identify cultural resources within the Cultural APE and to assess the effects of the proposed Project on cultural resources. The cultural resources inventory report will be prepared following SHPO field and reporting guidelines and will include the required Cultural Resources Survey Cover Sheet that is included in Appendix D. If cultural resources are present in the APE, recommendations will be made to avoid, minimize, or mitigate adverse effects.

### 3.13.8 Bibliography

Archaeological Services. 2016. *Cultural Resource Reconnaissance Survey of the Twin Springs Road and Grassy Mountain Processing Parcel Project Areas.*

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

Ferguson Daryl E., and David A. Harder.1997. Archaeological Survey of the Cow Hollow Fire Rehabilitation Area in Malheur County, Oregon. In *Contributions in Cultural Resource Management*, No. 58. Prepared by Center for Northwest Anthropology for BLM. Report No. 15961 on file at BLM Vale District, Vale, Oregon.

Harding, William M. 2006. *Cultural Resource Inventory of the Double Mountain Fire*. Report No. 20421 on file at BLM Vale District, Vale, Oregon.

Holschuh, Dana L.2015.*Cultural Resource Reconnaissance Survey of the Grassy Mountain Mine Project Area, Malheur County, Oregon.* Prepared by Archaeological Services LLC for HDR Engineering. Report No. 27108 on file at BLM Vale District, Vale, Oregon.

Oregon State Historic Preservation Office (SHPO). 2011. *State of Oregon Archaeological Reporting Guidelines.* http://www.oregon.gov/oprd/HCD/ARCH/docs/state_of_oregon_archaeological_survey_and_reporting_standards.pdf

Oregon State Historic Preservation Office (SHPO). 2013. *Guidelines for Conducting Field Archaeology in Oregon.* Oregon State Historic Preservation Office, Salem. Electronic document, http://www.oregon.gov/oprd/HCD/ARCH/docs/final_field_guidelines%202013.pdf, accessed February 27, 2017.

Peterson, Robert R. 1991. *A Class III Cultural Resources Inventory of the Atlas Precious Metals Project, Malheur County, Oregon*. Prepared by Western Cultural Resource Management, Inc. for Atlas Precious Metals, Inc. Report No. 12112 on file at BLM Vale District, Vale, Oregon.

Plew, Mark G. 1984. *Sagebrush Burn and Seeding*. Report No. 6485 on file at BLM Vale District, Vale, Oregon.

Pritchard, Diane H. 1996. *A Cultural Resource Inventory of Cow Hollow Seeding, Malheur County, Oregon*. Report No. 18220 on file at BLM Vale District, Vale, Oregon.

Senco-Phenix (September 1989). *Cultural Resource Survey – Grassy Mountain Site.*

Senulis, John A.1989. *Intensive Cultural Resource Block Survey and Inventory of the Proposed Grassy Mountain Mine Addendum Adjacent Exploration Areas, Malheur County, Oregon*. Prepared by Senco-Phenix for Atlas Precious Metals. Report No. 11906on file at BLM Vale District, Vale, Oregon.

Smith, Michael, Dana Holschuh, Julie Wilt, and Alexander Gall. 2016. *Cultural Resource Reconnaissance Survey of the Twin Springs Road and Grassy Mountain Processing Parcel Project Areas, Malheur County, Oregon*. Prepared by Archaeological Services LLC for HDR Engineering. Report on file at BLM Vale District, Vale, Oregon.

State of Oregon. 2011. *State of Oregon Archaeological Reporting Guidelines*. Oregon State Historic Preservation Office, Salem.

Stoner, Edward, and Robert Peterson.1990. *A Cultural Resource Inventory of Proposed Access Roads and Shovel Testing of Previously Recorded Sites in the Grassy Mountain Project Area, Malheur County, Oregon.* Prepared by Western Cultural Resource Management, Inc. for Atlas Precious Metals, Inc. Report No. 11905 on file at BLM Vale District, Vale, Oregon.

Western Cultural Resource Management, Inc. (MY 15, 1991). *A Cultural Resource Inventory of Proposed Access Roads and Shovel Testing of Previously Recorded Sites in the Grassy Mountain Project Area.* http://www.oregon.gov/oprd/HCD/ARCH/Pages/index.aspx

### 3.13.9

Cheryl Bradford
Archaeologist
U.S. Department of Interior
Bureau of Land Management, Vale District
541-473-6348
cbradford@blm.gov

Matt Diederich
State Historic Preservation Office
503-986-0577
Matthew.diederich@oregon.gov

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

Emily S. Whorton, M.A., RPA
Senior Archaeologist and Cultural Program Manager
EM Strategies, Inc.
775- 826-8822
emily@emstrats.com

## 3.14 Land Use

LAND USE ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.14.1 Purposes and Objectives

Oregon's statewide land use planning program is governed by statute, administrative rules administered by the Oregon Department of Land Conservation and Development (DLCD), and city and county codes. Land use planning and zoning is intended to accomplish a number of statewide "goals." The goals set forth Oregon's policies of land use and resource protection. Malheur County has adopted a comprehensive plan which governs the land on which the Calico Resources USA Corp. (Calico) project will be located. That plan has been approved by DLCD and is designed to carry out the statutory policies and goals.

The purpose and objective of the baseline study is to identify existing land use and land use designations for the project area (Oregon Administrative Rule [OAR] 632-037-0055 (1)(l)). The baseline study information will be used to obtain the local land use permits from Malheur County pursuant to Oregon Revised Statute (ORS) 517.971, and Oregon Department of Geology and Mineral Industries (DOGAMI) Division 37 permit. If future changes to the mine plan occur, additional information and permits will be obtained using the methodologies described in this work plan. In this situation, the same methodology as described in this document will be applied.

### 3.14.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |

Anticipated Project Disturbance (excluding access road): 400 acres

The land use project study area is shown in **Figure 24, Land Use Study Area and Permit Area**. The Malheur County code requires an analysis of the Permit Area and a 1,000-foot radius.

The present land use in the proposed Grassy Mountain Project area is grazing. Under the definition of farm use in ORS 215.203, grazing is farming. Although it is not a pertinent consideration for obtaining a local land use permit, there may also be limited recreational and mineral exploration use in the study area.

The proposed project is located on land the county has zoned exclusive range use (ERU). The proposed project study area conforms to the area required to meet project needs, namely, the main access road, mine, haul road, and processing and ancillary facilities (described in Section 1 of this document). By statutes, ERU property is designated to implement statewide Planning Goal 3, which is to "preserve and maintain land for farm use, and with the state's agricultural land use policies expressed in ORS 215.243 and 215.203(2)(a)" (OAR 660-015-000(3). Malheur County has designated certain uses that may occur within an ERU zone, which are allowed "outright." Mining is not an outright use within an ERU zone. The statutes, administrative rules, and the county code do, however, allow mining as a "conditional use" on land within an ERU zone.

### 3.14.3 Regulatory Framework

Regarding Oregon's statewide land use planning system, farm land must be protected. ORS 215.298 sets limits and provides guidance on what is and is not "mining" requiring a land use permit when conducted in an exclusive farm use (EFU) zone.

Provisions for mining and processing are contained in ORS 215.283 (2)(b)(B) and (D), subject to the requirements in ORA 215.296.

For further clarification, refer to OAR 660-033-0120, "Uses Authorized on Agricultural Lands," and OAR 660-033-0130 (5), "Minimum Standards Applicable to the Schedule of Permitted and Conditional Uses."

Malheur County's adopted comprehensive plan governs the study area in which the project will be located, and a conditional use permit (CUP) will be required. This permit and other necessary coordination/consultation are described in the sections that follow. This includes both the county and DLCD regarding information necessary to obtain either a CUP or a statewide Planning Goal 5 amendment (if needed), along with OAR Divisions 16 and 23.

Additional environmental requirements for the project are included in Division 37, Chemical Process Mining (OAR 632-037-0005 through 632-037-0155), and Division 420, Chemical Mining (OAR 340-0043-0000 through 340-043-0180).

#### 3.14.3.1 BLM Three Rivers Resource Management Plan

The *Three Rivers Resource Management Plan/Record of Decision* (RMP/ROD) provides management direction to 1.71 million acres of BLM-administered public lands in Harney, Grant, Lake, and Malheur counties (BLM 1992). The energy and minerals objective EM 3 in the RMP/ROD calls for providing maximum opportunity for mineral exploration and development on federal mineral estates in areas identified as open to operation of the mining laws. The Three Rivers RMP/ROD identified the BLM-administered lands within the project area as open to exploration and mining operations and identified the area as having moderate to high mineral potential (Three Rivers RMP/ROD, pages 2-162 and 2-165).

#### 3.14.3.2 Federal Land Policy and Management Act, the Mining and Mineral Policy Act of 1970, and BLM Mineral Policy

Public lands under BLM jurisdiction are managed "…on the basis of multiple use and sustained yield unless otherwise specified by law" (Sec. 102(a)(7), Federal Land Policy and Management Act [FLPMA]). Section 102(a)(12) of FLPMA states that "the public lands be managed in a manner which recognizes the Nation's need for domestic sources of minerals, food, timber, and fiber from the public lands, including implementation of the Mining and Minerals Policy Act of 1970 (84 Stat. 1876, 30 U.S.C. 21a) as it pertains to the public lands." The Mining and Minerals Policy Act declares that it is the continuing policy of the federal government to foster and encourage private enterprise in the development of domestic mineral resources. BLM's *Mineral Policy* (1984) states that public lands will remain open and available for mineral exploration and development unless withdrawal or other administrative action is clearly justified in the national interest.

#### 3.14.3.3 Malheur County Comprehensive Management Plan

This plan was adopted in 1982. It defines what Malheur County wants to occur during the planning period. It is meant to be responsive to change, as opposed to restricting opportunities for growth. It describes allowed users, a development code, natural hazards mitigation, and a transportation system plan. It also addresses mining.

#### 3.14.3.4 Farmland Protection Policy (Oregon Revised Statutes 215.243)

The Malheur County comprehensive plan identifies a goal of farming in the general area of the proposed mine. Portions of the project area are zoned as ERU. The Farmland Protection Policy was adopted by the Oregon state legislature in 1973. It calls for the "preservation of a maximum amount of the limited supply of agricultural land" (ORS 215: http://www.oregon.gov/LCD/Pages/farmprotprog.aspx).

There are provisions and requirements for mining in an ERU zone, which are outlined in Section 215.243 and 215.296. Mining is not an "outright" use. However, the statutes, administrative rules, and county code do allow mining as a "conditional use" in an ERU zone.

#### 3.14.3.5 Mining in Exclusive Range Use Zone, Land Use Permit (Oregon Revised Statutes 215.298, 215.283, 215.243)

Regarding Oregon's statewide land use planning system, farm and range land must be protected. ORS 215.298 sets limits and provides guidance on what is and is not "mining" requiring a land use permit when conducted in an EFU or ERU zone.

Provisions for mining are included in ORS 215.283 (2)(b)(B) and (D), subject to the requirements in ORS 215.296. Provisions for processing are included in ORS 215.283(2)(b)(C), subject to the requirements in ORS 215.296.

For further clarification, refer to OAR 660-033-0120, "Uses Authorized on Agricultural Lands," and OAR 660-033-0130 (5), "Minimum Standards Applicable to the Schedule of Permitted and Conditional Uses."

Additionally, for purposes of ORS 215.243 and ORS 215.296, a land use permit is required for mining more than 1,000 cubic yards of material or excavation preparatory to mining a surface area of more than 1 acre. Mining within an ERU zone is allowed if the applicant demonstrates that the land is suitable for mining, and that the project will not do the following: 1) force a significant change in accepted farm or forest practices on surrounding land devoted to farm or forest use; or 2) significantly increase the cost of accepted farm or forest practices on surrounding lands devoted to farm or forest uses (Malheur County Code 6-6-7(H); see also ORS 215.296(1); see also OAR 660-033-0130). The county code also provides additional criteria that may be considered by the county in determining that Calico's proposed project will be compatible with surrounding agricultural practices (Malheur County Code 6-3A-1 and 6-6-7).

### 3.14.4 Study Methodology

#### 3.14.4.1 Literature Review

- Bureau of Land Management (BLM). 1984. *Mineral Policy*.
- Bureau of Land Management (BLM). 1992. *Three Rivers Resource Management Plan (RMP)/Record of Decision*.
- 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
- HDR Engineering, Inc. (HDR). 2015. *Land Use Baseline Study Grassy Mountain Exploration Project.*
- Malheur County Comprehensive Plan, 1982 (as amended 2007)
- Malheur County Code. 2011.
- Malheur County. Zoning Ordinance. Article A. Resource Lands, EFU Exclusive Farm Use Zone, ERU Exclusive Range Use Zone, EFFU Exclusive Farm-Forest Use Zone. Accessed January 2013: http://sterlingcodifiers.com/codebook/index.php?book_id=695&chapter_id=52406
- Oregon Department of Land Conservation and Development (DLCD). Statutes 215.243. Accessed December 2012: http://www.oregon.gov/LCD/Pages/farmprotprog.aspx
- Oregon Department of Land Conservation and Development (DLCD). DLCD Farmland Protection Program. Accessed January 2013: http://www.oregon.gov/LCD/pages/farmprotprog.aspx#Farmland_Protection_Program
- Oregon Revised Statute (ORS), Volume 6, Chapter 215, §215.283, "Uses permitted in exclusive farm use zones in nonmarginal lands counties." Accessed February 2013: http://www.oregonlaws.org/ors/215.283

#### 3.14.4.2 Field Studies

No field studies are anticipated.

#### 3.14.4.3 Coordination/Consultation

Discussions will be held with the Malheur County planning director; the Oregon Department of Agriculture, Land Use and Water planning coordinator; and DLCD to collect data that will provide an inventory of land use and operations in the study area. Due to the remote nature of the location of the project, Malheur County planning staff has identified existing uses as limited to cattle grazing. The information obtained will identify the impacts of mining, if any, on that use. Additional consultation with Malheur County and DLCD regarding the information and applicable criteria necessary to complete a CUP application, or statewide Planning Goal 5 amendment process will be required. The sources of all information will be cited.

### 3.14.5 Timing and Duration of Baseline Data Collection and Verification

The land use baseline study will be completed no later than 2018 using information gathered from statewide land use planning goals and governing land use agencies.

### 3.14.6 Further Anticipated Studies

No additional studies are anticipated. If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies.

### 3.14.7 Baseline Characterization

A land use environmental baseline characterization report will be prepared that focuses on consistencies and/or issues with the BLM resource management plan for the project area, and the Malheur County comprehensive plan and related ordinances. The report will describe all land use within the study area and a suitable "area of impact." A map showing existing land uses, EFU zones, and current land use designations will be a key deliverable. The baseline characterization report will include:

- Introduction
- Regulatory environment
- Description of study area land uses
- Data sources
- Methodology
- Existing allowable land uses
- Exclusive farm use (rangeland)
- Potential land use conflicts
- Mitigation opportunities (see *Malheur County Natural Hazards Mitigation Plan* (2007))

### 3.14.8 Bibliography

Bureau of Land Management (BLM). 1984. *Mineral Policy*.

Bureau of Land Management (BLM). 1992. *Three Rivers Resource Management Plan (RMP)/Record of Decision.*

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

HDR Engineering, Inc. (HDR). 2015. *Land Use Baseline Study Grassy Mountain Exploration Project.*

Malheur County. Zoning Ordinance. Article A. Resource Lands, EFU Exclusive Farm Use Zone, ERU Exclusive Range Use Zone, EFFU Exclusive Farm-Forest Use Zone. Accessed January 2013: http://sterlingcodifiers.com/codebook/index.php?book_id=695&chapter_id=52406

Oregon Department of Land Conservation and Development (DLCD). Statutes 215.243. Accessed December 2012: http://www.oregon.gov/LCD/Pages/farmprotprog.aspx

Oregon Department of Land Conservation and Development (DLCD). DLCD Farmland Protection Program. Accessed January 2013: http://www.oregon.gov/LCD/pages/farmprotprog.aspx#Farmland_Protection_Program

Oregon Revised Statute (ORS), Volume 6, Chapter 215, §215.283, "Uses permitted in exclusive farm use zones in nonmarginal lands counties." Accessed February 2013: http://www.oregonlaws.org/ors/215.283

### 3.14.9 Contacts

Alvin Scott
Malheur County Planning Director
251 "B" St. West #12
Vale, Oregon 97918
541-473-5185
alvin.scott@malheurco.org

Jim Johnson
Land Use and Water Planning Coordinator
Oregon Department of Agriculture
503-986-4706
jjohnson@oda.state.or.us

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

## 3.15 Transportation

TRANSPORTATION ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

The transportation network within, and in the vicinity of, the Grassy Mountain Project area includes a U.S. Highway, Malheur County roads, Bureau of Land Management (BLM) roads, and private roads. The project is accessed via Highway 20, west from Vale, and south on Russell Road, which becomes Twin Springs Road. The site is approximately 25 miles south along Twin Springs Road. This component will involve BLM right(s)-of-way and use county roads and an Oregon state highway. These roads also support public access, grazing, and outdoor recreation, as well as power line right(s)-of-way. All of these will be considered in the baseline work plan and related analyses.

### 3.15.1 Purposes and Objectives

The purpose of the transportation baseline study is to describe existing conditions associated with access roads to the project area. The baseline study will be used to support the preparation of the Division 37 permit application, and any related National Environmental Policy Act (NEPA) analysis that may be required for a future mining operation at the Grassy Mountain site. Ultimately, this information will also be used in the preparation of the plan of operations (POO) for the project.

### 3.15.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |

Anticipated Project Disturbance (excluding access road): 400 acres

The transportation project study area is shown in **Figure 25, Transportation Study Area**. Roads to the site from Nyssa and Vale will be characterized.

### 3.15.3 Regulatory Framework

- Division 37 permit application
- BLM right(s)-of-way
- Related NEPA requirements
- Interface with Malheur County

### 3.15.4 Study Methodology

The study method for transportation and roads will use the following information to define the baseline condition:

- BLM master title plats
- BLM LR2000 database
- Grassy Mountain Project POO
- Malheur County transportation system plan/records
- BLM geographical information system (GIS) data

#### 3.15.4.1 Literature Review

- 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
- Oregon Department of Transportation, Traffic Counts. http://www.oregon.gov/ODOT/TD/TDATA/tsm/docs/2011_TVT.pdf
- HDR Engineering, Inc. (HDR). 2015. *Transportation Baseline Study, Grassy Mountain Exploration Project.*
- Malheur County Road Department. http://www.malheurco.org/roads
- *Malheur County Transportation System Plan*. The plan guides the management of existing and future transportation facilities for the next 20 years. This document will replace the existing transportation chapter of the county's comprehensive plan (Chapter 12) and satisfies the requirements of the Oregon Transportation Planning Rule (TPR). https://scholarsbank.uoregon.edu/xmlui/handle/1794/4155

#### 3.15.4.2 Field Studies

Traffic counts will be conducted in the spring and fall to capture the seasonal variability of the road usage. The traffic counts will be coordinated with the Malheur County surveyor (Tom Edwards). Malheur County will provide traffic counters to conduct the traffic counts. Two sites were selected for the traffic counts:

1. Russell Road will have seasonal changes with farm work and farm to market traffic. Twin Springs Road will have the most use in the fall.
2. The selected location of the cattle guard at the property line should be the safest location for the counting equipment (see **Figure 26, Traffic Counter Locations**).

### 3.15.5 Timing and Duration of Baseline Data Collection and Verification

#### 3.15.5.1 Timing and Duration

- Transportation counts will be conducted during the spring and fall.

- Each traffic count will be conducted over a one-week period. The traffic counters will be checked two times during the week-long data collection period to ensure proper functioning.

#### 3.15.5.2 Verification

- The sources of all information will be cited and verified with the appropriate agencies.
- Traffic counts will provide information on road usage for a window in time during the spring and fall.

### 3.15.6 Further Anticipated Studies

No additional studies are anticipated. If additional information is determined to be necessary, it will be collected using approved methodologies gathered from documented sources and coordinated with appropriate agencies.

### 3.15.7 Baseline Characterization

An environmental baseline characterization report for transportation will describe estimated transportation use needs for the Grassy Mountain Project and will include:

- Introduction
- Regulatory environment
- Study area
- Data sources
- Methodology
- Existing transportation system
  - Map showing road ownership for the roads from Vale and Nyssa
  - Highway 20 description
  - Russell Road use
  - Twin Springs Road use
  - Main haul road configuration
  - Internal service roads configuration
  - Anticipated vehicle types
  - Potential transportation use conflicts
  - Seasonal variations in traffic

### 3.15.8 Bibliography

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

HDR Engineering, Inc. (HDR). 2015. *Transportation Baseline Study, Grassy Mountain Exploration Project.*

Malheur County. 1998. *Malheur County Transportation System Plan*. https://scholarsbank.uoregon.edu/xmlui/handle/1794/4155

Malheur County Road Department. http://www.malheurco.org/roads

Oregon Department of Transportation, Traffic Counts. 2011. http://www.oregon.gov/ODOT/TD/TDATA/tsm/docs/2011_TVT.pdf

### 3.15.9 Contacts

Andy Bentz
Bentz Solutions, Inc.
2092 Westridge
Ontario, OR 97914
541-881-6320
Andy.bentz@bentzsolutions.com

Vern Pritchard
Vale District Engineer
U.S. Department of the Interior Bureau of Land Management, Vale District
100 Oregon Street
Vale, OR 97918
541-473-6267
vpritchard@blm.gov

Tom Edwards
Malheur County Surveyor
251 B St W, Suite 7
Vale, OR 97918
541-473-5520
tedwards@malheurco.org

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

## 3.16 Socioeconomics

SOCIOECONOMICS ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.16.1 Purposes and Objectives

The purpose of the socioeconomic baseline study is to characterize the social and economic conditions in Malheur County, Oregon, and the communities nearest the project area.

Malheur County is located in southeast Oregon, and is included in the eight-county definition of Eastern Oregon. As of 2011, the population was 31,068. Ontario is the largest city, and the county seat is Vale.

### 3.16.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |
| Anticipated Project Disturbance (excluding access road): | 400 acres |

The socioeconomic project study area is shown in **Figure 27, Regional Socioeconomics Study Area**. The study area includes Malheur County.

### 3.16.3 Regulatory Framework

With the exception of Division 37 permit application guidelines, no regulatory standards apply.

### 3.16.4 Study Methodology

#### 3.16.4.1 Literature Review

- *Argus Observer, The*. "Employment news for Malheur County." September 4, 2012. "http://www.argusobserver.com/news/employment-in-malheur-county-takes-a-hard-hit/article_6d2a6a34-f6b3-11e1-9ab0-0019bb2963f4.html
- HDR Engineering, Inc. (HDR). 2015. *Socioeconomic Baseline Study, Grassy Mountain Exploration Project.*
- Lilburn Corporation, Sacramento, CA. *Recommended Methodology for Socio-Economic Baseline Data Collection for Proposed Grassy Mountain Gold Mining Project Malheur County, Oregon*, October 29, 1993.
- Malheur County Economic Development Department. 2012. County profile including: population, major employers, medical facilities, transportation and taxation. http://ecodev.malheurco.org/
- *Sperling's Best Places*. Economy in Malheur County, Oregon. This site discusses overview, people, health, economy, housing, rankings, crime, climate, education, transportation, cost of living, religion, and voting. http://www.bestplaces.net/economy/county/oregon/malheur
- U.S. Census Bureau: "State and County QuickFacts." Data derived from population estimates, American community survey, Census of population and housing, state and county housing unit estimates, county business patterns, non-employer statistics, economic census, survey of business owners, building permits, consolidated federal funds report; last revised: Thursday, 16-Aug-2012 10:37:29 EDT http://quickfacts.census.gov/qfd/states/41/41045.html
- Wikipedia. This site covers Malheur County history, demographics, economy, communities, and Census data. http://en.wikipedia.org/wiki/Malheur_County,_Oregon

#### 3.16.4.2 Field Studies

No field studies are anticipated.

### 3.16.5 Timing and Duration of Baseline Data Collection and Verification

The socioeconomic baseline data collection will be completed no later than 2018.

### 3.16.6 Further Anticipated Studies

No additional studies are anticipated. If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies.

### 3.16.7 Baseline Characterization

An environmental baseline report on Malheur County socioeconomics will be prepared. Ultimately, it would serve as the basis for conducting a socioeconomic impact analysis of the proposed Grassy Mountain Project. The data collected will be adequate to identify a local "input-output" multiplier for the project.

The following information will be included in the socioeconomics baseline report:

- Introduction
- Regulatory environment
- Study area
- Data sources
- Methodology

- Population demographics in Malheur County: Population demographics and census of Malheur County, including race, minority and migrant farm worker data summaries; demographic breakdown by annual average income; historic population data.
  - Vale
  - Nyssa
  - Ontario
- Existing socioeconomic environment
  - Housing: Describe the status of housing, particularly workforce housing in surrounding, potentially-affected communities (e.g., Ontario, Nyssa, Vale, Adrian). Data assessment/summary will include statistics such as housing vacancy rate, cost (ownership, per-square-foot values, rental rates), types, location, number and location of permitted and prospective (applications in-process un-built residential lots, current availability, trends in availability and location of multifamily units.
  - Household income in Malheur County: Description of median family income of surrounding communities, typical average annual salaries and/or wages by employment category.
  - Economic profile
  - Regional employment/unemployment/total employment in Malheur County: Characterize the employment/unemployment status of surrounding area, including identifying the total civilian labor force and average wage rates by category
  - Census data, including migrant farm worker population.
- Tax base utilities
- Public services: The availability and quantity of public services will be described, including the cost and availability of the services over the projected life of the project and the first few years after mine closure.
  - Water
  - Sewer
  - Fire protection
  - Solid waste
  - Sherriff/police
  - Criminal justice system
  - Roads
  - Schools
  - Libraries
  - Parks
  - Flood control
  - Public assistance
  - Public health
  - Animal control
  - Hazardous materials incident response
  - Human services
  - Medical emergency services (physicians, hospitals, ambulance)
  - Disaster response

### 3.16.8 Bibliography

*Argus Observer, The*. “Employment news for Malheur County.” September 4, 2012. "http://www.argusobserver.com/news/employment-in-malheur-county-takes-a-hard-hit/article_6d2a6a34-f6b3-11e1-9ab0-0019bb2963f4.html

HDR Engineering, Inc. (HDR). 2015. *Socioeconomic Baseline Study, Grassy Mountain Exploration Project.*

Lilburn Corporation. 1993. M*ethodology for Socio-Economic Baseline Data Collection for Proposed Grassy Mountain Gold Mining Project Malheur County, Oregon*.

Malheur County Economic Development Department. 2012. County profile including: population, major employers, medical facilities, transportation and taxation. http://ecodev.malheurco.org/

*Sperling's Best Places*. Economy in Malheur County, Oregon. http://www.bestplaces.net/economy/county/oregon/malheur

U.S. Census Bureau: "State and County QuickFacts." 2012. Data derived from population estimates, American community survey, Census of population and housing, state and county housing unit estimates, county business patterns, non-employer statistics, economic census, survey of business owners, building permits, consolidated federal funds report; last revised: Thursday, 16-Aug-2012 10:37:29 EDT http://quickfacts.census.gov/qfd/states/41/41045.html

Wikipedia. 2012. Malheur County history, demographics, economy, communities, Census data. http://en.wikipedia.org/wiki/Malheur_County,_Oregon

### 3.16.9 Contacts

Randy Jones
Oregon Department of Environmental Quality
503-962-3983
Jones.Randy@deq.state.or.us

Jim Jensen
Malheur County Economic Development Department
522 SW Fourth Street
Ontario, Oregon 97914
541-889-6216
malheurcountyedc@gmail.com

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

## 3.17 Environmental Justice

ENVIRONMENTAL JUSTICE ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.17.1 Purposes and Objectives

This work plan is responsive to the requirements of the 2008 Oregon Environmental Justice Law that intends that Oregon public agency actions are in compliance with the act, including permitting, cleanup, policy and planning, outreach and education, and compliance and enforcement.

### 3.17.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |
| Anticipated Project Disturbance (excluding access road): | 400 acres |

The environmental justice project study area is shown in **Figure 28, Environmental Justice Study Area**. The study area includes the following census tracts that comprise Malheur County: 9702; 9703; 9704; 9705; 9706; 9707; 9709; and 9400. These census tracts include the communities of Harper, Vale, Ontario, Nyssa, Kingman, Adrian and Owyhee.

### 3.17.3 Regulatory Framework

The basic concept behind the term "environmental justice" is that all people – regardless of their race, color, nation of origin, or income – are able to enjoy equally high levels of environmental protection. Environmental justice communities are commonly identified as those where residents are predominantly minorities or low-income; where residents have been excluded from the environmental policy setting or decision-making process; where they are subject to a disproportionate impact from one or more environmental hazards; and where residents experience disparate implementation of environmental regulations, requirements, practices and activities in their communities. Environmental justice efforts attempt to address the inequities of environmental protection in these communities. Legal authorities to support these efforts include both statutory and common law protections. Both the federal government and the State of Oregon have taken formal steps in recent years to address this issue.

#### 3.17.3.1 Oregon Laws and Policies

Oregon's environmental justice law (SB 420, 2007 Oregon Session) requires state natural resource agencies to follow prescribed steps to provide greater public participation and ensure involvement of people who may be affected by agency actions. Environmental documentation that addresses the federal requirements would also address this state requirement. This work plan assumes that the project would require federal approval and, therefore, undergo an environmental justice evaluation consistent with Executive Order 12898 and the federal U.S. Environmental Protection Agency's (USEPA) implementing guidance for environmental justice (*Environmental Justice Guidance Under the National Environmental Policy Act* [1997] and applicable guidance of the lead agency, if such guidance exists).

The state's detailed requirements apply to more than just environmental documentation. The following goals identified by the state would apply to a specific project that would be permitted by the state:

- Ensure the determination of the affected public (including potential environmental justice populations)
- Disseminate information to the affected public (including environmental justice populations)
- Provide opportunities for participation
- Foster community partnerships
- Pursue innovative responses to problems

Applicable implementation measures identified by the state include the following:

- Ensure that permit writers identify and address low-income and minority issues in the permitting process. This item could be addressed during the environmental documentation process.
- Schedule agency meetings in facilities that meet American Disability Act (ADA) requirements. This item would be addressed as part of the project's public involvement program.

Oregon Department of Environmental Quality's (ODEQ) adopted environmental justice policy is available at http://www.deq.state.or.us/nwr/docs/1997DEQ-EJ-policy.pdf.

#### 3.17.3.2 Federal Laws

Executive Order 12898, Federal Actions To Address Environmental Justice in Minority and Low-Income Populations, mandates that all federal actions are reviewed for possible effects on environmental justice populations. Environmental justice means that, to the greatest extent practicable and permitted by law, all populations are provided the opportunity to comment before decisions are rendered on, are allowed to share in the benefits of, are not excluded from, and are not affected in a disproportionately high and adverse manner by government programs and activities affecting human health or the environment. This executive order would apply to the project if the project requires federal agency approval.

### 3.17.4 Study Methodology

The following methodology outlines the approach for completing an environmental justice analysis.

#### 3.17.4.1 Literature Review

- HDR Engineering, Inc. (HDR). 2015. *Environmental Justice Baseline Study Grassy Mountain Exploration Project*.
- Malheur County Economic Development Department. 2012. County profile including: population, major employers, medical facilities, transportation and taxation. Ecodev.malheurco.org.
- ODEQ's adopted environmental justice policy is available at http://www.deq.state.or.us/nwr/docs/1997DEQ-EJ-policy.pdf.
- Oregon's Environmental Justice Law: http://www.oregon.gov/gov/GNRO/docs/enrolled-senatebill420.pdf
- Executive Order 12898, of February 11, 1994. Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations http://www.archives.gov/federal-register/executive-orders/pdf/12898.pdf.
- U.S. Census Bureau: State and County QuickFacts. 2012. Data derived from population estimates, American community survey, Census of population and housing, state and county housing unit estimates, county business patterns, non-employer statistics, economic census, survey of business owners, building permits, consolidated federal funds report; last revised: Thursday, 16-Aug-2012 10:37:29 EDT http://quickfacts.census.gov/qfd/states/41/41045.html
- Wikipedia. 2012. Malheur County history, demographics, economy, communities, Census data. http://en.wikipedia.org/wiki/Malheur_County,_Oregon

#### 3.17.4.2 Project Phase: Scoping

During scoping, the project team will work with lead and cooperating agencies to identify known potential environmental justice concerns and perform outreach directed toward environmental justice populations. Outreach might require preparing materials in languages other than English and/or making direct contact with environmental justice communities through door-to-door visits; local assistance agencies; and local community organizations, such as churches, and organizations in the communities of Vale and Nyssa that provide assistance to low-income, elderly, and minority residents.

At the end of scoping, the project team will highlight detailed information about environmental justice populations and determine the need for additional or specialized outreach during the environmental documentation phase.

#### 3.17.4.3 Project Phase: Environmental Documentation

**Identify Presence.** As part of environmental documentation, the project team will use information gathered during scoping to help define the presence and extent of potential environmental justice populations. Depending on the amount of, and findings based on, the information gathered, the project team might conduct further investigation on state and local agencies that oversee programs related to low-income and minority populations (such as programs that provide housing assistance). The project team will also gather recent data related to income, race, and ethnicity (in geographical information system [GIS] shape files, if available). The project team will start with the most recent data available from the U.S. Census Bureau (decennial census and American Community Survey results). If the initial data show that there might be environmental justice populations in the study area, the project team will gather other appropriate data, if available, from databases maintained by the U.S. Department of Housing and Urban Development (HUD) and the State of Oregon. Finally, if necessary, the project team will conduct more detailed surveys of the affected area by driving through the communities (Vale and Nyssa), talking with local business owners, and talking with people representing local churches, schools, and community facilities (such as senior centers). Note that this on-the-ground verification would only be needed if other information indicates that

an environmental justice population (as defined by the USEPA guidance and lead agency guidance) is or might be present in the project area. Once all of the information is gathered, the project team would make a determination regarding the presence or absence of environmental justice populations.

**Analyze Potential Effects.** If there are no environmental justice populations present in the project area, then no further analysis is required. If an environmental justice population(s) is (are) confirmed, then the project team will determine whether the proposed action might cause *disproportionate adverse effects* to the population(s). The project team will consider the physical location of the identified population(s) in the study area, and the potential health and environmental effects that might apply to that area. Particular effects likely considered would be those related to engagement in the process, such as noise; air quality, including dust and air toxics; surface and ground water contamination; hazardous materials; land use; the local economy; and circulation and access throughout the project area. If potential adverse effects are identified, then the project team would determine whether the effects would cause disproportionate adverse effects to the identified population(s). The project team would make a finding of effect and propose mitigation (if appropriate). If mitigation is necessary and feasible, the project team will work with the lead and cooperating agencies to minimize the disproportionate adverse effects. The project team might also work with local assistance agencies to identify mitigation, as appropriate. Consideration will be given to the environmental justice policies of Oregon's natural resource agencies, including, but not limited to ODEQ, Oregon Department of Fish and Wildlife (ODFW), Oregon Department of Transportation (ODOT), Oregon State Department of Lands (DSL) and Oregon Department of Geology and Mineral Industries (DOGAMI). In order to ensure more authentic public participation, the following actions will be taken:

- Provide early notice with information about proposed permits
- Provide project information materials in English and Spanish
- Prepare a public participation plan
- Provide project updates on a regular basis

If other issues arise that could cause adverse effects to an environmental justice population through the characterization and evaluation process, they will be addressed.

If the analysis results show that an environmental justice population is present and would be affected by the project, but that the project would not cause disproportionate adverse effects (to that population), then no mitigation specific to the environmental justice population would be required.

### 3.17.5 Timing and Duration of Baseline Data Collection and Verification

#### 3.17.5.1 Timing and Duration

The environmental justice characterization will be completed no later than 2018.

#### 3.17.5.2 Verification

Sources of all information will be cited and verified with the appropriate agencies. Evaluation of potential effects of the project on environmental justice will be conducted according to Oregon Revised Statutes (ORS) Volume 5 Chapter 182.545. http://www.oregonlaws.org/ors/182.545

### 3.17.6 Further Anticipated Studies

No additional studies are anticipated. If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies.

### 3.17.7 Baseline Characterization

The baseline environmental justice characterization will include the following information:

- Introduction
- Regulatory environment
- Study area description (map of study area)
- Data sources
- Methodology description
    - Literature review
- Description of environmental justice populations if any
- Description of potential effects to environmental justice populations if any
- Description of mitigation if necessary

### 3.17.8 Bibliography

Executive Order 12898, of February 11, 1994. Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations http://www.archives.gov/federal-register/executive-orders/pdf/12898.pdf.

HDR Engineering, Inc. (HDR). 2015. *Environmental Justice Baseline Study Grassy Mountain Exploration Project.*

Malheur County Economic Development Department. 2012. County profile including: population, major employers, medical facilities, transportation and taxation. Ecodev.malheurco.org.

Oregon Department of Environmental Quality (ODEQ). Environmental Justice-state laws and policy. Accessed January 2013: http://www.deq.state.or.us/about/envjusticelaws.htm#Oregon law

Oregon Department of Environmental Quality (ODEQ). Environmental Justice policy. Accessed January 2013: http://www.deq.state.or.us/nwr/docs/1997DEQ-EJ-policy.pdf

U.S. Census Bureau: State and County QuickFacts. 2012. Data derived from population estimates, American community survey, Census of population and housing, state and county housing unit estimates, county business patterns, non-employer statistics, economic census, survey of business owners, building permits, consolidated federal funds report; last revised: Thursday, 16-Aug-2012 10:37:29 EDT http://quickfacts.census.gov/qfd/states/41/41045.html

Wikipedia. 2012. Malheur County history, demographics, economy, communities, Census data. http://en.wikipedia.org/wiki/Malheur_County,_Oregon

### 3.17.9 Contacts

Randy Jones
Oregon Department of Environmental Quality
541-962-3983
Jones.Randy@deq.state.or.us

Jim Jensen
Malheur County Economic Development Department
522 SW Fourth Street
Ontario, Oregon 97914
541-889-6216
malheurcountyedc@gmail.com

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

## 3.18 Recreation

RECREATION ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.18.1 Purposes and Objectives

The purpose of the recreation baseline study is to describe existing recreation opportunities, amenities, and recreation usage in the Grassy Mountain Project area. The primary recreation use area is located on Bureau of Land Management (BLM)-administered land.

### 3.18.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |
| Anticipated Project Disturbance (excluding access road): | 400 acres |

The recreation project study area is shown in **Figure 29, Recreation Study Area and Permit Area**.

### 3.18.3 Regulatory Framework

Federal agencies, including the BLM, U.S. Forest Service (USFS), U.S. Fish & Wildlife Service (USFWS), administer over 51 percent of the lands in Oregon and 70 percent of the lands in southeast Oregon (Harney, Malheur, and Lake counties), making them the largest managers of outdoor recreation and land facilities in the state. Therefore, these agencies play a major role in providing dispersed recreation opportunities as well

as resource protection of some of the state's most unique and important scenic, natural, and cultural resources.

Hunting, sightseeing, driving for pleasure, and fishing are among the most popular types of dispersed recreation, according to the Southeast Oregon recreation plan for Harney, Lake, and Malheur counties. Horseback riding, camping, hunting, hiking, wildlife viewing, and off-highway vehicle (OHV) use are also popular activities. Specific activities such as hunting, hiking, and camping, as well as sites visited are discussed in the plan.

Two recreation management objectives relevant to the project area are outlined in the *Three Rivers Resource Management Plan and Record of Decision* (RMP/ROD):

- Provide opportunities for unstructured outdoor recreation activities with the necessary facilities and services; and
- Establish and maintain intensive use areas where the presence of high quality natural resources and the current or potential demand warrants intensive use practices to protect the areas for their scientific, educational, or recreational values.

### 3.18.4 Study Methodology

Data regarding existing and potential recreational uses within the project area will be extracted from the Three Rivers RMP/ROD and the southeast Oregon recreation plan, and in consultation with federal, state and county agencies.

#### 3.18.4.1 Literature Review

- 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
- BLM *Three Rivers Resource Management Plan (RMP) and Record of Decision (ROD)*.
- Dean Runyon Associates. May 2009. Fishing, Hunting, Wildlife Viewing, and Shellfishing in Oregon 2008 State and County Expenditure Estimates. http://www.dfw.state.or.us/agency/docs/Report_5_6_09--Final%20(2).pdf
- HDR Engineering, Inc. (HDR). 2015. *Recreation Baseline Study Grassy Mountain Exploration Project*.
- Statewide Comprehensive Outdoor Recreation Planning Group (no date). *SE Oregon Recreation Plan for Harney, Lake and Malheur Counties*.
- Dean Runyon Associates. May 2009. Fishing, Hunting, Wildlife Viewing, and Shellfishing in Oregon 2008 State and County Expenditure Estimates. http://www.dfw.state.or.us/agency/docs/Report_5_6_09--Final%20(2).pdf

#### 3.18.4.2 Field Studies

No specific field studies are planned.

### 3.18.5 Timing and Duration of Baseline Data Collection and Verification

The recreation baseline study will be completed no later than 2018 using available information.

### 3.18.6 Further Anticipated Studies

No additional studies are anticipated. If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies.

### 3.18.7 Baseline Characterization

A recreational resources environmental baseline report will be prepared. The following outline addresses the major contents.

- Introduction
- Current outdoor recreation base
- Regulatory environment (agency roles)
- Study area
- Data sources
- Methodology
- Existing recreation environment (physical setting)
  - Recreation opportunities
  - Recreation amenities
  - Recreation access
  - Recreation usage
- Recreation values and goals
- Potential conflicts with mining activities

### 3.18.8 Bibliography

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

Bureau of Land Management (BLM). *Three Rivers Resource Management Plan (RMP) and Record of Decision (ROD)*.

Dean Runyon Associates. May 2009. Fishing, Hunting, Wildlife Viewing, and Shellfishing in Oregon 2008 State and County Expenditure Estimates. http://www.dfw.state.or.us/agency/docs/Report_5_6_09--Final%20(2).pdf

HDR Engineering, Inc. (HDR). 2015. *Recreation Baseline Study Grassy Mountain Exploration Project*.

Statewide Comprehensive Outdoor Recreation Planning Group. (No date). *SE Oregon Recreation Plan for Harney, Lake and Malheur Counties*.

### 3.18.9 Contacts

Andrea Bowen
Vale District Office
Bureau of Land Management
100 Oregon Street
Vale, Oregon 97918
541-473-6369
abowen@blm.gov

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

## 3.19 Mined Land Reclamation

MINED LAND RECLAMATION ENVIRONMENTAL BASELINE WORK PLAN
CALICO RESOURCES USA CORP.
GRASSY MOUNTAIN PROJECT
SEPTEMBER 2017

### 3.19.1 Purposes and Objectives

The purpose of the baseline study is to characterize existing baseline conditions, including present land use, topography, climate, soils, vegetation, noxious weeds, and hydrology to use in future preparation of a reclamation plan for the Grassy Mountain Project. The reclamation plan will be developed to cover concurrent, temporary, and final reclamation/closure scenarios. It will serve as a major element of the Division 37 permit application as it relates to Oregon Administrative Rule (OAR) 632-037-0130, Reclamation and Mine Closure Standards. Ultimately, the reclamation plan must also meet Bureau of Land Management (BLM) requirements under 43 Code of Federal Regulations (CFR), Part 3800.

### 3.19.2 Project Study Area

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

The Mine and Process Area parcel is located on three patented lode mining claims and 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 419 unpatented lode mining claims and nine mill site claims on lands administered by the BLM (**Figure 2**). All proposed mining would occur on the patented claims. The Mine and Process Area is located in all or portions of Sections 5-8, Township 22 South, Range 44 East (Willamette Meridian).

The Access Road Area parcel is located on public land managed by the BLM, and private land controlled by others (**Figure 2**). A majority of the access road is a Malheur County Road named Twin Springs Road. The access road extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area parcel is located in portions of: Section 5, Township 22 South, Range 44 East; Sections 3, 10, 11, 14, 21- 23, 28, 29, and 32, Township 21 South, Range 44 East; Sections 1, 12-14, 23, 26, 27, and 34, Township 20 South, Range 44 East; and Sections 23, 26, 35, and 36, Township 19 South, Range 44 East (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline). This width is used to accommodate possible minor widening or re-routing, and a potential power line 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 shown on **Figure 2**.

The approximate acreages of the two parcels described above are as follows:

| | |
|---|---|
| Mine and Process Area: | 886 acres |
| Access Road Area: | 876 acres |
| **Total Permit Area**: | **1,762 acres** |

Anticipated Project Disturbance (excluding access road):

The mined land reclamation project study area is shown in **Figure 30, Mined Land Reclamation Study Area**.

### 3.19.3 Regulatory Framework

#### 3.19.3.1 Department of Geology and Mineral Industries, Division 30 Oregon Mined Land Reclamation Act Applicable to All Surface Mining Except As Specifically Provided

OAR Chapter 632, Division 035 (Coal and Metal-Bearing Ore Operations), and OAR Chapter 632, Division 037 (Chemical Process Mining) describe reclamation plan requirements (http://arcweb.sos.state.or.us/pages/rules/oars_600/oar_632/632_030.html).

Under these regulations, the Oregon Department of Geology and Mineral Industries (DOGAMI) requires that a chemical process mine comply with reclamation and closure standards. The operator must use best available and practicable technology and best management practices (BMPs). The reclamation plan must consider environmental protection and restoration, human health and safety, wildlife and fish, and livestock.

#### 3.19.3.2 Oregon Department of Geology and Mineral Industries Mined Land Reclamation Program

229 Broadalbin Street SW
Albany, OR 97321-2246
541-967-2039
Fax 541-967-2075

#### 3.19.3.3 Bureau of Land Management, 43 CFR Part 3800

Under 43 CFR Part 3800 (Mining Claims under the General Mining Laws), BLM has defined its final rule regarding surface management to include performance standards that govern the operation and reclamation of surface mining projects. A plan of operations (POO) must be filed with the BLM field office with jurisdiction over the land involved in the mining activities. The plan must include the following:

1) description of the operations
2) reclamation plan
3) monitoring plan
4) interim management plan
5) estimate of reclamation costs

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 "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.

Mining and processing activities associated with the Grassy Mountain Project will be conducted solely on patented land. However, the access corridor between the mine and mill will be across BLM-administered land. Therefore, a reclamation plan to address reclamation/rehabilitation of mined land and related facilities will be required by both DOGAMI and BLM.

In order to comply with applicable DOGAMI Division 30 and 37 permit application requirements, Calico will prepare a POO and reclamation plan that will meet the specifications of these regulations, as well as those which address state fish and wildlife standards (OAR 632-037-0125), and BLM 3809 regulations. The plan will address the operating plan requirements described in OAR 632-037-0060, as well as the reclamation and closure plan requirements in OAR 632-037-0070. An initial reclamation cost estimate will be prepared, which defines anticipated financial security needs for the project.

### 3.19.4 Study Methodology

#### 3.19.4.1 Literature Review

- Atlas Precious Metals, Inc. (Atlas). 1991. *Grassy Mountain Project Reclamation Permit Application, Plan of Operations Amendment and Environmental Information.*
- Atlas Precious Metals, Inc. (Atlas). 1991. *Reclamation Permit Application, Plan of Operations Amendment and Environmental Information.*
- Bureau of Land Management (BLM). 2006. *BLM Reclamation Regulating (3809.420).*
- Oregon Administrative Rule Chapter 632, Division 035.
- Oregon Administrative Rule Chapter 632, Division 037.
- U.S Forest Service (USFS). 1979. *Mining and Reclamation in the West. User Guide to Vegetation.*
- U.S. Forest Service (USFS). 2004. *Training Guide to Reclamation Bond Estimation and Administration (36 CFR 228A).*
- Related Grassy Mountain environmental baseline documents (soils and geology, wildlife resources, geotechnical, vegetation resources, and water resources).

#### 3.19.4.2 Field Studies

Field studies will include collecting soils samples to be analyzed for fertility and nutrient requirements; and review of present land use, vegetation, soils and geology, topography, wildlife habitat, and surface water hydrology baseline studies.

### 3.19.5 Timing and Duration of Baseline Data Collection and Verification

The baseline characterization study will be completed no later than 2018.

### 3.19.6 Further Anticipated Studies

No additional studies are anticipated. If additional information is determined to be necessary, it will be collected using approved methodologies, gathered from documented sources, and coordinated with appropriate agencies.

### 3.19.7 Baseline Characterization

- Description of present land use (narrative)
  - Photo documentation
- Description of topography (narrative)
  - Photo documentation
- Summary of existing hydrology
- Characterization of soil types
  - Available topsoil for salvaging and stockpiling
  - Results of chemical analysis of soils
  - Photo documentation
- Climate

#### 3.19.7.1 Conceptual Reclamation Plan

- Reclamation goals and objectives
- Future land use objectives
- Overview description of reclamation activities
  - Regrading (blending contours with existing topography)
  - Slope stabilization

  - Erosion control
  - Water management
  - Topsoiling
  - Seed bed preparation
  - Seeding
    - Seed mixture (weed free, pure live seed)
  - Live plantings
    - List of species
    - Planting densities
  - Fertilizing
    - Fertilizer composition based on soil fertility testing
  - Mulching
  - Irrigation
  - Weed and pest management
  - Maintenance
  - Monitoring
    - Criteria for reclamation success
    - Monitoring reports
  - Adaptive management
- Reclamation cost estimate summary by mining component
  - Mine adit and underground workings
  - Processing facilities
  - Waste rock storage facility
  - Tailings storage facility
  - Access road, haul road, and service roads
  - Ancillary facilities
- Reclamation schedule
  - Concurrent reclamation
  - Final reclamation
- Reclamation monitoring
  - Stability
  - Revegetation
  - Water management

### 3.19.8 Bibliography

Atlas Precious Metals, Inc. (Atlas). 1991. *Grassy Mountain Project Reclamation Permit Application, Plan of Operations Amendment and Environmental Information.*

Atlas Precious Metals, Inc. (Atlas). 1991. *Reclamation Permit Application, Plan of Operations Amendment and Environmental Information.*

Bureau of Land Management (BLM). 2006. *BLM Reclamation Regulating (3809.420).*

Oregon Administrative Rule Chapter 632, Division 035.

Oregon Administrative Rule Chapter 632, Division 037.

U.S Forest Service (USFS). 1979. *Mining and Reclamation in the West. User Guide to Vegetation.*

U.S. Forest Service (USFS). 2004. *Training Guide to Reclamation Bond Estimation and Administration (36 CFR 228A).*

### 3.19.9 Contacts

Robert Houston
Natural Resources Specialist
Oregon Department of Geology and Mineral Industries (DOGAMI)
514-225-6451
Robert.HOUSTON@oregon.gov

Andrea Bowen
Vale District Office
Bureau of Land Management
100 Oregon Street
Vale, Oregon 97918
541-473-6369
abowen@blm.gov

Richard DeLong
EM Strategies, Inc.
1650 Meadow Wood Lane
Reno, Nevada 89502
775-826-8822
rich@emstrats.com

## 3.20 Wild, Scenic or Recreational Rivers

### 3.20.1 Purposes and Objectives

The requirements for the existing environment section of the consolidated application (Oregon Administrative Rule [OAR] 632-037-0055) specify that baseline data shall include an inventory of state scenic waterways listed under Oregon Revised Statutes (ORS) 390.925, and any federal wild, scenic or recreational rivers designated under 28 United States Code (U.S.C.) 1271-1287. The Owyhee River, Idaho border to Three Forks (25 miles), is the only listed scenic river in the region (see **Figure 31, Wild and Scenic and Recreational Rivers in the Vicinity of Malheur County**). There are no perennial streams within the project area. The Owyhee Reservoir is the largest surface water in the region. It is located about 5 miles southeast of Grassy Mountain at its closest point.

The program establishing these waterways, the Oregon Scenic Waterways Program, was initiated in 1970. It strives "to achieve a balance between protecting the rivers' natural resources, and equally valuable lives and plans of the people who live along them." The program is overseen by the Oregon Parks and Recreation Department OAR 736-0055 applies to the Owyhee Scenic Waterway.

Activities such as logging, mining, road or utilities construction, building or other structures must notify the department if the activities are within one-quarter mile of the river bank. The proposed Grassy Mountain Mine Project is not located within this constraint. The Owyhee River is not visible from either the proposed mine site, or the mill location. Therefore, OAR 736-040-0055 does not apply. There are no designated federal wild, scenic or recreational rivers in the study area. Therefore, this work plan will not address those resources designated under 28 U.S.C. 1271-1287.

## 3.21 Areas of Critical Environmental Concern/Research Natural Areas

### 3.21.1 Areas of Critical Environmental Concern

Areas of critical environmental concern (ACEC) are parcels of public land that require special management attention to protect special features or values. These areas are designated under the Federal Land Policy and Management Act (43 United States Code [U.S.C.] 1700 et. seq.) as ACECs.

The Bureau of Land Management (BLM) *Southeastern Oregon Resource Management Plan and Record of Decision* (2002) lists 28 ACECs in the Malheur and Jordan resource areas, encompassing over 207,000 acres, as shown below in **Table 25** and **Figure 32, Areas of Critical Environmental Concern in the Jordan and Malheur Resources Areas**.

The objective of this work plan is to retain existing and designate new ACECs and research natural areas (RNAs) where relevant and important criteria are met, and special management is required to protect the identified values. No ACECs or RNAs located within the proposed Grassy Mountain Project study area would be affected by the mine proposal. Therefore, this work plan does not address this component.

**Table 25. Existing Areas of Critical Environmental Concern**

| ACEC | Primary Resource Value/Description | |
|---|---|---|
| **Malheur Resources Area** | | |
| Black Canyon ACEC/RNA<br>2,644 acres | Vegetation cells - stiff sagebrush/Sandberg bluegrass, western juniper/big sagebrush/ bluebunch wheatgrass, riparian community dominated by coyote willow with Pacific willow, and first to third order stream system in sagebrush zone | |
| Castle Rock ACEC<br>23,799 acres | Scenic, cultural, historic, and wildlife habitat | |
| Coal Mine Basin ACEC/RNA<br>755 acres | Two special status plant species, ash communities, and paleontological resources. | |
| Dry Creek Gorge ACEC<br>16,082 acres | Scenery, special status fish (redband trout) and amphibian species (Columbia spotted frog) and associated habitat, and rare geologic features | |
| Hammond Hill Sand Hills ACEC/RNA<br>3,712 acres | Big sagebrush-antelope bitterbrush/Indian ricegrass and big sagebrush-greasewood/Indian ricegrass | |
| Honeycombs ACEC/RNA<br>15,847 acres | Vegetation community types, including big sagebrush/needle and thread grass on cinders; special status plants; special status bighorn sheep and habitat; scenic geology | |
| Lake Ridge ACEC/RNA<br>3,825 acres | Low sagebrush/ bluebunch wheatgrass community and low sagebrush/Idaho fescue community vegetation cells;<br>Sage grouse and several leks | |
| Leslie Gulch ACEC<br>11,673 acres | Scenic geology; special status plants; special status bighorn sheep and habitat | |
| Mahogany Ridge ACEC/RNA<br>682 acres | Neotropical migratory bird habitat; vegetation community type of mountain mahogany-big sagebrush; special status plant | |
| North Fork Malheur River ACEC<br>1,810 acres | Scenery, two special status fish and their habitat, and a special status amphibian and habitat | |
| North Ridge Bully Creek ACEC/RNA<br>1,569 acres | Big sagebrush/ Thurber needlegrass community and big sagebrush-threetip sagebrush/Idaho fescue community; sage grouse and their associated habitat | |
| Oregon National Historic Trail ACEC – Kenney Pass Segment<br>3,154 acres | Historic; scenic; and a special status plant species, Cronquist's stickseed. | |
| Oregon National Historic Trail ACEC – Tub Mountain Segment | Historic, cultural, and scenic | |

**Table 25. Existing Areas of Critical Environmental Concern**

| ACEC | Primary Resource Value/Description | |
|---|---|---|
| 5,902 acres | | |
| Oregon National Historic Trail ACEC – Birch Creek Segment<br>119 acres | Historic and scenic | |
| Owyhee River Below the Dam ACEC<br>11,239 acres | High scenic values of diverse landscape elements in a substantially natural setting, a special status plant species (Mulford's milkvetch), the rare presence of a black cottonwood gallery in a riverine system, and the combined wildlife values of diverse habitat types supporting a large number of wildlife species and an important migratory corridor for neotropical birds | |
| Owyhee Views ACEC<br>52,506 acres | High scenic properties associated with the area's virtually unaltered landscape, special status bighorn sheep and habitat, and special status plant species (sterile milkvetch, Ertter's senecio, and Owyhee clover). Another special status plant species (Cusick's chaenactis) is suspected to grow in the area. | |
| South Alkali Sand Hills ACEC<br>3,520 acres | Special status plant species and their habitat. | |
| South Bull Canyon ACEC/RNA<br>792 acres | Big sagebrush-antelope bitterbrush/Idaho fescue | |
| South Ridge Bully Creek ACEC/RNA<br>620 acres | Big sagebrush/Thurber needlegrass community and big sagebrush-squaw apple/Idaho fescue community vegetation cell; sage grouse, loggerhead shrikes, and their associated habitat | |
| Spring Mountain ACEC/RNA<br>1,002 acres | Mountain big sagebrush/Idaho fescue, low sagebrush/bluebunch wheatgrass, and riparian community dominated by peachleaf willow and coyote willow with quaking aspen/whortleleaf snowberry; quaking aspen patches associated with springs and north-facing talus slopes | |
| Stockade Mountain ACEC/RNA<br>1,767 acres | Vegetation community type of western juniper/big sagebrush plus potential low sagebrush/Sandberg bluegrass type; wildlife habitat | |
| **Jordan Resources Area** | | |
| Dry Creek Bench ACEC/RNA<br>1,616 acres | Mountain mahogany/whortleleaf snowberry/Idaho fescue and mountain mahogany/big sagebrush/Idaho fescue Basin and Range Province | |

**Table 25. Existing Areas of Critical Environmental Concern**

| ACEC | Primary Resource Value/Description | |
|---|---|---|
| Jordan Craters ACEC/RNA 31,370 acres | Historic, cultural, and scenic values; special status plants; vegetation community type of big sagebrush/bluebunch wheatgrass; outstanding geologic features of recent lava flows; relict vegetation sites; wildlife habitat including high-quality riparian areas; natural hazards from collapsed lava pits and contraction cracks | |
| Little Whitehorse Creek Exclosure 58 acres | Vegetation cells; first to third order stream, high gradient reach, in sagebrush zone, with mountain alder and red osier dogwood; riparian community dominated by mountain alder and red osier dogwood, with potential black cottonwood and riparian community dominated by Pacific willow and Wood's rose; presence of Lahontan cutthroat trout, a Federally-listed threatened species | |
| Mendi Gore Playa ACEC/RNA 148 acres | Winterfat community and a small area representing a black sagebrush community | |
| Palomino Playa ACEC/RNA 642 acres | Shadscale saltbush/bunchgrass, black greasewood/bunchgrass community mosaic and bare playa; special status plant species, Davis' peppergrass | |
| Saddle Butte ACEC 7,056 acres | Special status western big-eared bats and habitat, high quality lava tube caves; hazardous conditions due to cave instability | |
| Toppin Creek Butte ACEC/RNA 3,996 acres | Low sagebrush/bluebunch wheatgrass community in excellent condition and low sagebrush/Idaho fescue plant community vegetation cells identified by the Oregon Natural Heritage Program (ORNHP). These plant communities will be specially managed for current and future research. Also identified as relevant and important values are sage grouse and associated habitat for neotropical bird migration | |

## 3.22 Outstanding Natural Areas

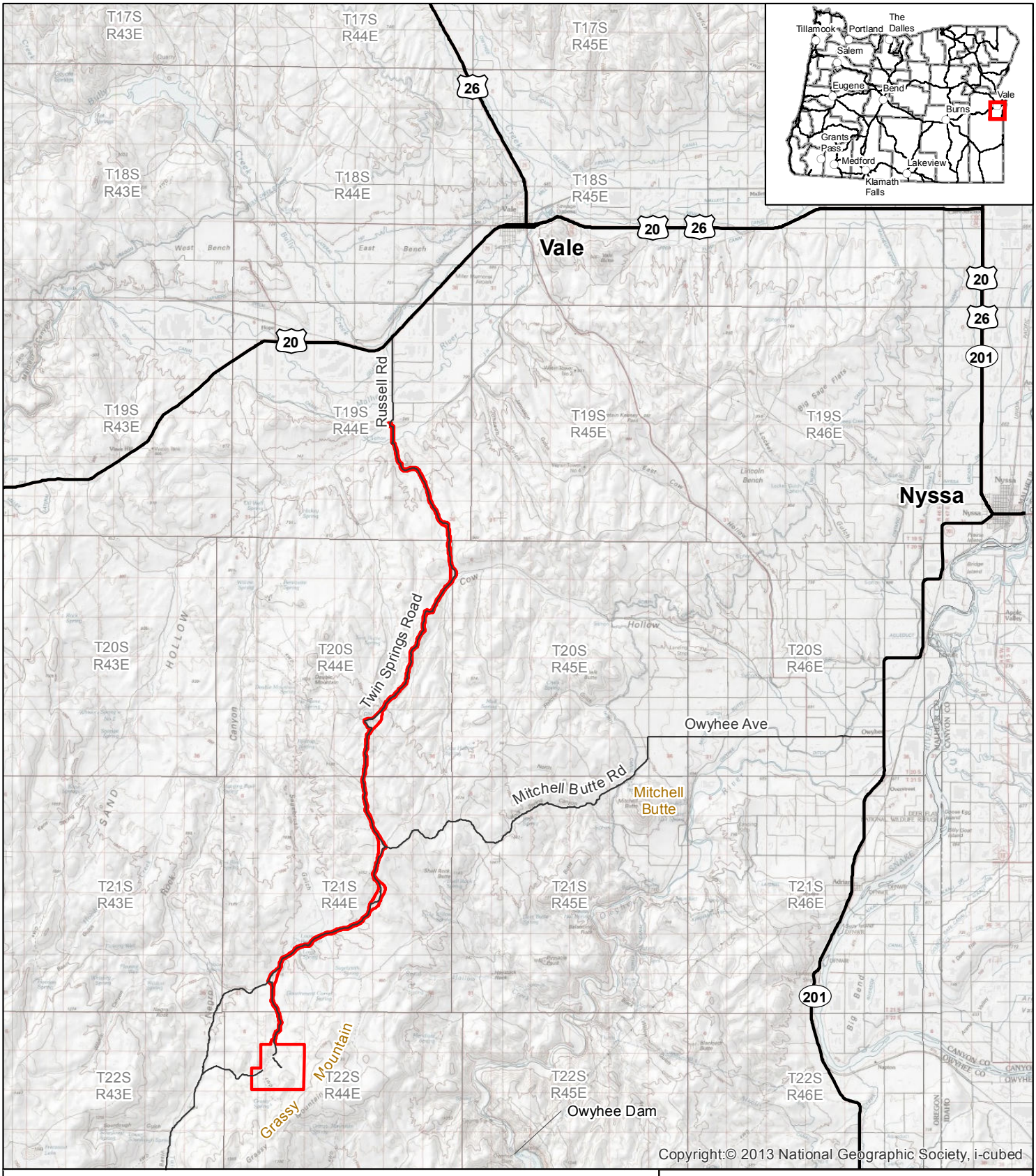
BLM has the authority to designate outstanding natural areas (ONAs) in order to protect unique scenic, scientific, educational, and recreational values. The agency has made three such designations nationally. None occur in the project study area. This work plan does not address ONAs as none exist in the study area.

## 3.23 Oregon Natural Heritage Plan Areas

Section 4 of the Endangered Species Act (ESA) directs the U.S. Fish and Wildlife Service (USFWS) to designate "critical habitat" for listed species "to the maximum extent prudent and determinable." These designations are made for the conservation of species that may require special management considerations or protection.

At this time, there are no critical habitat designations in the project study area. The regulations allow designation of unoccupied habitat only when a designation limited to a threatened and endangered species' present range would be inadequate to ensure the conservation of that species. No such ESA designations have been made in the project study area.

# Appendix A
## Figures




**Explanation**

Permit Area

Existing Road

Projection: UTM Zone 11 North, NAD83, meters

0 5,000 10,000 Feet

0 1 2 Miles

N

# CALICO RESOURCES USA CORP.

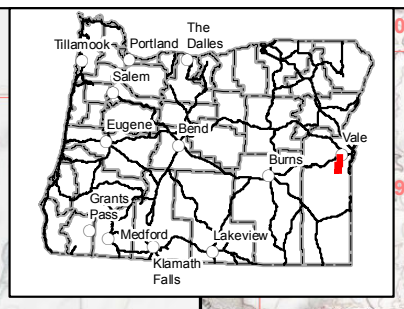
## GRASSY MOUNTAIN PROJECT

### Location Map

Figure 1

| | |
|---|---|
| Date: 09/18/2017 | Drawn By: JDB |
| Revised: | Project No.: 3672 |
| Base Map: USGS 100K quads: Boise, Brogan, Vale, Weiser | |
| File Name: 3672G_GrassyMtn_1709_Fig01_Location.mxd | |

EM STRATEGIES




Russell Road

Twin Springs Road

Match Line

T19S R44E

T20S R44E

T20S R45E

T21S R44E

T22S R44E

Copyright:© 2013 National Geographic Society, i-cubed

Copyright:© 2013 National Geographic Society, i-cubed

**Explanation**

- Permit Area
- Mine and Process Area
- Access Road Area
- Patented Lode Claims
- Proposed Access Road
- Possible Road Realignment

Projection: UTM Zone 11 North, NAD83, meters

0 2,000 4,000 6,000 8,000 10,000 Feet

0 1 2 Miles

N

# CALICO RESOURCES USA CORP.

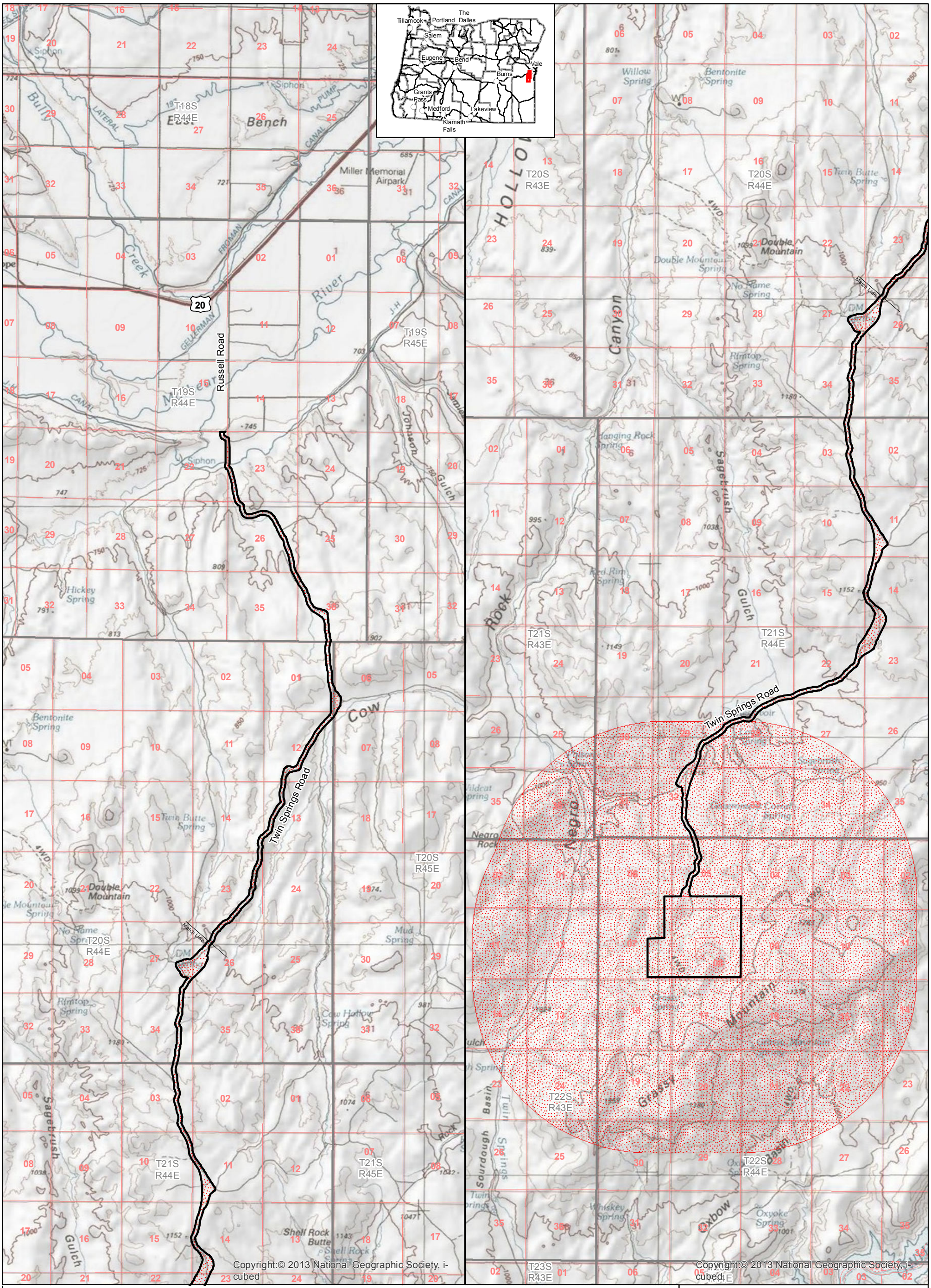
## GRASSY MOUNTAIN PROJECT

### Permit Area Map

Figure 2

| | | | |
|---|---|---|---|
| Date: | 09/18/2017 | Drawn By: | JDB |
| Revised: | | Project No.: | 3672 |
| Base Map: | USGS 7.5' quads: Double Mountain, Grassy Mountain, Kane Spring Gulch, Sourdough Spring, Vale West | | |
| File Name: | 3672G_GrassyMtn_1709_Fig02_PermitArea.mxd | | |

EM STRATEGIES




**Explanation**

Permit Area

Geology Study Area

Projection: UTM Zone 11 North, NAD83, meters

0 2,000 4,000 6,000 8,000 10,000 Feet

0 1 2 Miles

N

# CALICO RESOURCES USA CORP.

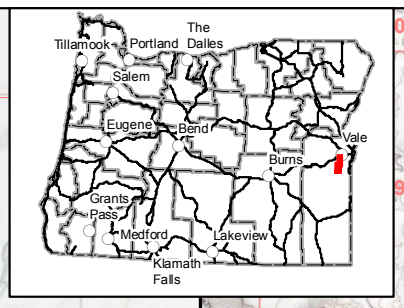
## GRASSY MOUNTAIN PROJECT

### Geology Study Area and Permit Area

Figure 3

| | |
|---|---|
| Date: 09/21/2017 | Drawn By: JDB |
| Revised: | Project No.: 3672 |
| Base Map: USGS 100K quad: Vale | |
| File Name: 3672G_GrassyMtn_1709_Fig03_GeologyPermit.mxd | |

EM STRATEGIES




Russell Road

Twin Springs Road

Match Line

T19S R44E

T20S R44E

T20S R45E

T21S R44E

T22S R44E

Copyright:© 2013 National Geographic Society, i-cubed

Copyright:© 2013 National Geographic Society, i-cubed

**Explanation**

Permit Area

Soils Study Area

Projection: UTM Zone 11 North, NAD83, meters

0 2,000 4,000 6,000 8,000 10,000 Feet

0 1 2 Miles

N

# CALICO RESOURCES USA CORP.

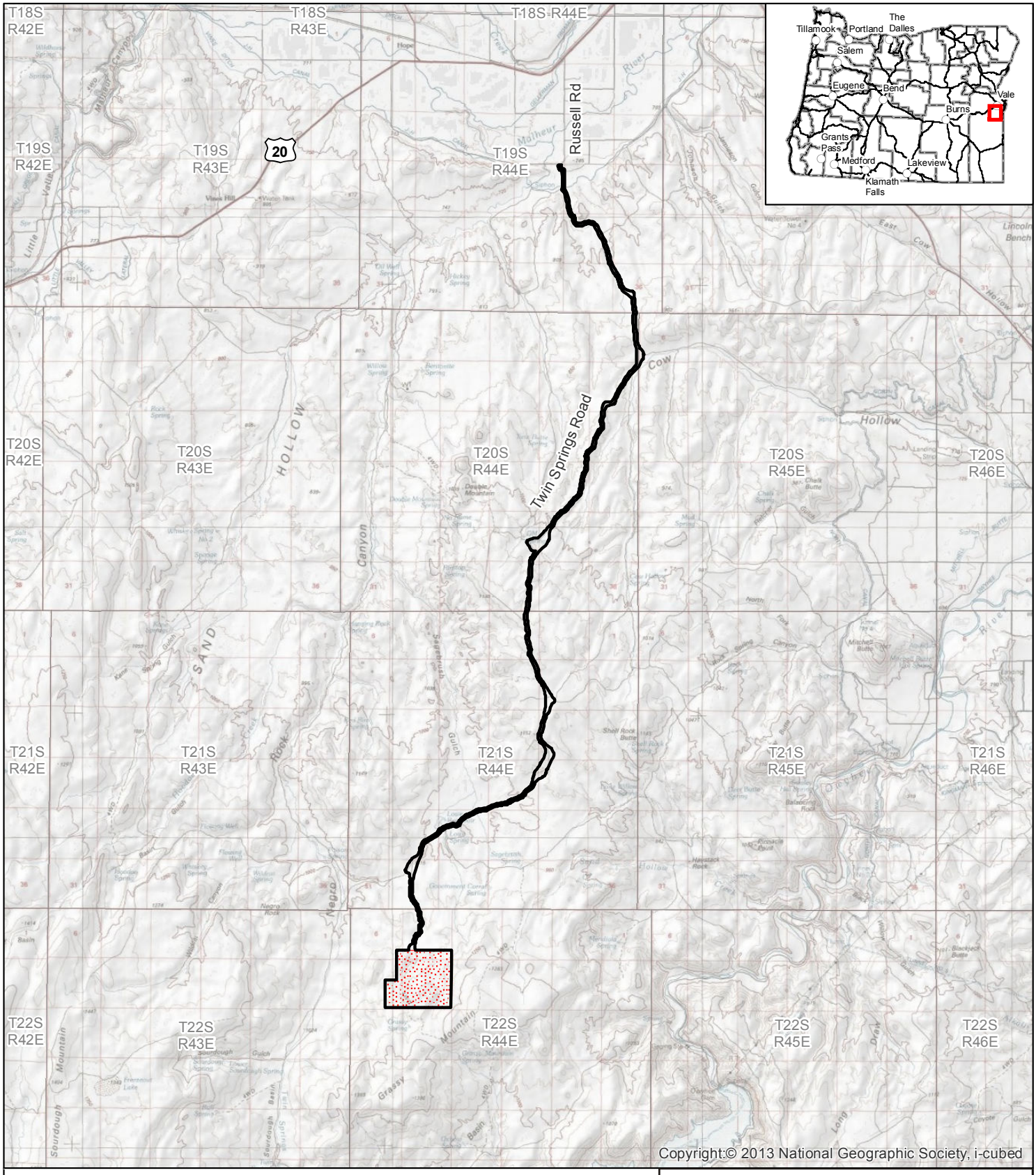
## GRASSY MOUNTAIN PROJECT

## Soils Study Area and Permit Area

Figure 4

| | | | |
|---|---|---|---|
| Date: | 09/21/2017 | Drawn By: | JDB |
| Revised: | | Project No.: | 3672 |
| Base Map: | USGS 7.5' quads: Double Mountain, Grassy Mountain, Kane Spring Gulch, Sourdough Spring, Vale West | | |
| File Name: | 3672G_GrassyMtn_1709_Fig04_Soil.mxd | | |

EM STRATEGIES




**Explanation**

- Permit Area
- Geochemistry Study Area

Projection: UTM Zone 11 North, NAD83, meters

0 5,000 10,000 Feet

0 1 2 Miles

N

# CALICO RESOURCES USA CORP.

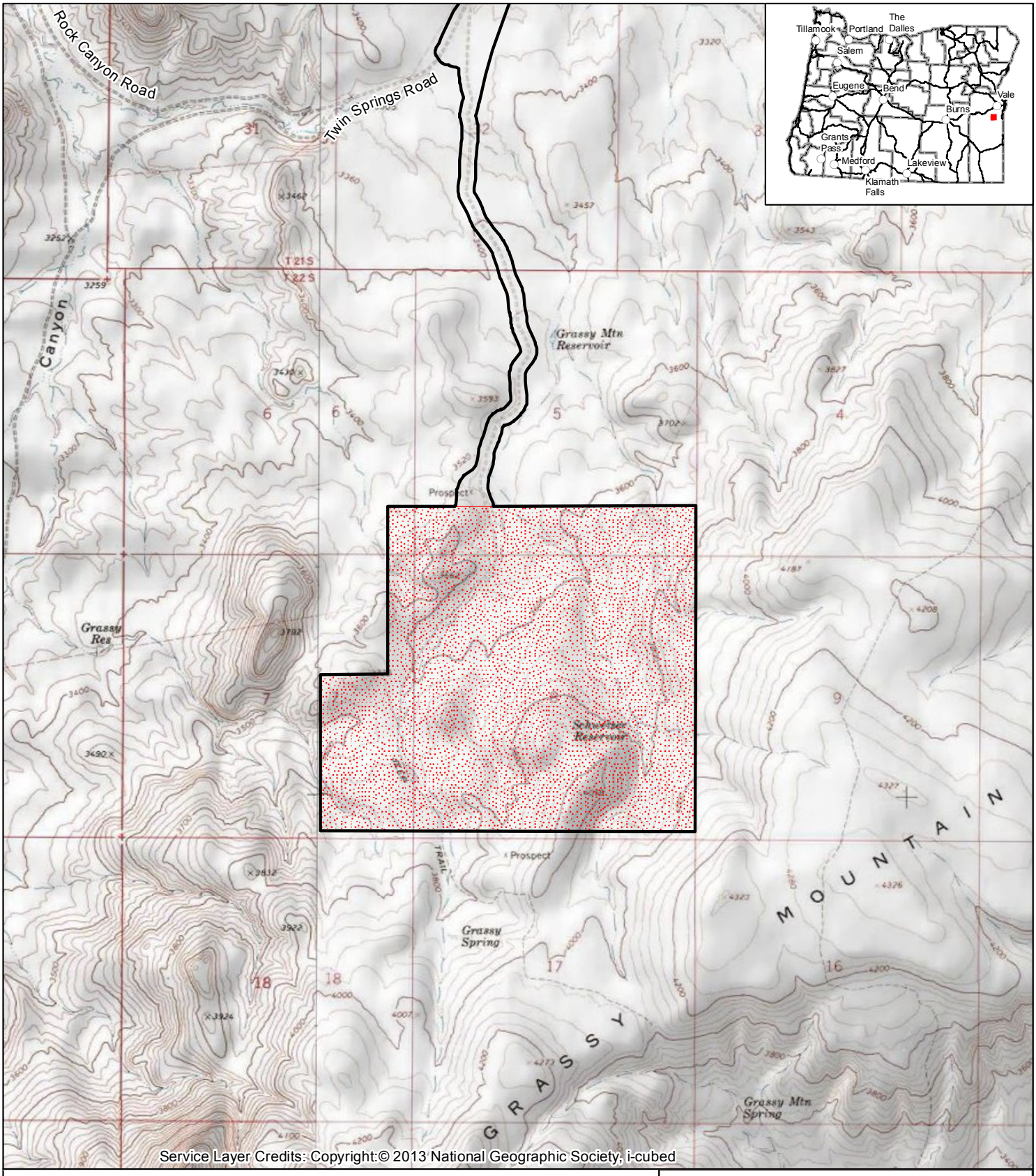
## GRASSY MOUNTAIN PROJECT

### Geochemistry Study Area and Permit Area

Figure 5

| | |
|---|---|
| Date: 09/21/2017 | Drawn By: JDB |
| Revised: | Project No.: 3672 |
| Base Map: USGS 100K quad: Vale | |
| File Name: 3672G_GrassyMtn_1709_Fig05_GeoChemPermit.mxd | |

EM STRATEGIES




**Explanation**

- Permit Area
- Geochemistry Study Area

Projection: UTM Zone 11 North, NAD83, meters

0 1,000 2,000 Feet

0 0.25 0.5 Miles

N

# CALICO RESOURCES USA CORP.

## GRASSY MOUNTAIN PROJECT

### Geochemistry Study Area

Figure 6

| | | | |
|---|---|---|---|
| Date: | 09/21/2017 | Drawn By: | JDB |
| Revised: | | Project No.: | 3672 |
| Base Map: | USGS 7.5' quads: Grassy Mountain, Sourdough Spring | | |
| File Name: | 3672G_GrassyMtn_1709_Fig06_GeoChem.mxd | | |

EM STRATEGIES

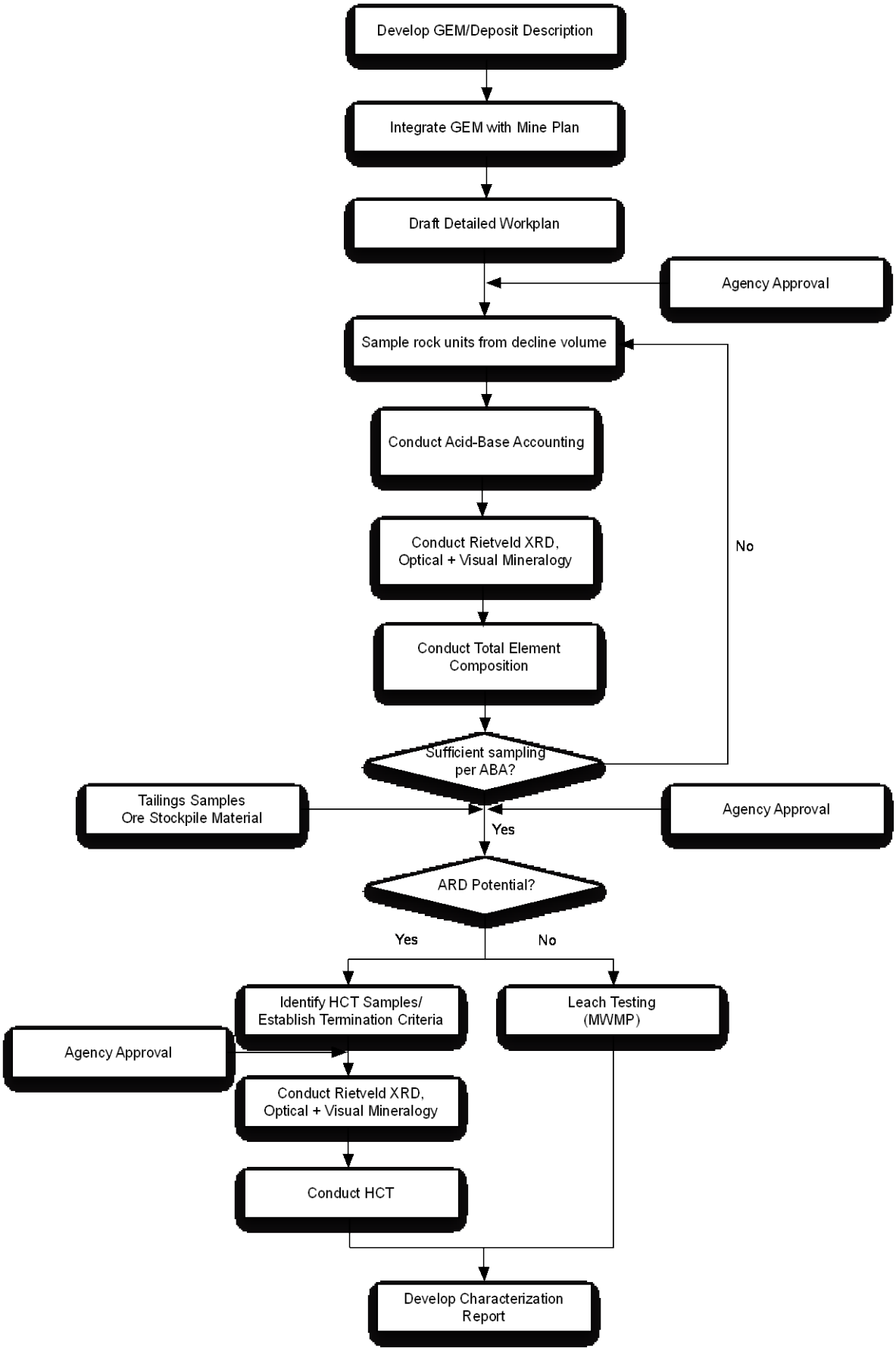
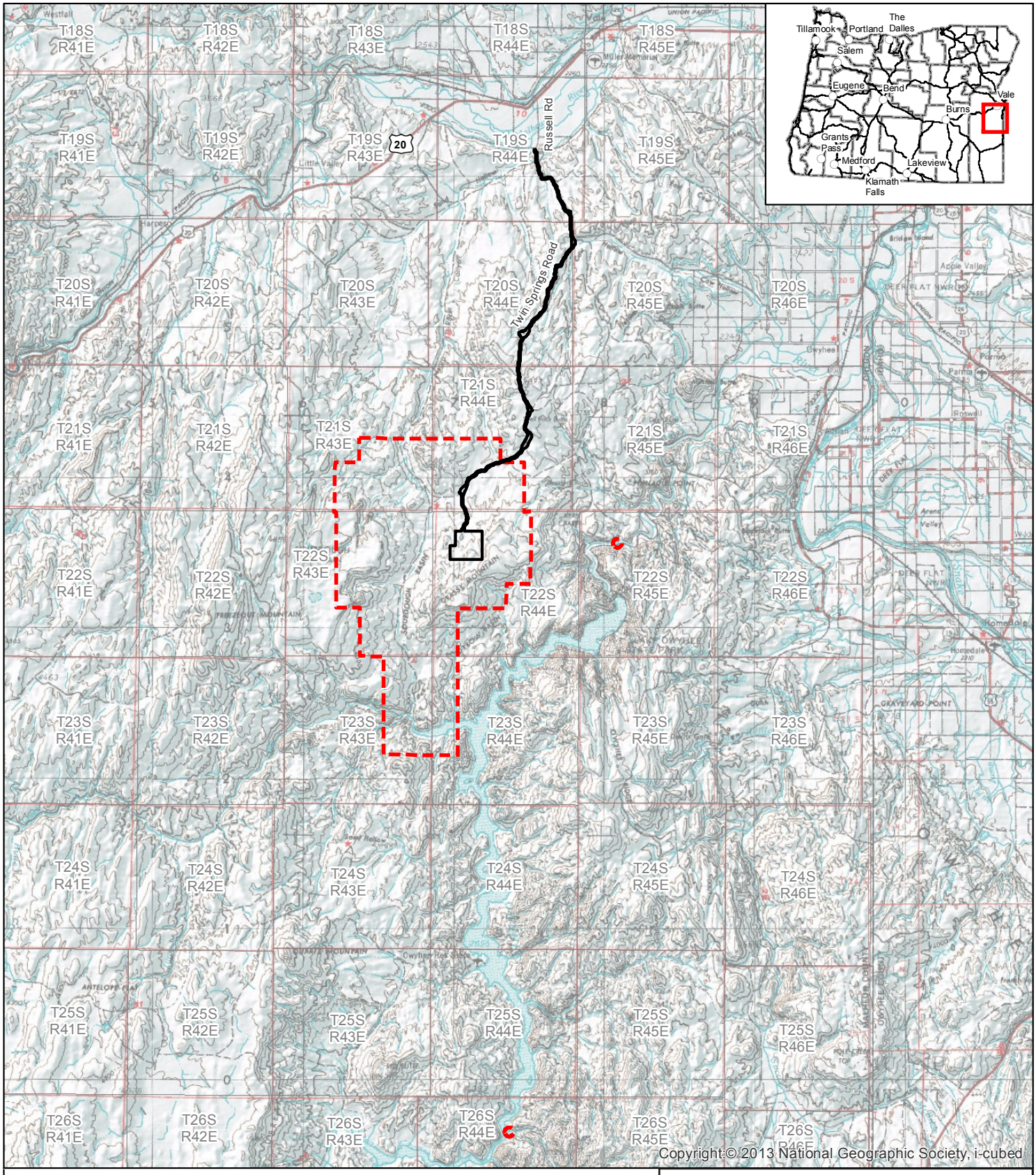



**Figure 7**
**Workflow for Geochemical Characterization Plan**




Copyright:© 2013 National Geographic Society, i-cubed

**Explanation**

- Permit Area
- Water Resources Study Area

Projection: UTM Zone 11 North, NAD83, meters

0 10,000 20,000 Feet

0 2 4 Miles

N

# CALICO RESOURCES USA CORP.

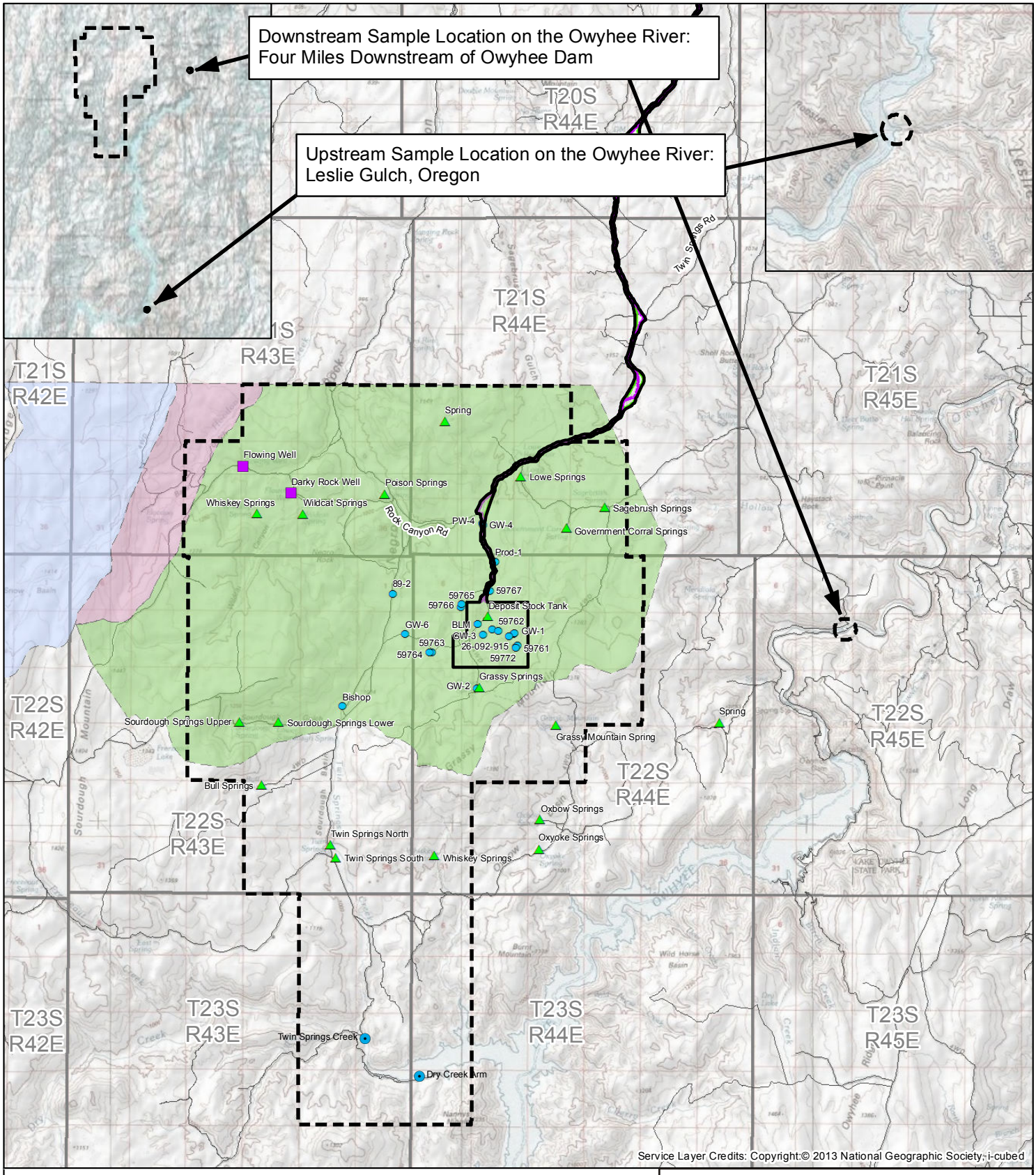
## GRASSY MOUNTAIN PROJECT

### Water Resources Study Area and Permit Area

Figure 8

| | | | |
|---|---|---|---|
| Date: | 09/21/2017 | Drawn By: | JDB |
| Revised: | | Project No.: | 3672 |
| Base Map: | USGS 250K quad: Boise | | |
| File Name: | 3672G_GrassyMtn_1709_Fig08_WaterR_Permit.mxd | | |

EM STRATEGIES




**Explanation**

- Permit Area
- Proposed Access Road
- Proposed Road Realignment
- Existing Road
- Water Resources Study Area
- Grassy Mtn Monitoring Wells
- Grassy Mtn Area Springs
- Flowing Wells
- Surface Water Site
- Sourdough Basin/Rock Canyon
- Snow Basin
- Hoodoo Basin

0 5,000 10,000 Feet

0 1 2 Miles

N

Projection: UTM Zone 11 North, NAD83, meters

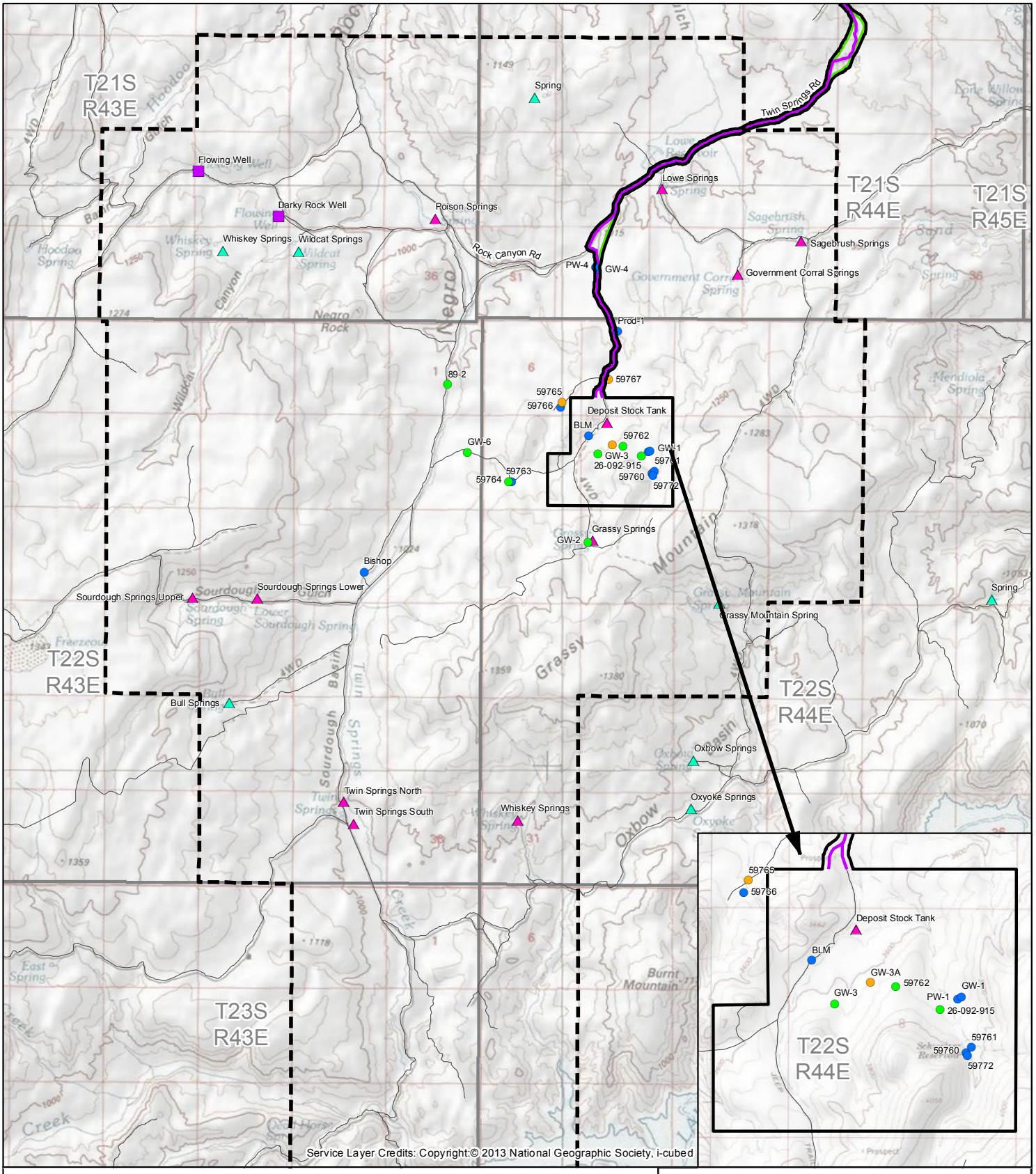
# CALICO RESOURCES USA CORP.

## GRASSY MOUNTAIN PROJECT

## Water Resources Study Area

Figure 9

| | | |
|---|---|---|
| Date: 09/21/2017 | Drawn By: JDB | EM STRATEGIES |
| Revised: | Project No.: 3672 | |
| Base Map: USGS 7.5' quads: Grassy Mountain, Sourdough Spring | | |
| File Name: 3672G_GrassyMtn_1709_Fig09_WaterResources.mxd | | |




**Explanation**

- Permit Area
- Proposed Access Road
- Proposed Road Realignment
- Existing Road
- Water Resources Study Area

**Grassy Mtn Area Springs**

- Quarterly Quantity/Water Quality
- Biannual Quantity

**Grassy Mtn Monitoring Wells**

- Quarterly Water Level/Water Quality
- Quarterly Water Level
- Dry

**Flowing Wells**

- Biannual Quantity

0 4,000 8,000 Feet

0 0.5 1 Miles

N

Projection: UTM Zone 11 North, NAD83, meters

# CALICO RESOURCES USA CORP.

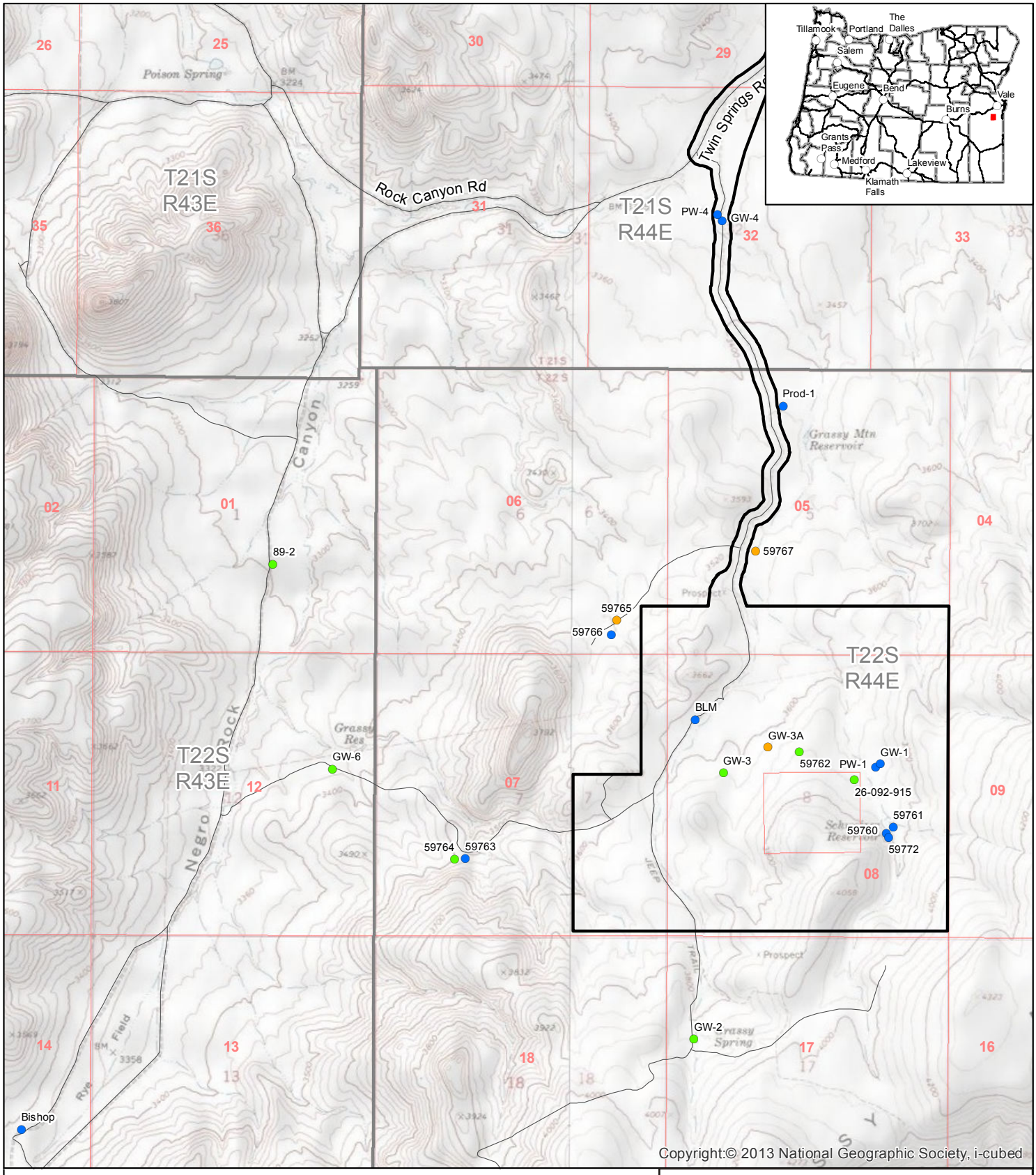
## GRASSY MOUNTAIN PROJECT

## Monitoring Wells and Springs

Figure 10

| | |
|---|---|
| Date: 09/21/2017 | Drawn By: JDB |
| Revised: | Project No.: 3672 |
| Base Map: USGS 7.5' quads: Grassy Mountain, Sourdough Spring | |
| File Name: 3672G_GrassyMtn_1709_Fig10_WellsSprings.mxd | |

EM STRATEGIES




**Explanation**

- Permit Area
- Existing Road

**Grassy Mtn Monitoring Wells**

- Quarterly Water Level/Water Quality
- Quarterly Water Level
- Dry

Projection: UTM Zone 11 North, NAD83, meters

0 1,000 2,000 Feet

0 0.25 0.5 Miles

N

# CALICO RESOURCES USA CORP.

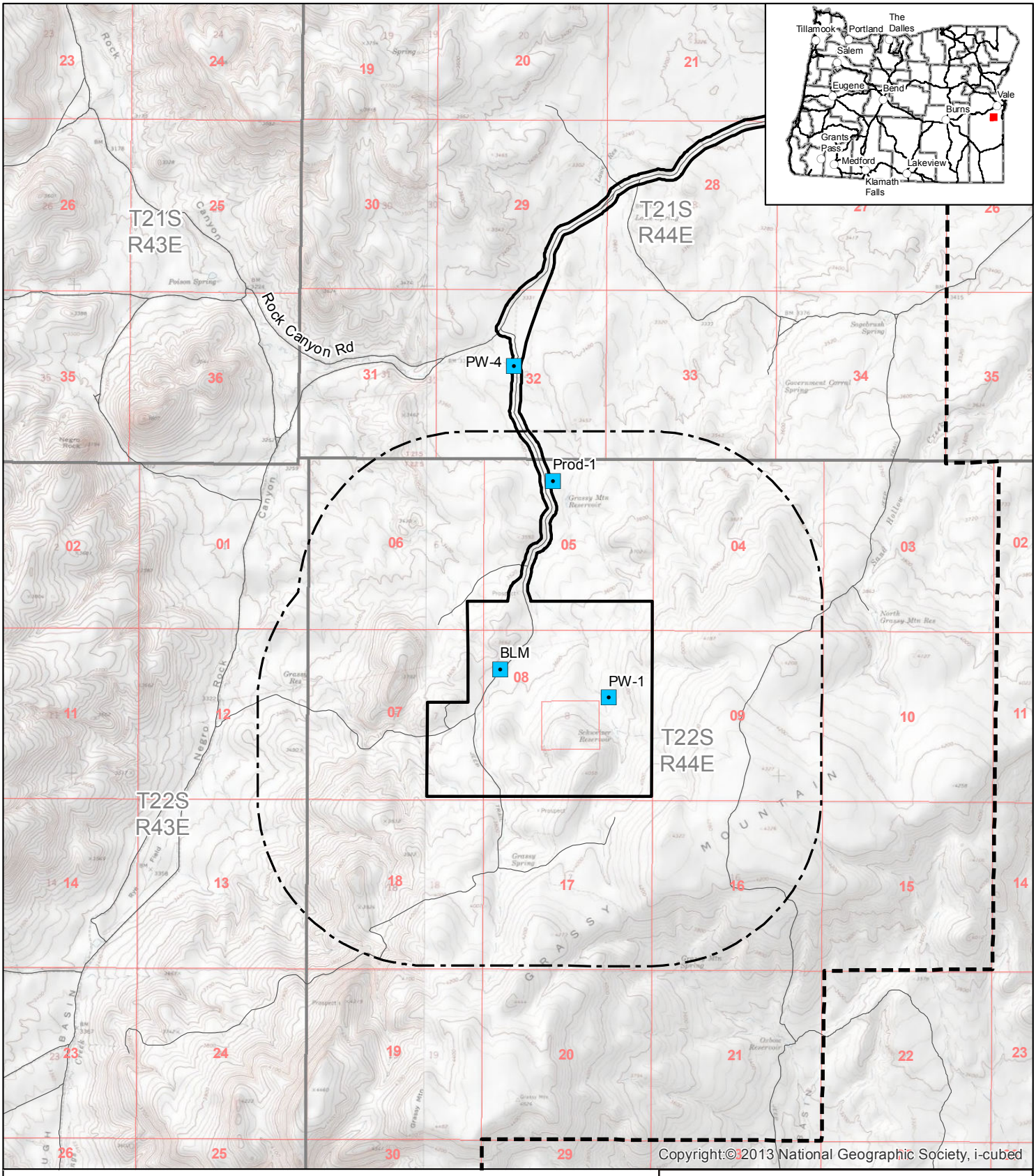
## GRASSY MOUNTAIN PROJECT

## Monitoring Wells

Figure 11

| | |
|---|---|
| Date: 09/21/2017 | Drawn By: JDB |
| Revised: | Project No.: 3672 |
| Base Map: USGS 7.5' quads: Grassy Mountain, Sourdough Spring | |
| File Name: 3672G_GrassyMtn_1709_Fig11_MonitoringWells.mxd | |

EM STRATEGIES




**Explanation**

- Permit Area
- 1-mile Mine and Process Area Boundary
- Existing Road
- Water Resources Study Area
- Grassy Mtn Supply Wells (MW)

Projection: UTM Zone 11 North, NAD83, meters

0 2,000 4,000 Feet

0 0.25 0.5 Miles

N

# CALICO RESOURCES USA CORP.

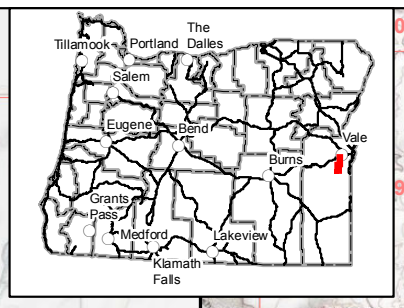
## GRASSY MOUNTAIN PROJECT

## Water Supply Wells

Figure 12

| | |
|---|---|
| Date: 09/21/2017 | Drawn By: JDB |
| Revised: | Project No.: 3672 |
| Base Map: USGS 7.5' quads: Grassy Mountain, Sourdough Spring | |
| File Name: 3672G_GrassyMtn_1709_Fig12_WaterSupply.mxd | |

EM STRATEGIES




Russell Road

Twin Springs Road

Match Line

T19S R44E

T20S R44E

T20S R45E

T21S R44E

T22S R44E

Copyright:© 2013 National Geographic Society, i-cubed

Copyright:© 2013 National Geographic Society, i-cubed

**Explanation**

Permit Area

Terrestrial Vegetation Study Area

Projection: UTM Zone 11 North, NAD83, meters

0 2,000 4,000 6,000 8,000 10,000 Feet

0 1 2 Miles

N

# CALICO RESOURCES USA CORP.

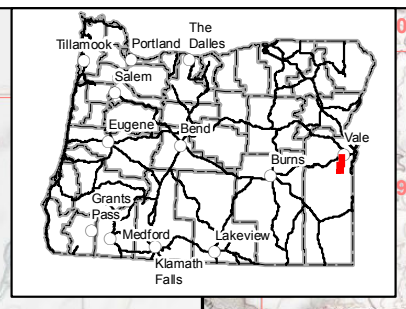
## GRASSY MOUNTAIN PROJECT

### Terrestrial Vegetation Study Area and Permit Area

Figure 13

| | | | |
|---|---|---|---|
| Date: | 09/21/2017 | Drawn By: | JDB |
| Revised: | | Project No.: | 3672 |
| Base Map: | USGS 7.5' quads: Double Mountain, Grassy Mountain, Kane Spring Gulch, Sourdough Spring, Vale West | | |
| File Name: | 3672G_GrassyMtn_1709_Fig13_Terrestrial.mxd | | |

EM STRATEGIES




Russell Road

Twin Springs Road

Match Line

T19S R44E

T20S R44E

T20S R45E

T21S R44E

T22S R44E

Copyright:© 2013 National Geographic Society, i-cubed

Copyright:© 2013 National Geographic Society, i-cubed

**Explanation**

Permit Area

Wetland Study Area

Projection: UTM Zone 11 North, NAD83, meters

0 2,000 4,000 6,000 8,000 10,000 Feet

0 1 2 Miles

N

# CALICO RESOURCES USA CORP.

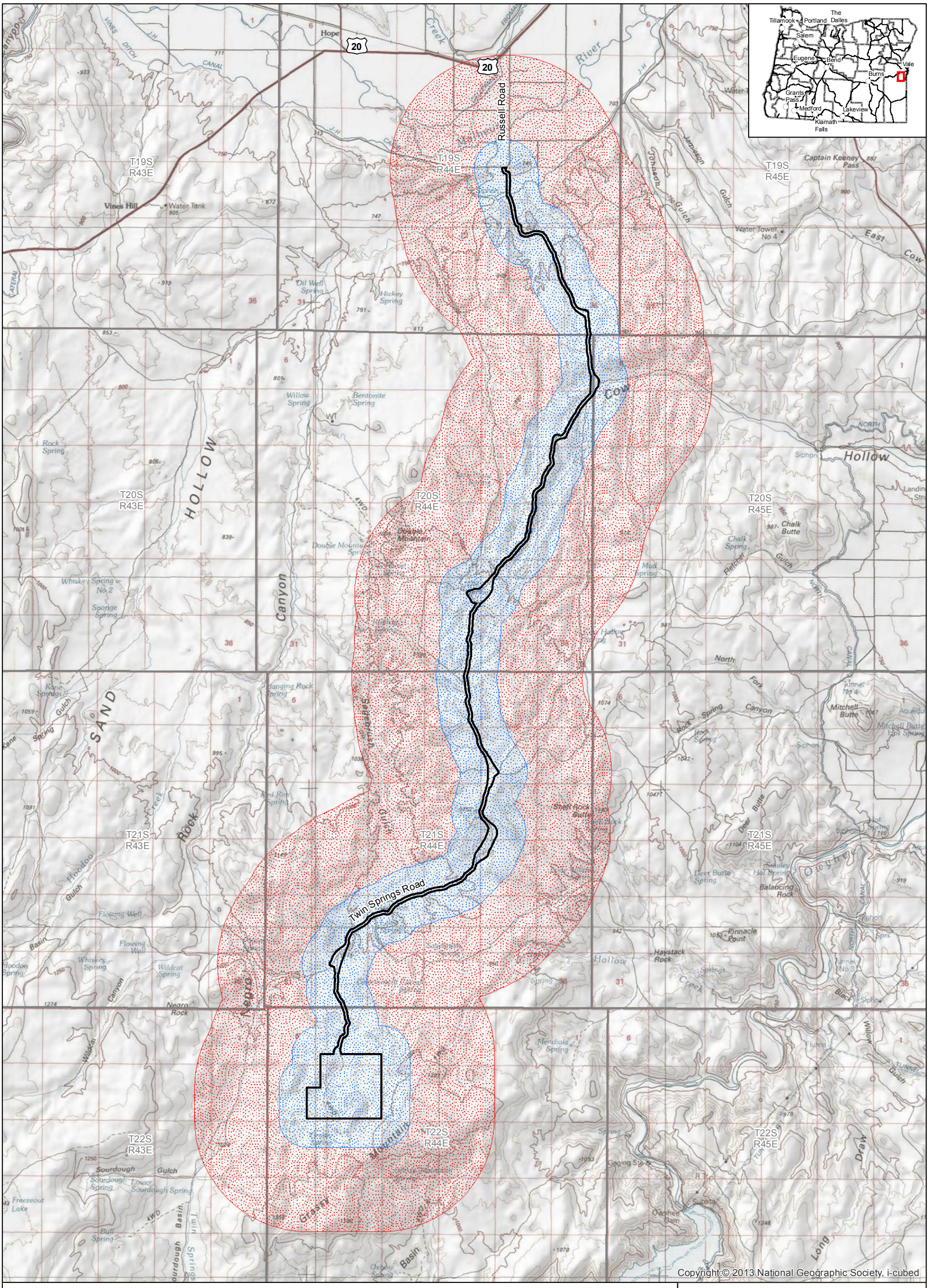
## GRASSY MOUNTAIN PROJECT

### Wetland Study Area and Permit Area

Figure 14

| | | | |
|---|---|---|---|
| Date: | 09/21/2017 | Drawn By: | JDB |
| Revised: | | Project No.: | 3672 |
| Base Map: | USGS 7.5' quads: Double Mountain, Grassy Mountain, Kane Spring Gulch, Sourdough Spring, Vale West | | |
| File Name: | 3672G_GrassyMtn_1709_Fig14_Wetland.mxd | | |

EM STRATEGIES




**Explanation**

- Permit Area
- Wildlife Study Area (0.5-mile Permit Area buffer)
- Wildlife Study Area (2-mile Permit Area buffer)

Projection: UTM Zone 11 North, NAD83, meters

0 4,000 8,000 12,000 16,000 20,000 Feet

0 2 4 Miles

N

# CALICO RESOURCES USA CORP.

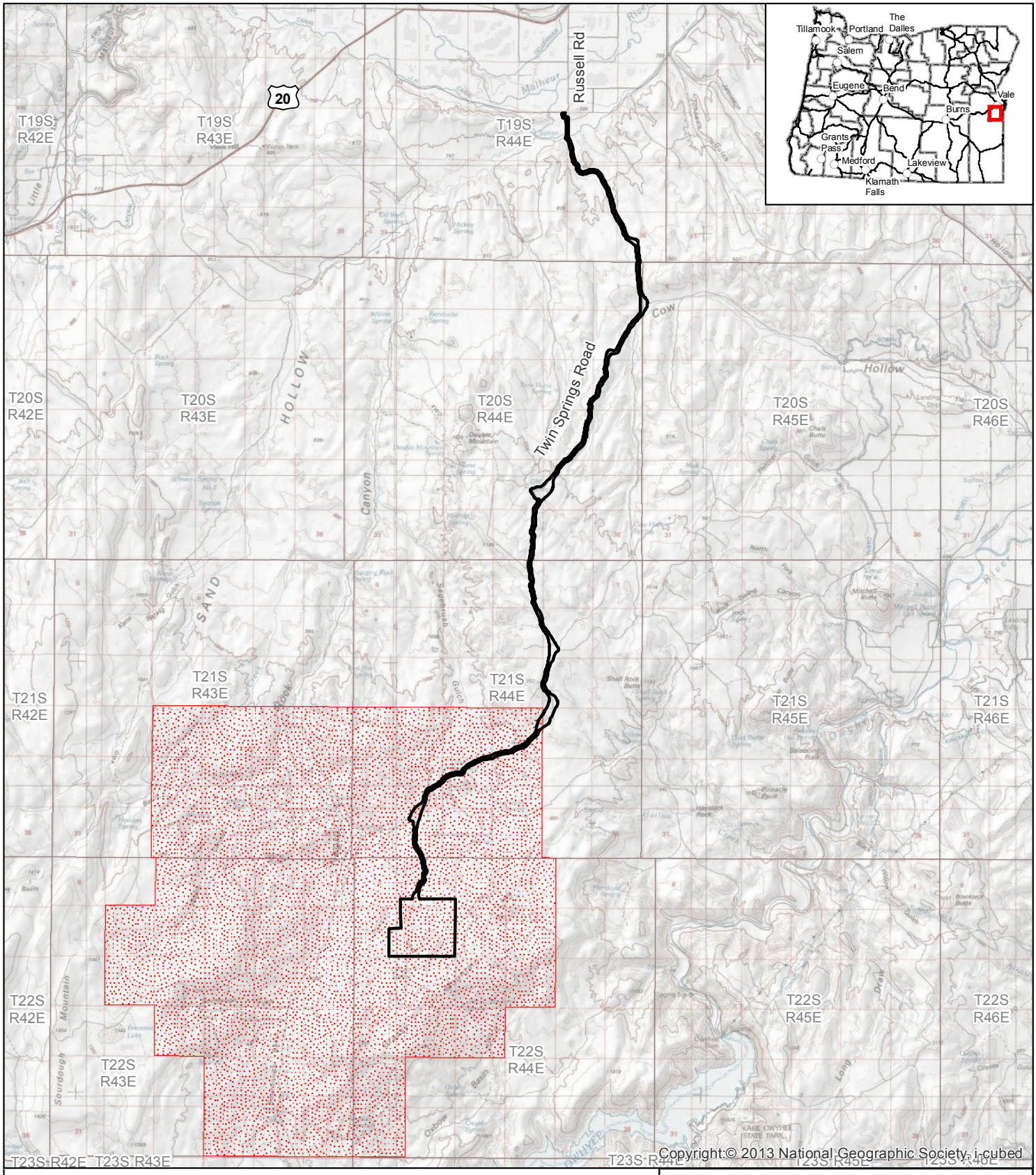
## GRASSY MOUNTAIN PROJECT

## Wildlife Study Area and Permit Area

Figure 15

| | |
|---|---|
| Date: 09/21/2017 | Drawn By: JDB |
| Revised: | Project No.: 3672 |
| Base Map: USGS 100K quad: Vale | |
| File Name: 3672G_GrassyMtn_1709_Fig15_Wildlife.mxd | |

EM STRATEGIES







**Explanation**

- Permit Area
- Aquatic Resources Study Area

0 5,000 10,000 Feet

0 1 2 Miles

N

Projection: UTM Zone 11 North, NAD83, meters

# CALICO RESOURCES USA CORP.

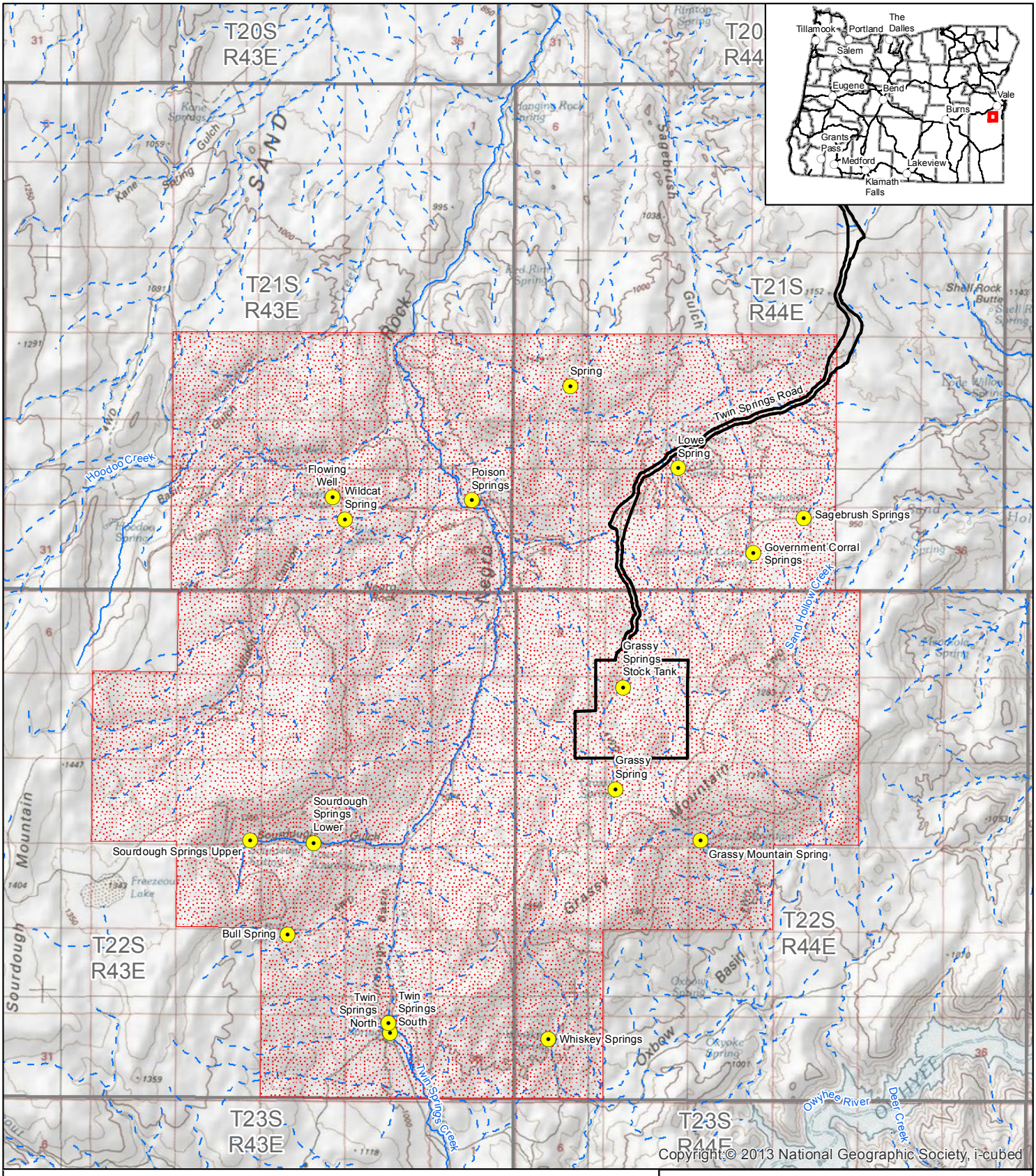
## GRASSY MOUNTAIN PROJECT

### Aquatic Resources Study Area and Permit Area

Figure 16

| | |
|---|---|
| Date: 09/21/2017 | Drawn By: JDB |
| Revised: | Project No.: 3672 |
| Base Map: USGS 100K quad: Vale | |
| File Name: 3672G_GrassyMtn_1709_Fig16_Aquatic_Permit.mxd | |

EM STRATEGIES




**Explanation**

- Permit Area
- Aquatic Resources Study Area
- Springs
- Perennial Stream
- Intermittent/Ephemeral Stream

Projection: UTM Zone 11 North, NAD83, meters

0 4,000 8,000 Feet

0 0.5 1 Miles

N

# CALICO RESOURCES USA CORP.

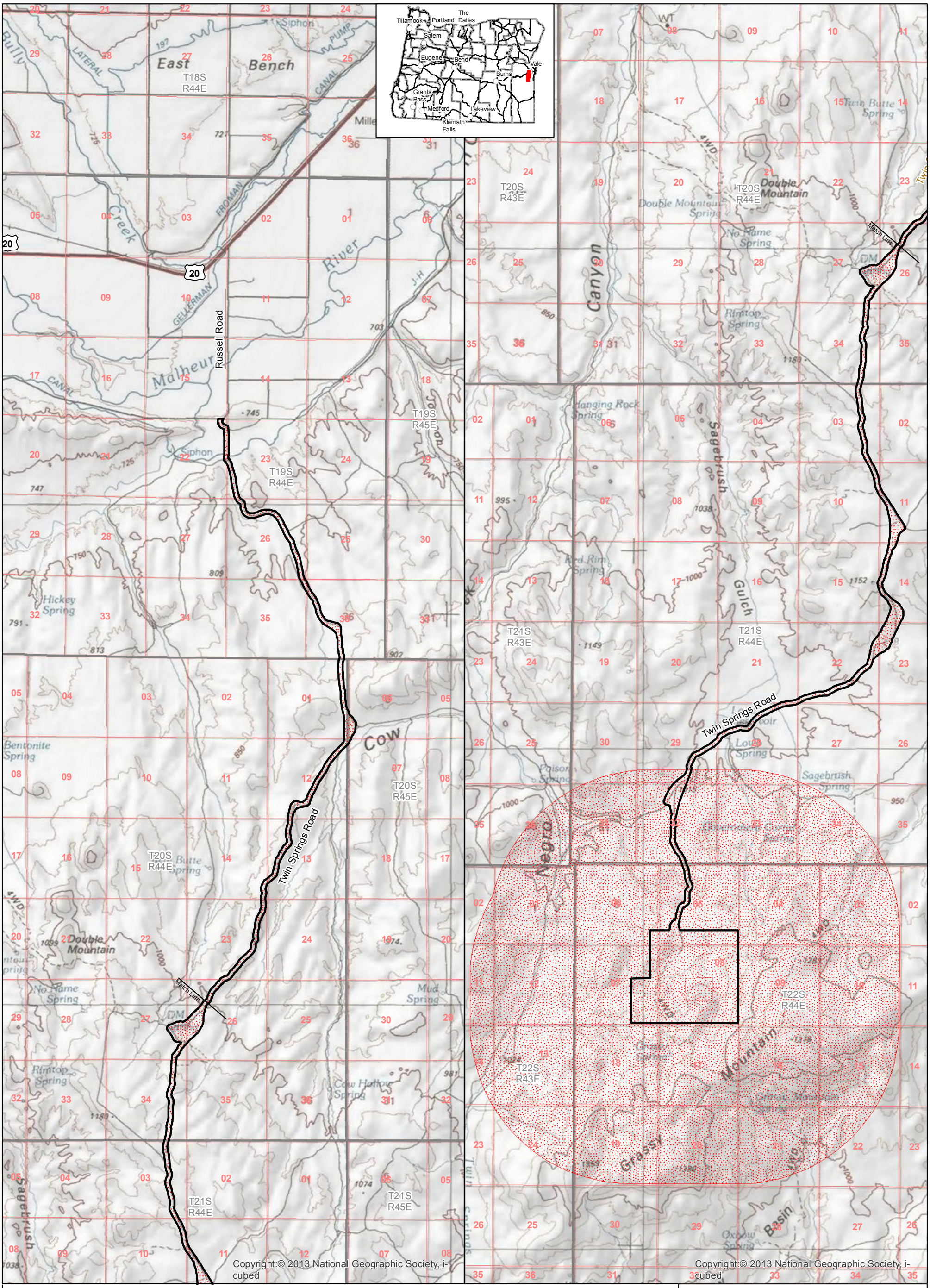
## GRASSY MOUNTAIN PROJECT

### Aquatic Resources Study Area

Figure 17

| | | | |
|---|---|---|---|
| Date: | 09/21/2017 | Drawn By: | JDB |
| Revised: | | Project No.: | 3672 |
| Base Map: | USGS 100K quad: Vale | | |
| File Name: | 3672G_GrassyMtn_1709_Fig17_Aquatic.mxd | | |

EM STRATEGIES




**Explanation**

- Permit Area
- Grazing Management Study Area

Projection: UTM Zone 11 North, NAD83, meters

0 2,000 4,000 6,000 8,000 10,000 Feet

0 1 2 Miles

N

**CALICO RESOURCES USA CORP.**

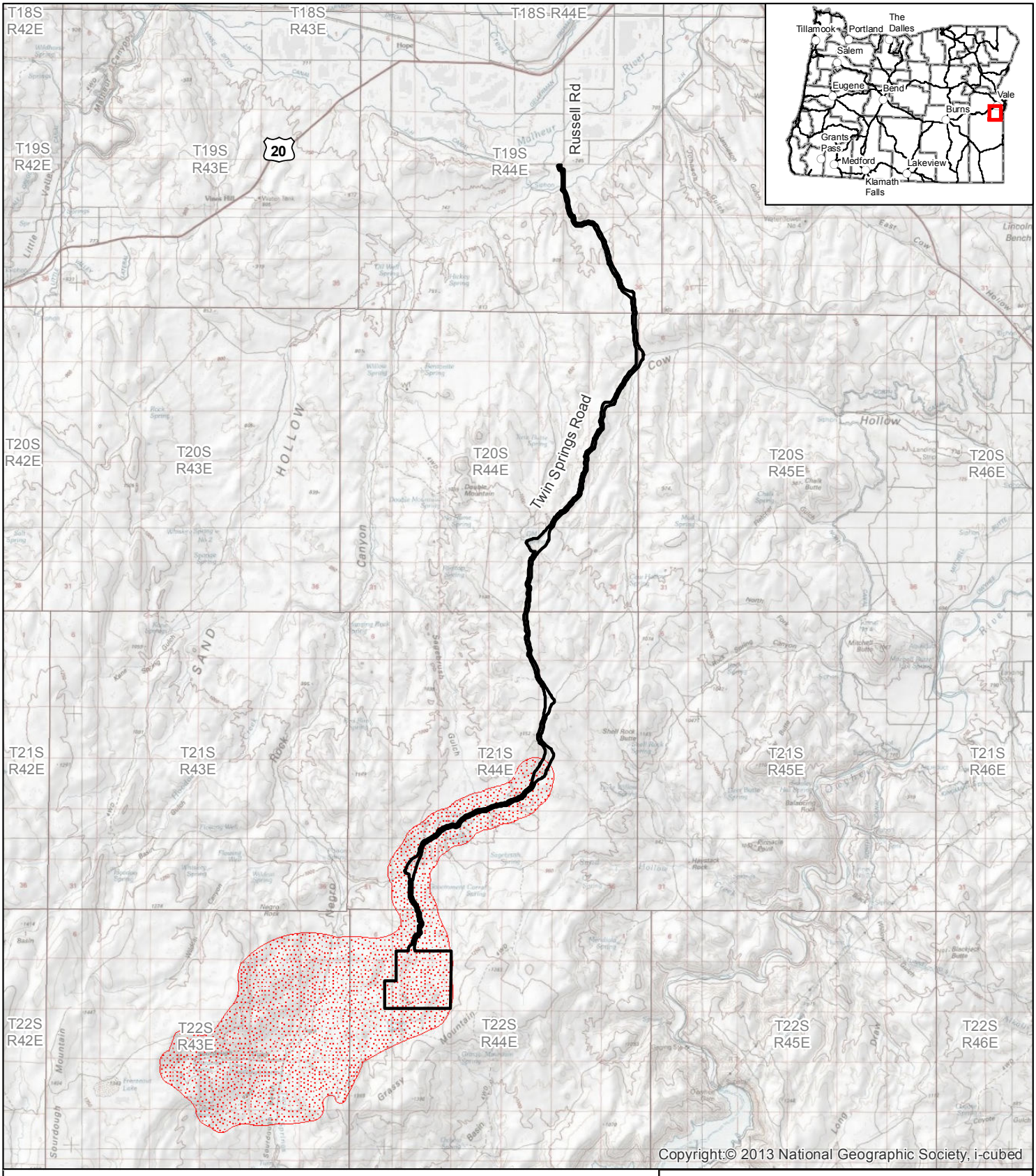
GRASSY MOUNTAIN PROJECT

Grazing Management Study Area and Permit Area

Figure 18

| | |
|---|---|
| Date: 09/21/2017 | Drawn By: JDB |
| Revised: | Project No.: 3672 |
| Base Map: USGS 100K quad: Vale | |
| File Name: 3672G_GrassyMtn_1709_Fig18_Grazing.mxd | |

EM STRATEGIES







**Explanation**

- Permit Area
- Visual Resources Study Area

0 5,000 10,000 Feet

0 1 2 Miles

N

Projection: UTM Zone 11 North, NAD83, meters

# CALICO RESOURCES USA CORP.

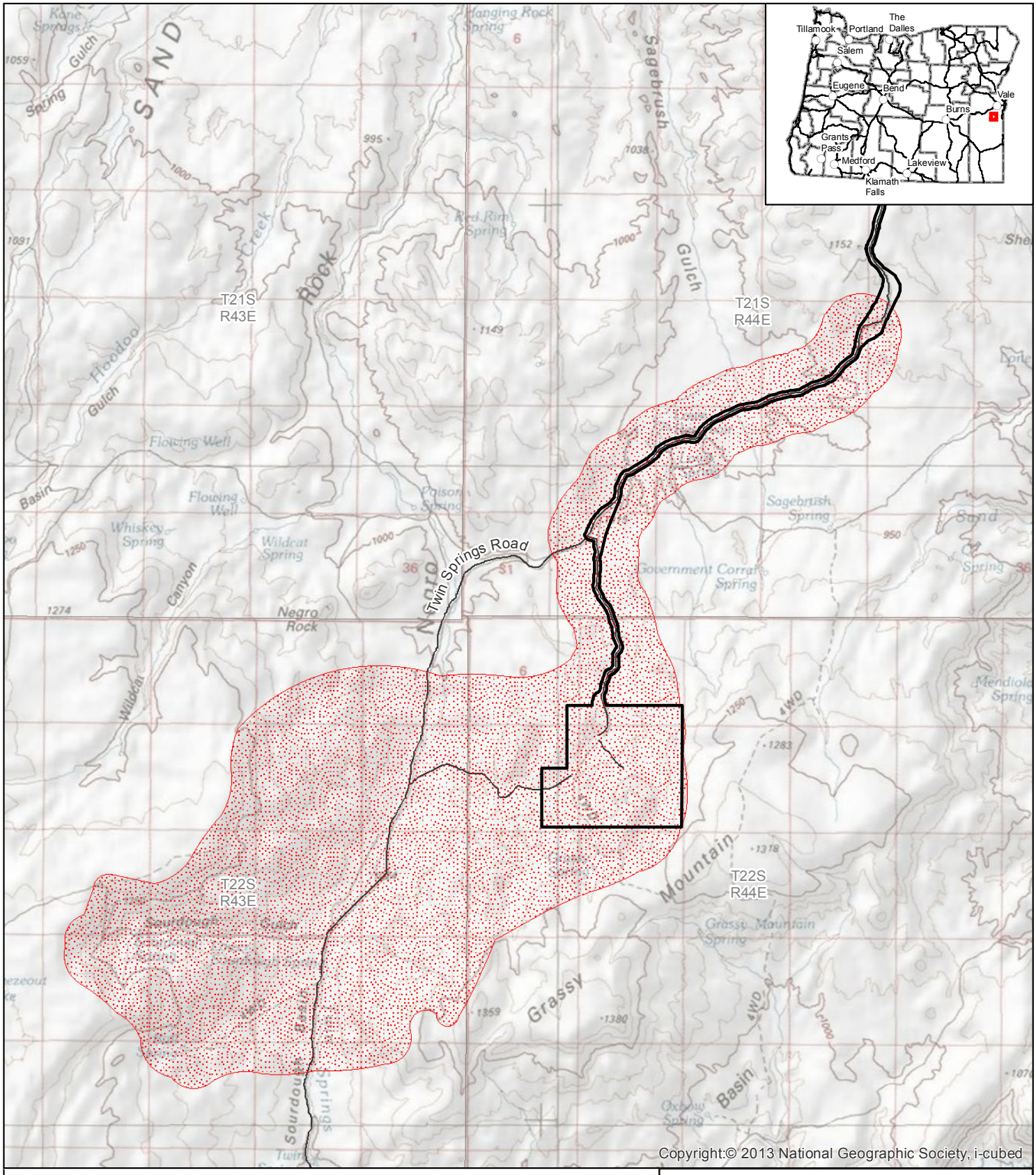
## GRASSY MOUNTAIN PROJECT

### Visual Resources Study Area and Permit Area

Figure 19

| | |
|---|---|
| Date: 09/21/2017 | Drawn By: JDB |
| Revised: | Project No.: 3672 |
| Base Map: USGS 100K quad: Vale | |
| File Name: 3672G_GrassyMtn_1709_Fig19_Visual_Permit.mxd | |

EM STRATEGIES




**Explanation**

- Permit Area
- Visual Resources Study Area
- Existing Road

Projection: UTM Zone 11 North, NAD83, meters

0 2,000 4,000 Feet

0 0.5 1 Miles

N

# CALICO RESOURCES USA CORP.

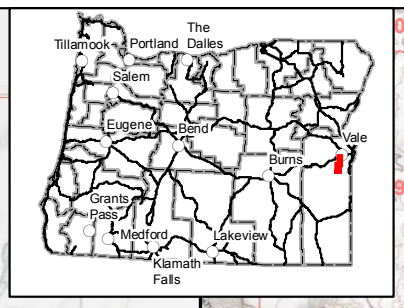
## GRASSY MOUNTAIN PROJECT

## Visual Resources Study Area

Figure 20

| | |
|---|---|
| Date: 09/21/2017 | Drawn By: JDB |
| Revised: | Project No.: 3672 |
| Base Map: USGS 100K quad: Vale | |
| File Name: 3672G_GrassyMtn_1709_Fig20_Visual.mxd | |

EM STRATEGIES




Russell Road

Twin Springs Road

Match Line

T19S R44E

T20S R44E

T20S R45E

T21S R44E

T22S R44E

Copyright:© 2013 National Geographic Society, i-cubed

Copyright:© 2013 National Geographic Society, i-cubed

**Explanation**

Permit Area

Local Air Quality Study Area

Projection: UTM Zone 11 North, NAD83, meters

0 2,000 4,000 6,000 8,000 10,000 Feet

0 1 2 Miles

N

# CALICO RESOURCES USA CORP.

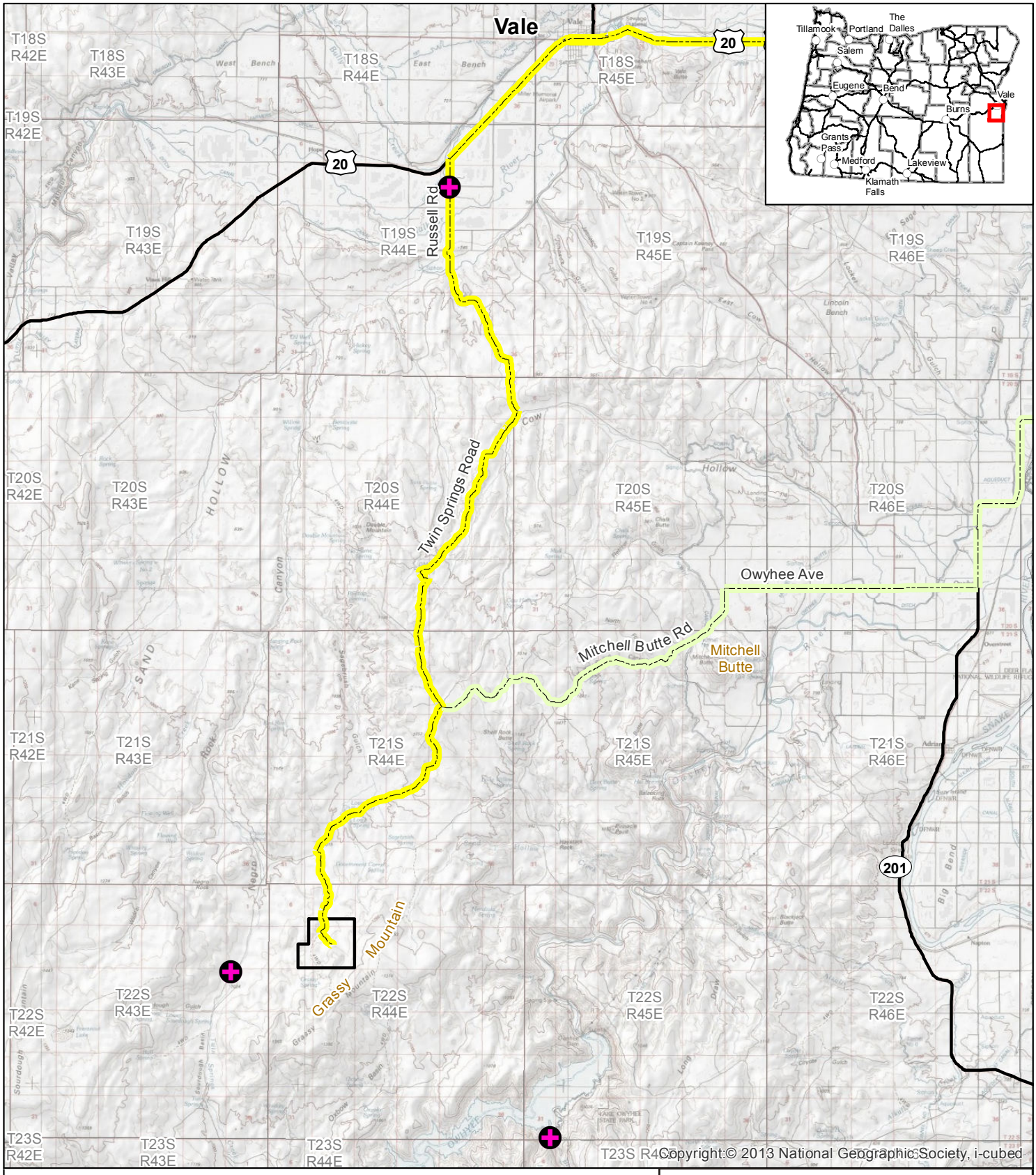
## GRASSY MOUNTAIN PROJECT

### Local Air Quality Study Area and Permit Area

Figure 21

| | | | |
|---|---|---|---|
| Date: | 09/21/2017 | Drawn By: | JDB |
| Revised: | | Project No.: | 3672 |
| Base Map: | USGS 7.5' quads: Double Mountain, Grassy Mountain, Kane Spring Gulch, Sourdough Spring, Vale West | | |
| File Name: | 3672G_GrassyMtn_1709_Fig21_LocalAir.mxd | | |

EM STRATEGIES




**Explanation**

- Mine and Process Area
- Approximate Location of Noise Monitoring Stations
- Main Access Road
- Secondary Access Road

Projection: UTM Zone 11 North, NAD83, meters

0 5,000 10,000 Feet

0 1 2 Miles

N

# CALICO RESOURCES USA CORP.

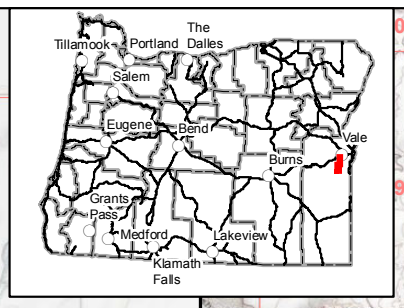
## GRASSY MOUNTAIN PROJECT

## Noise Study Area

Figure 22

| | | | |
|---|---|---|---|
| Date: | 09/21/2017 | Drawn By: | JDB |
| Revised: | | Project No.: | 3672 |
| Base Map: | USGS 100K quad: Vale | | |
| File Name: | 3672G_GrassyMtn_1709_Fig22_Noise.mxd | | |

EM STRATEGIES




Russell Road

Twin Springs Road

Match Line

T19S R44E

T20S R44E

T20S R45E

T21S R44E

T22S R44E

Copyright:© 2013 National Geographic Society, i-cubed

Copyright:© 2013 National Geographic Society, i-cubed

**Explanation**

Permit Area

Cultural Resources Study Area

Projection: UTM Zone 11 North, NAD83, meters

0 2,000 4,000 6,000 8,000 10,000 Feet

0 1 2 Miles

N

# CALICO RESOURCES USA CORP.

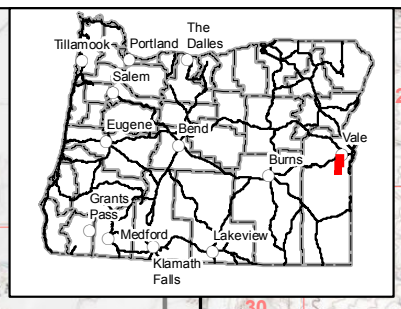
## GRASSY MOUNTAIN PROJECT

### Cultural Resources Study Area and Permit Area

Figure 23

| | | | |
|---|---|---|---|
| Date: | 09/21/2017 | Drawn By: | JDB |
| Revised: | | Project No.: | 3672 |
| Base Map: | USGS 7.5' quads: Double Mountain, Grassy Mountain, Kane Spring Gulch, Sourdough Spring, Vale West | | |
| File Name: | 3672G_GrassyMtn_1709_Fig23_Cultural.mxd | | |

EM STRATEGIES




Russell Road

Twin Springs Road

Match Line

T20S R44E

T19S R45E

T20S R44E

T20S R45E

T21S R44E

T22S R44E

Copyright:© 2013 National Geographic Society, i-cubed

Copyright:© 2013 National Geographic Society, i-cubed

**Explanation**

Permit Area

Land Use Study Area (1,000-foot Permit Area buffer)

Projection: UTM Zone 11 North, NAD83, meters

0 2,000 4,000 6,000 8,000 10,000 Feet

0 1 2 Miles

N

**CALICO RESOURCES USA CORP.**

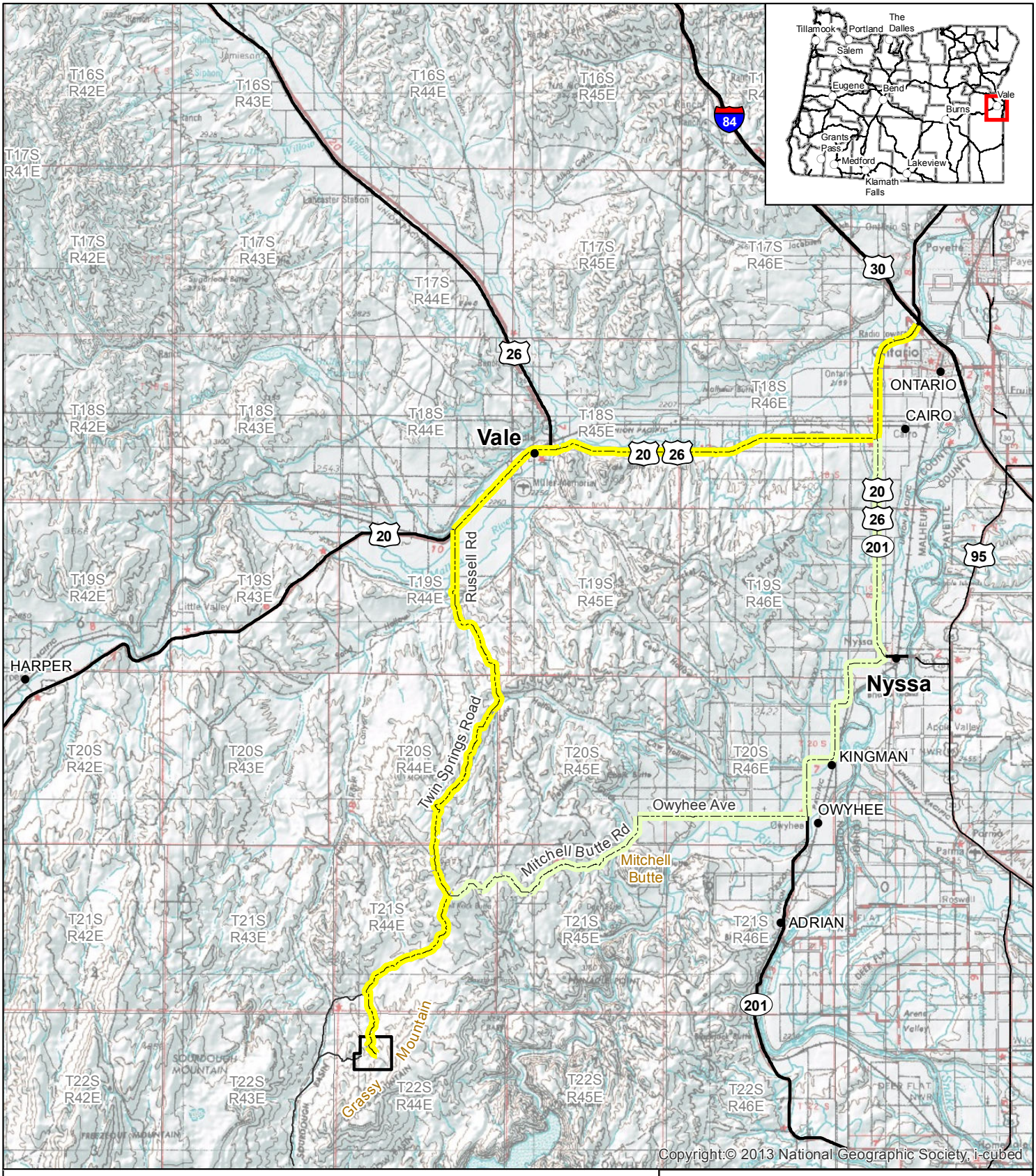
GRASSY MOUNTAIN PROJECT

Land Use Study Area and Permit Area

Figure 24

| | | | |
|---|---|---|---|
| Date: | 09/21/2017 | Drawn By: | JDB |
| Revised: | | Project No.: | 3672 |
| Base Map: | USGS 7.5' quads: Double Mountain, Grassy Mountain, Kane Spring Gulch, Sourdough Spring, Vale West | | |
| File Name: | 3672G_GrassyMtn_1709_Fig24_LandUse.mxd | | |

EM STRATEGIES




**Explanation**

- Mine and Process Area
- Main Access Road
- Secondary Access Road

Projection: UTM Zone 11 North, NAD83, meters

0 10,000 20,000 Feet

0 2 4 Miles

N

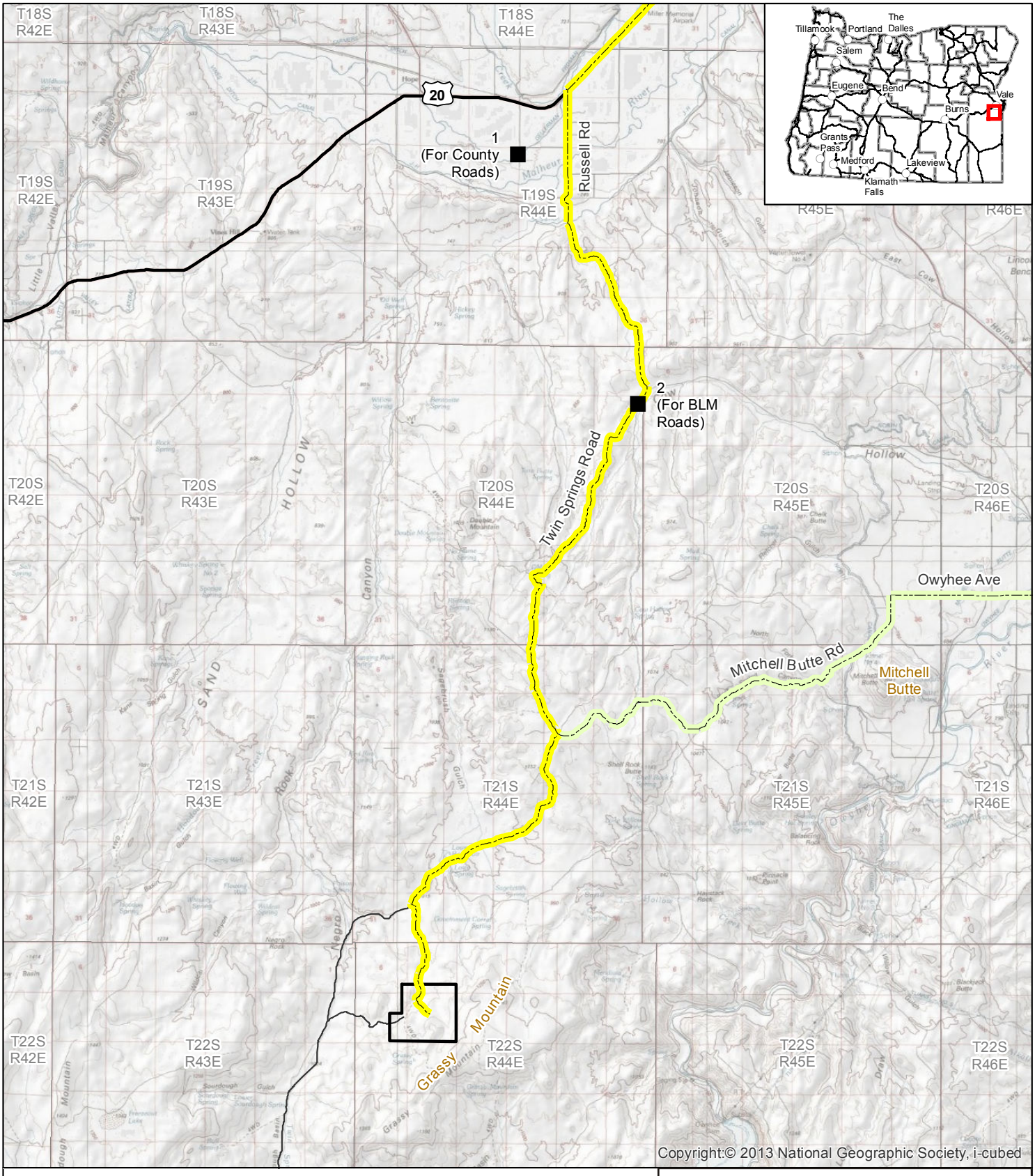
# CALICO RESOURCES USA CORP.

## GRASSY MOUNTAIN PROJECT

## Transportation Study Area

Figure 25

| | | |
|---|---|---|
| Date: 09/21/2017 | Drawn By: JDB | EM STRATEGIES |
| Revised: | Project No.: 3672 | |
| Base Map: USGS 250K quads: Baker, Boise | | |
| File Name: 3672G_GrassyMtn_1709_Fig25_Transportation.mxd | | |




**Explanation**

- Mine and Process Area
- Proposed Traffic Counter Locations
- Main Access Road
- Secondary Access Road

Projection: UTM Zone 11 North, NAD83, meters

0 5,000 10,000 Feet

0 1 2 Miles

N

# CALICO RESOURCES USA CORP.

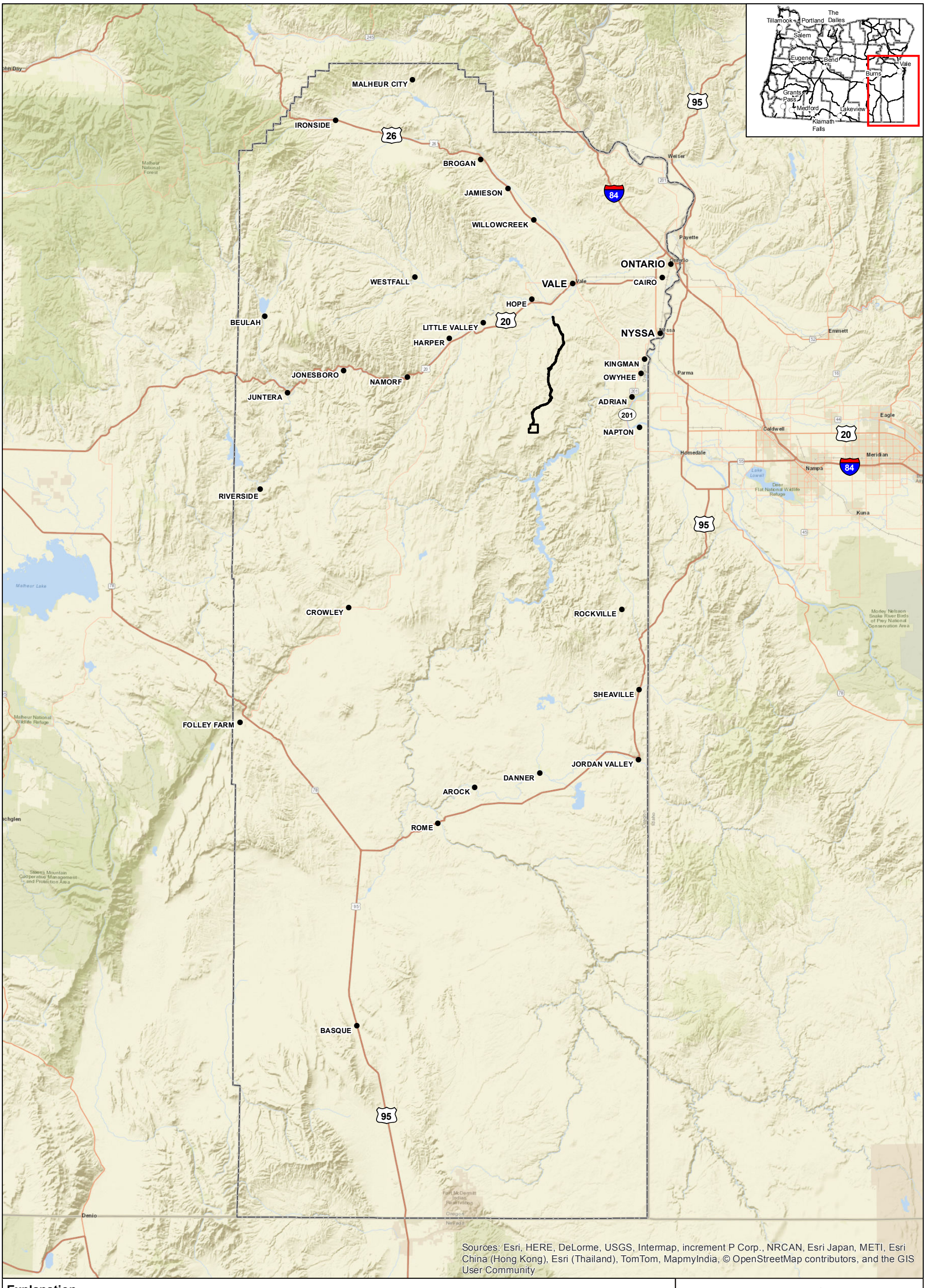
## GRASSY MOUNTAIN PROJECT

### Traffic Counter Locations

Figure 26

| | |
|---|---|
| Date: 09/21/2017 | Drawn By: JDB |
| Revised: | Project No.: 3672 |
| Base Map: USGS 100K quad: Vale | |
| File Name: 3672G_GrassyMtn_1709_Fig26_Traffic.mxd | |

EM STRATEGIES




Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

**Explanation**

Permit Area

Malheur County (Study Area)

Projection: UTM Zone 11 North, NAD83, meters

0 10 20 Miles

N

# CALICO RESOURCES USA CORP.

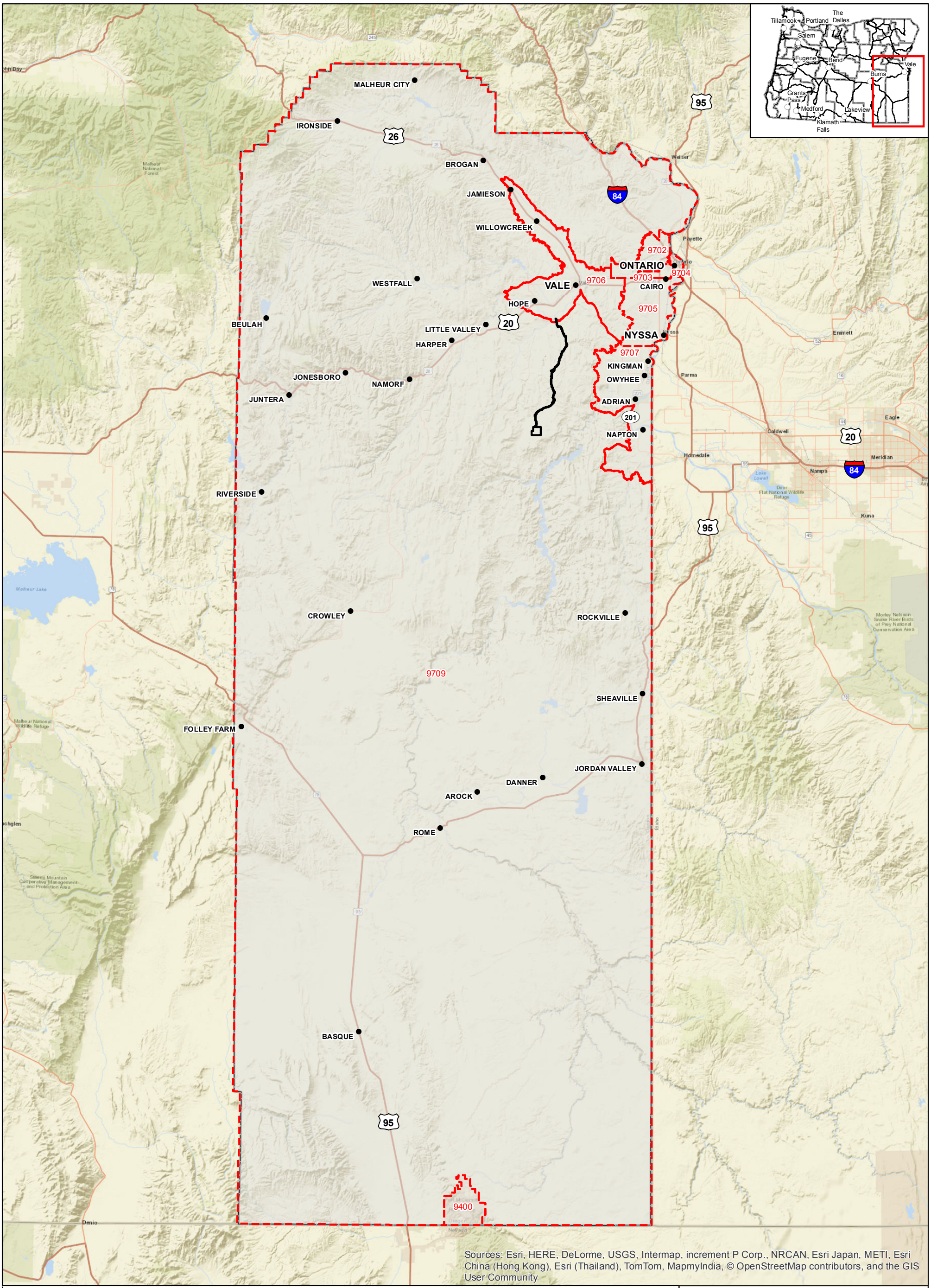
## GRASSY MOUNTAIN PROJECT

## Regional Socioeconomics Study Area

Figure 27

| | |
|---|---|
| Date: 09/21/2017 | Drawn By: JDB |
| Revised: | Project No.: 3672 |
| Base Map: | |
| File Name: 3672G_GrassyMtn_1709_Fig27_Socioeco.mxd | |

EM STRATEGIES




**Explanation**

- Permit Area
- Census Tracts
- Malheur County (Study Area)

Projection: UTM Zone 11 North, NAD83, meters

0 10 20 Miles

N

# CALICO RESOURCES USA CORP.

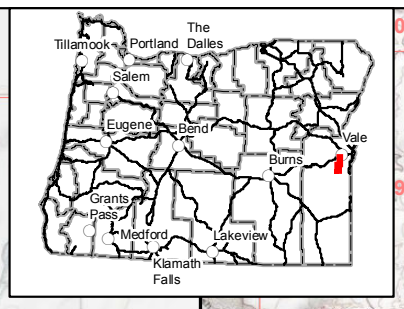
## GRASSY MOUNTAIN PROJECT

## Environmental Justice Study Area

Figure 28

| | |
|---|---|
| Date: 09/21/2017 | Drawn By: JDB |
| Revised: | Project No.: 3672 |
| Base Map: | |
| File Name: 3672G_GrassyMtn_1709_Fig28_EnviroJustice_L.mxd | |

EM STRATEGIES




Russell Road

Twin Springs Road

Match Line

T19S R44E

T20S R44E

T20S R45E

T21S R44E

T22S R44E

Copyright:© 2013 National Geographic Society, i-cubed

Copyright:© 2013 National Geographic Society, i-cubed

**Explanation**

Permit Area

Recreation Study Area

Projection: UTM Zone 11 North, NAD83, meters

0 2,000 4,000 6,000 8,000 10,000 Feet

0 1 2 Miles

N

# CALICO RESOURCES USA CORP.

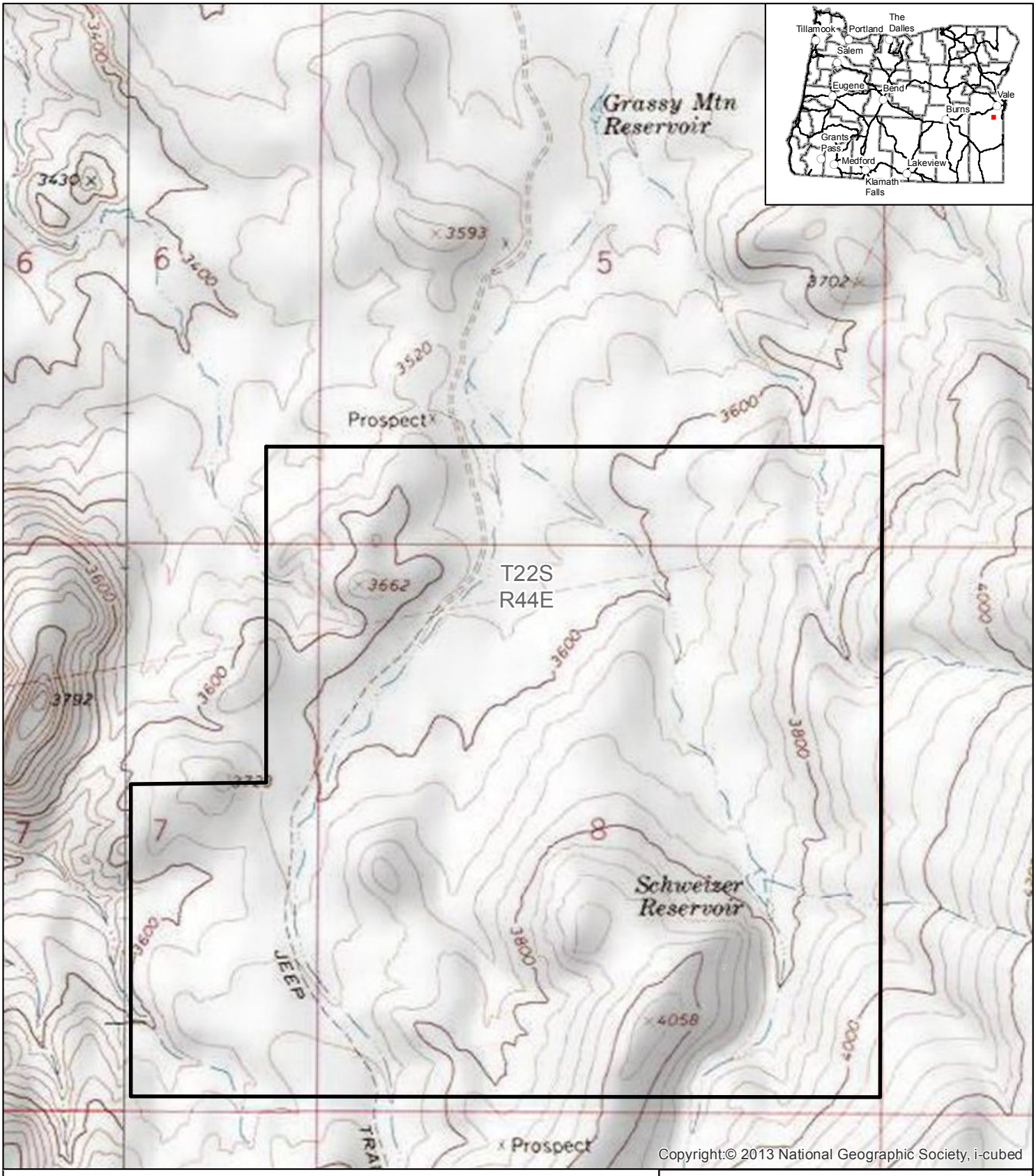
## GRASSY MOUNTAIN PROJECT

### Recreation Study Area and Permit Area

Figure 29

| | | | |
|---|---|---|---|
| Date: | 09/21/2017 | Drawn By: | JDB |
| Revised: | | Project No.: | 3672 |
| Base Map: | USGS 7.5' quads: Double Mountain, Grassy Mountain, Kane Spring Gulch, Sourdough Spring, Vale West | | |
| File Name: | 3672G_GrassyMtn_1709_Fig29_Recreation.mxd | | |

EM STRATEGIES




Copyright:© 2013 National Geographic Society, i-cubed

**Explanation**

Mine and Process Area (Study Area)

Projection: UTM Zone 11 North, NAD83, meters

0 500 1,000 Feet

0 0.125 0.25 Miles

N

# CALICO RESOURCES USA CORP.

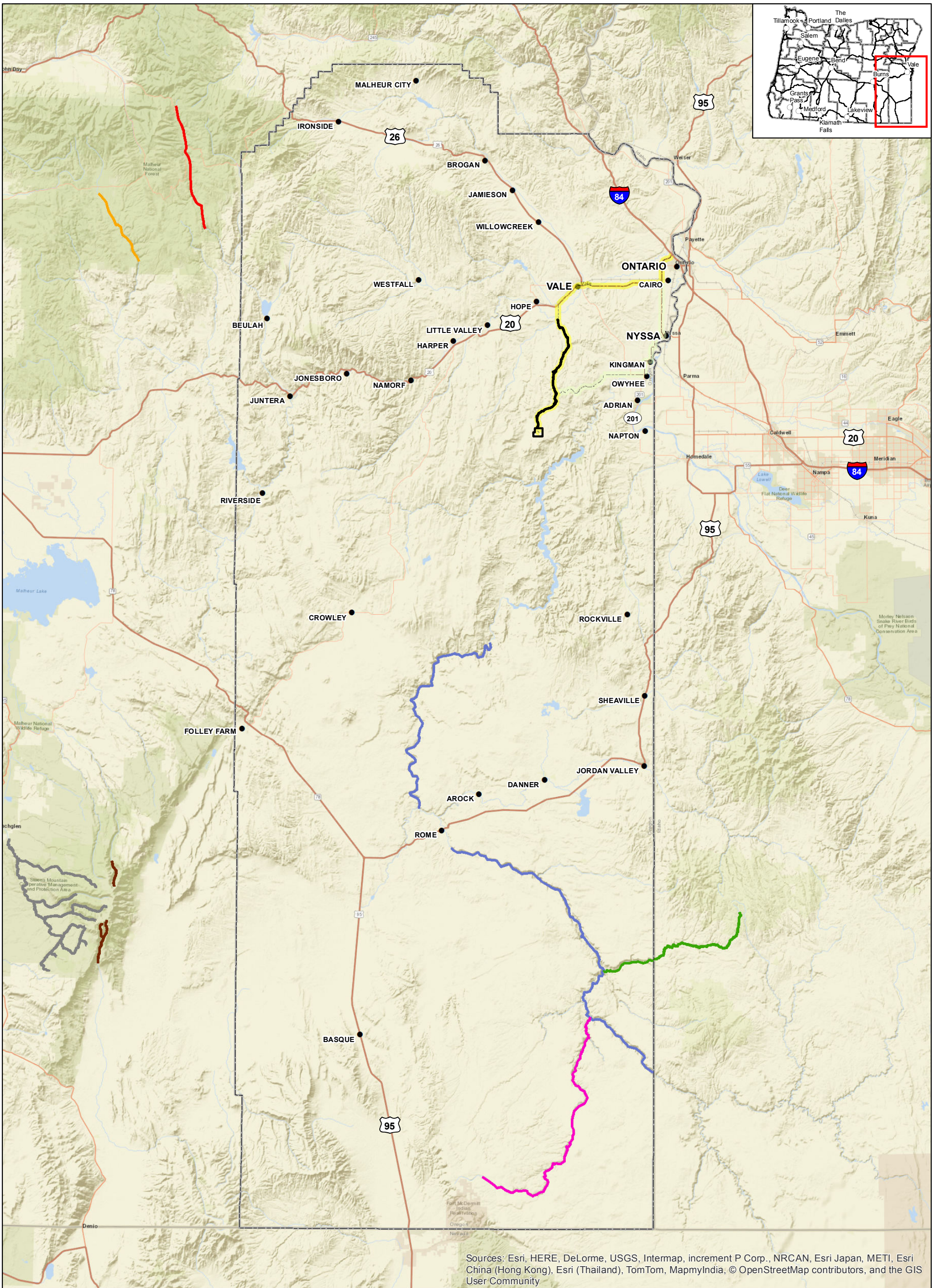
## GRASSY MOUNTAIN PROJECT

## Mined Land Reclamation Study Area

Figure 30

| | |
|---|---|
| Date: 09/21/2017 | Drawn By: JDB |
| Revised: | Project No.: 3672 |
| Base Map: USGS 7.5' quads: Grassy Mountain, Sourdough Spring | |
| File Name: 3672G_GrassyMtn_1709_Fig30_Reclamation.mxd | |

EM STRATEGIES




Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

**Explanation**

- Permit Area
- Main Access Road
- Secondary Access Road
- Malheur County

**Designated Wild and Scenic Rivers**

- Donner und Blitzen, Oregon
- Malheur, Oregon
- North Fork Malheur, Oregon
- North Fork Owyhee, Oregon
- Owyhee, Oregon
- West Little Owyhee, Oregon
- Wildhorse and Kiger Creeks, Oregon

Projection: UTM Zone 11 North, NAD83, meters

0 10 20 Miles

N

# CALICO RESOURCES USA CORP.

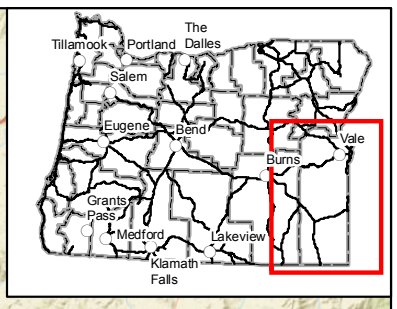
## GRASSY MOUNTAIN PROJECT

### Wild and Scenic and Recreational Rivers In the Vicinity of Malheur County

Figure 31

| | |
|---|---|
| Date: 09/21/2017 | Drawn By: JDB |
| Revised: | Project No.: 3672 |
| Base Map: | |
| File Name: 3672G_GrassyMtn_1709_Fig31_WSR.mxd | |

EM STRATEGIES




| MapNo | Area Name |
|---|---|
| **Malheur Resources Area** | |
| 1 | BlackCanyon |
| 2 | Castle Rock |
| 3 | Coal Mine Basin |
| 4 | Dry Creek Gorge |
| 5 | Hammond Hill Sand Hills |
| 6 | Honeycombs |
| 7 | Lake Ridge |
| 8 | Leslie Gulch |
| 9 | Mahogany Ridge |
| 10 | North Fork Malhuer River |
| 11 | North Ridge Bully Creek |
| 12 | Oregon Trail, Birch Creek |
| 13 | Oregon Trail, Keeney Pass |
| 14 | Oregon Trail, Tub Mountain |
| 15 | Owyhee Below Dam |
| 16 | Owyhee Views |
| 17 | South Alkali Sand Hills |
| 18 | South Bull Canyon |
| 19 | South Ridge Bully Creek |
| 20 | Spring Mountain |
| 21 | Stockade Mountain |
| **Jordan Resources Area** | |
| 22 | Dry Creek Bench |
| 23 | Jordan Craters |
| 24 | Little Whitehorse Creek |
| 25 | Mendi Gore Playa |
| 26 | Palomino Playa |
| 27 | Saddle Butte |
| 28 | Toppin Creek Butte |

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

**Explanation**

- Permit Area
- Main Access Road
- Secondary Access Road
- Malheur County

**Area of Concern/Resource Area**

- Primary Area of Environmental Concern (ACEC); Malheur Resources Area
- Primary Area of Environmental Concern (ACEC); Jordan Resources Area
- Research Natural Area (RNA); Malheur Resources Area
- Research Natural Area (RNA); Jordan Resources Area

Projection: UTM Zone 11 North, NAD83, meters

Miles 0 10 20 N

# CALICO RESOURCES USA CORP.

## GRASSY MOUNTAIN PROJECT

Areas of Critical Environmental Concern
In the Jordan and Malheur Resources Areas

Figure 32

| | | | |
|---|---|---|---|
| Date: | 09/21/2017 | Drawn By: | JDB |
| Revised: | | Project No.: | 3672 |
| Base Map: | | | |
| File Name: | 3672G_GrassyMtn_1709_Fig32_ACEC.mxd | | |

EM STRATEGIES

# Appendix B

## Suggested Baseline Data Methodologies
## Calico Resources USA Corp.
## Technical Review Team

**Suggested Baseline Data Methodologies Submittal**

**Oregon Chemical Process Mining**

## GENERAL

The Baseline Data Methodology submission (see Oregon Administrative Rules 632-037-0055 and OAR 632-037-0040) should be organized to clearly state the purpose, objectives and methodologies of the proposed work plan. The following format is suggested for most disciplines, although some may not lend themselves to this exact format:

1) *PURPOSES AND OBJECTIVES*

   Provide a clear statement of the purpose and objectives of the chapter. Explain why the information is being collected.

2) *REGIONAL AND SITE SETTING*

   Provide a summary of existing site conditions with sufficient detail to allow the reviewers to properly assess the appropriateness of the methodology being applied. For instance, a vegetation study would need sufficient detail to inform the reader that the project is in sagebrush grassland rather than a Douglas fir forest.

3) *COLLECTION METHODOLOGIES*

   Provide a detailed discussion of the methodologies to be used in collection of the data. This must include, as appropriate for the specific discipline:

   a) The literature available relative to the site,
   b) The sample collecting methodology including sampling density, frequency, and duration, including references
   c) The analytical methods to be used, including detection limits.

   Specific location of identified archeological sites should be maintained as confidential.

4) *QUALITY ASSURANCE / QUALITY CONTROL PROCEDURES*

   Provide a discussion of the Quality Assurance/Quality Control (QA/QC) procedures that will be followed to ensure proper sample collection, handling, and analysis, including field sample data forms, as appropriate for the specialty. Note that copies of the completed field sample data forms should be included in the Consolidated Application.

5) *FURTHER ANTICIPATED STUDIES*

   An outline of any iterative work that may be necessary after the first round of sampling is completed and analyzed. For example, follow-up work may be required on some rock materials for acid rock drainage characterization. Indicate what paths the follow-up work will take.

6) *SUMMARY*

   Indicate how the collected and interpreted data will be used to fulfill the purpose and objectives of the chapter and why the methodology is appropriate.

## PRESENTATION

Maps must be of an appropriate scale for the data being presented and must use common English scales. For example, the regional hydrological setting might be shown on a 1:62,500 scale map while the details of the hydrogeology in the proposed mine would be on a much more detailed map.

Each data map should be easily related to other maps to improve understanding.

Where appropriate, geo-resource codes should be provided for items such as water wells or geologic maps.

## USE OF EXISTING DATA

Existing data may be submitted with the final consolidated application if the methodology used to collect that data meets the standards of the approved proposed work plan and the data is not outdated. At the discretion of the TRT, a soil survey made according to the approved methodology may be accepted even though the survey was made 10 years ago. On the other hand, unemployment data from 1983 would have no relevance for current unemployment levels, even thought it was collected by acceptable methods. Wetland delineations expire after five years.

## MISCELLANEOUS

Where required, Oregon engineering, engineering geologist, or geologist professional registration must be provided.

Although some baseline data may have been collected, it will be most useful to limit the Baseline Data Methodologies submittal to just the Methodologies, not the data itself, at this point.

State agencies will provide additional specifics on format requirements for specific data. The baseline data methodologies should be submitted to DOGAMI electronically as a PDF and as a *Word* file.

*DOGAMI - Calico Technical Review Team*

*July, 2012*

# OREGON CHEMICAL PROCESS MINING REGULATIONS – BASELINE DATA METHODOLOGY LEAD AGENCIES - July, 2012

| *Baseline Data Collection Topic* | *Lead State Agency* | *Supporting State Agency* | *Federal Agency to be Involved?* | *Local Agency to be Involved?* | *Notes/Ideas* |
|---|---|---|---|---|---|
| **Vegetation** | Dept. of Ag | ODFW<br><br>DSL | BLM – noxious weeds | Malheur County – noxious weeds – Gary Page is contact | Use Army Corps of Engineers Delineation Manual of 1987 - Arid West Supplement<br><br>Tribal governments may be interested in specific vegetation such as first foods |
| **Soil/overburden** | DOGAMI | DSL<br><br>Dept. of Ag | | | Use Army Corps of Engineers Delineation Manual of 1987 - Arid West Supplement |
| **Climate/air quality** | DEQ | | | | DEQ will provide additional information and guidance to Calico |
| **Fish, fish habitat and aquatic biology** | ODFW | DSL<br><br>DEQ | | | |
| **Wildlife and wildlife habitat** | ODFW | DSL – if wetlands present<br><br>DEQ | | | Additional ODFW specifics at end of document.<br><br>Information available regarding habitat classification |

# OREGON CHEMICAL PROCESS MINING REGULATIONS – BASELINE DATA METHODOLOGY
# LEAD AGENCIES - July, 2012

| *Baseline Data Collection Topic* | *Lead State Agency* | *Supporting State Agency* | *Federal Agency to be Involved?* | *Local Agency to be Involved?* | *Notes/Ideas* |
|---|---|---|---|---|---|
| **State or federally listed threatened or endangered species and habitat and state sensitive species and habitat** | ODFW | DSL (if wetlands or waterways are impacted) | US Fish & Wildlife<br><br>BLM | | Additional information available on the ODFW web site *http://www.dfw.state.or.us/wildlife/diversity/species/threatened_endangered_candidate_lisi.asp* |
| **Surface and groundwater - *Quantity*** | WRD | DEQ | | | WRD will provide additional information<br><br>Conceptual hydrogeological model of area is needed |
| **Surface and groundwater – *Quality*** | DEQ | WRD | | | Sampling & Analysis Plan needed<br><br>Laboratory QA/QC plan needed<br><br>If fish present, additional information may be needed |
| **Seismicity** | DOGAMI | | USGS | | Should be able to use existing USGS data |
| **Geology and geologic hazards** | DOGAMI | DEQ<br><br>WRD | | | Inventory should include erionite |

# OREGON CHEMICAL PROCESS MINING REGULATIONS – BASELINE DATA METHODOLOGY LEAD AGENCIES - July, 2012

| *Baseline Data Collection Topic* | *Lead State Agency* | *Supporting State Agency* | *Federal Agency to be Involved?* | *Local Agency to be Involved?* | *Notes/Ideas* |
|---|---|---|---|---|---|
| **Mineralogy and chemistry** | DOGAMI<br><br>DEQ | WRD | BLM | | Data must be adequate to evaluate acid rock drainage potential<br><br>Backfill details will need to be included in the Consolidated Application<br><br>The DOGAMI technical consultant may have a role here. |
| **Noise** | | | | Malheur County does not have a local noise ordinance | A consultant will be necessary to review the proposed methodologies. DEQ has statewide regulations regarding noise, but no noise staff or expertise. |
| **Existing land use and land use designations** | | | | Malheur County | The mine will require a conditional use permit |
| **Cultural/Historical Resources**<br><br>**Note:** Cultural/Historical Resources and Archaeological Resources can be combined into a single category of "*Historic Properties*" | SHPO | | BLM | | Must use qualified staff; see Secretary of Interior standards and State of Oregon standard for qualified field archaeologists<br><br>Tribal governments have expressed an interest in this issue |

# OREGON CHEMICAL PROCESS MINING REGULATIONS – BASELINE DATA METHODOLOGY
## LEAD AGENCIES - July, 2012

| *Baseline Data Collection Topic* | *Lead State Agency* | *Supporting State Agency* | *Federal Agency to be Involved?* | *Local Agency to be Involved?* | *Notes/Ideas* |
|---|---|---|---|---|---|
| **Archaeological Resources**<br><br>**Note:** Cultural/Historical Resources and Archaeological Resources can be combined into a single category of "*Historic Properties*" | | | | | |
| **Socioeconomic Conditions** | Oregon Business? | DOGAMI | | Malheur County Economic Development | Add'l consulting services may be needed in this area |
| **State scenic waterways; federal wild, scenic or recreational rivers** | State Parks<br><br>DSL | | BLM | | If there was a 404 permit, Army Corps of Engineers would be involved |

# OREGON CHEMICAL PROCESS MINING REGULATIONS – BASELINE DATA METHODOLOGY
## LEAD AGENCIES - July, 2012

| *Baseline Data Collection Topic* | *Lead State Agency* | *Supporting State Agency* | *Federal Agency to be Involved?* | *Local Agency to be Involved?* | *Notes/Ideas* |
|---|---|---|---|---|---|
| **Identification of special natural areas designated by the state or federal government, including but not limited to the following:** | | | | | |
| (A) *Areas designated as areas of critical environmental concern as defined by the Federal Land Policy and Management Act* | | Parks? | BLM | | |
| (B) *Research natural areas as defined by the National Forest Management Act* | | | BLM<br><br>US Forest Service | | Not likely |
| (C) *Outstanding natural areas as defined by 43 CFR 2070;* | | | | | |
| (D) *Areas designated by the Oregon Natural Heritage Plan* | | | | | A copy of the plan can be accessed at http://orbic.pdx.edu/documents/2010NAP.pdf |

## OREGON CHEMICAL PROCESS MINING REGULATIONS – BASELINE DATA METHODOLOGY LEAD AGENCIES - July, 2012

| *Baseline Data Collection Topic* | *Lead State Agency* | *Supporting State Agency* | *Federal Agency to be Involved?* | *Local Agency to be Involved?* | *Notes/Ideas* |
|---|---|---|---|---|---|
| **Other Items**<br><br>**Wetland Delineation** | | | | | Use Army Corps of Engineers Delineation Manual of 1987 - Arid West Supplement |
| **Visual Resource Management** | | | BLM | | Baseline data adequate to complete a visual resource assessment is needed |

---

## Additional ODFW Suggestions on Wildlife Survey:

**Suggested Baseline Wildlife / Habitat Surveys**

**Calico – Grassy Mtn. Gold Mine**

**Sage Grouse** – The project area lies within low density sage grouse habitat. If the applicant desires a site specific assessment the following data will be needed. Characterization of sage grouse habitat, helicopter lek surveys in spring (April), ground search for sage grouse presence and/or sign in summer fall and winter. Refer to the Greater Sage-Grouse Conservation Assessment and Strategy for Oregon for details on survey protocols.

**Nesting Raptors** – Aerial or ground surveys with accepted protocol typically in May – June. Species of concern that are known or suspected to occur in the project area are; golden eagle, ferruginous hawk, burrowing owl, and Swainson's hawk.

**State Sensitive Species** – The following state sensitive species may occur in the project area; and should be surveyed for with accepted protocol; pygmy rabbit, white-tailed jack rabbit, Columbia spotted frog, bats, potential amphibians in springs and wetlands.

**Springs, wetlands, and riparian areas**, are considered essential limited habitats in Eastern Oregon. They need to be delineated and surveyed to characterize wildlife use. Include areas outside the project perimeter that may be influenced by groundwater use associated with the mine.

# OREGON CHEMICAL PROCESS MINING REGULATIONS – BASELINE DATA METHODOLOGY LEAD AGENCIES - July, 2012

**Habitat Classification** - The department will recommend that permitting agencies require mitigation as a condition of approval. Baseline vegetation data collection will need to provide sufficient detail to facilitate habitat characterization.

**Encounter Surveys** – Record observations of other wildlife species encountered during directed surveys other field work.

**Minimum Suggested Survey areas**

**Permit area plus 2 mile buffer*** - sage grouse, golden eagles and wetland delineation. Depending on the outcome of hydrological testing any spring or wetland affected by project water use should be included regardless of distance.

**Permit area plus .5 mile buffer*** - for all other species and along access and haul roads.

*Follow survey distance requirements in the adopted survey protocol if greater than the distance suggested above.

---

As discussed by the TRT, 7/16/12

# Appendix C
## Monitoring Well Site-specific Testing Plan

## 1. MONITORING WELL SITE SPECIFIC TESTING PLAN

A site specific testing plan for each of the twelve (12) wells proposed for sampling for the baseline monitoring program is included below.

### 1.1. GW-1 (OWRD Tag Number 107469)

Background:

GW-1 was completed January 18, 1989, with 12-inch steel casing from 2 feet above ground surface to a depth of 8 feet and 4-inch PVC casing to a depth of 135.5 feet. The well has 4-inch PVC screen from 135.5 feet to 155.5 feet. The total completed well depth is reported to be 155.5 feet.

The static water level in GW-1 was measured at 51.98 feet bgl on May 31, 2012. With a calculated purge volume (three times the casing volume) of 189 gallons, the well was pumped for 10 minutes at 19 gpm to adequately purge the well prior to sample collection on May 31, 2012.

RMEC Draft Report (2012) described the well as a good producer, able to maintain a sustained flow rate of over 20 gpm. Static water level was reported to be approximately 60 feet.

Test Plan:

A temporary 3-inch Grundfos pump supplied by Curt Hysell will be installed to a depth of 120 feet. Based on testing conducted in May 2012, it is anticipated that the well will be pumped at approximately 19 gpm for a minimum of 10 minutes to achieve the desired purge volume prior to sample collection.

### 1.2. GW-4 (OWRD Tag Number 107460)

Background:

A driller's report could not be located for GW-4, but RMEC (2012) reports that GW-4 was constructed January 31, 1989, with 8-inch steel surface casing and 4-inch PVC well casing. The screened interval is reported to be 280 to 350 feet, and the total completed well depth is reported to be 370 feet.

The static water level in GW-4 was measured at 80.93 feet bgl on May 30, 2012. With a calculated purge volume of 570 gallons, the well was pumped for 30 minutes at 20 gpm to adequately purge the well prior to sample collection.

RMEC Draft Report (2012) reported that the well has a static water level of approximately 83 feet and is capable of producing 12 to 19 gpm of sustained flow.

Test Plan:

A temporary 3-inch Grundfos pump supplied by Curt Hysell will be installed to a depth of 120 feet. Based on testing conducted in May 2012, it is anticipated that the well will be

pumped at approximately 20 gpm for a minimum of 30 minutes to achieve the desired purge volume prior to sample collection.

### 1.3. Prod 1 (OWRD Tag Number 107457)

Background:

Prod 1 was completed December 10, 1988, with 10-inch steel casing from 2 feet above ground surface to a depth of 99 feet and 6-inch PVC casing to a depth of 425 feet. The well is constructed with 6-inch PVC screen from 245 to 255 feet, from 325 to 355 feet, and from 380 to 420 feet. The total completed bore depth is reported to be 550 feet.

Prod 1 is an artesian well, and RMEC reported water flowing from an unknown location around the well casing (RMEC 2012). On June 1, 2012, artesian flow rate was measured at 1.6 gpm.

Test Plan:

Purge pumping is not required and static water level will not be measured. Artesian flow rate from the well will be measured.

### 1.4. PW-1 (OWRD Tag Number 109353)

Background:

PW-1 was completed December 1, 1989, with 8-inch steel surface casing to an unknown depth and 6-inch casing from 2 feet above ground surface to a depth of 320 feet and between 340 and 400 feet. The well has 6-inch stainless steel screen from 320 to 340 feet and from 400 to 420 feet. The total completed bore depth is 555 feet.

The static water level in PW-1 was measured at 51.96 feet bgl on June 1, 2012. With a calculated purge volume of 2,143 gallons, the well was pumped for 71 minutes at 30 gpm to adequately purge the well prior to sample collection. Upon completion of June 1, 2012, sampling, the 3-inch Grundfos pump used for testing was permanently installed for future use.

RMEC Draft Report (2012) noted the well has a static water level of approximately 64 feet and is capable of producing 10 gpm of sustained flow. Discharge was initially black-grey in color, but cleared up after sustained pumping.

Test Plan:

There is a permanent pump installed in PW-1 so it will not be necessary to install a temporary pump for purging and testing. The installed 3-inch Grundfos pump is set at 280 feet bgl. Based on testing conducted in June 2012, it is anticipated that the well will be pumped at approximately 30 gpm for at least 70 minutes to achieve the desired purge volume prior to sample collection.

### 1.5. PW-4 (OWRD Tag Number 109351)

Background:

PW-4 was completed November 20, 1989, with 10-inch steel surface casing to a depth of 40 feet and 6-inch PVC liner to a depth of 280 feet and between 300 and 340 feet. The well is screened with 6-inch PVC screen from 280 to 300 feet and from 340 to 360 feet. The total completed depth of the well is reported to be 375 feet.

The static water level in PW-4 was measured at 77.27 feet bgl on May 30, 2012. With a calculated purge volume of 1,354 gallons, the well was pumped for 68 minutes at 20 gpm to adequately purge the well prior to sample collection.

RMEC Draft Report (2012) noted the well has a static water level of 79.7 feet and is capable of producing 40 gpm of sustained flow with a black-grey color and milky consistency.

Test Plan:

A temporary 3-inch Grundfos pump will be installed to a depth of 140 feet. Based on testing conducted in May 2012, it is anticipated that the well will be pumped at approximately 20 gpm for at least 68 minutes to achieve the desired purge volume prior to sample collection.

### 1.6. BLM (OWRD Tag Number 109398)

Background:

The BLM (Owyhee Ridge) Well was completed August 16, 1972, with 10-inch steel surface casing to an unknown depth and 6-inch steel casing to a depth of 147 feet and 6-inch stainless steel screen from 159 to 166 feet. The total completed well depth is recorded as 175 feet.

The static water level in the BLM Well was measured at 156.3 feet bgl on May 31, 2012. With a calculated purge volume of 103 gallons, the well was pumped for 21 minutes at 5 gpm to adequately purge the well prior to sample collection.

RMEC Draft Report (2012) noted the well has a static water level of approximately 157 feet and is capable of producing 2 gpm of sustained flow.

Test Plan:

A temporary 3-inch Grundfos pump will be installed to an approximate depth of 170 feet. Based on testing conducted in May 2012, it is anticipated that the well will be pumped at approximately 5 gpm for 21, 42, and 84 minutes to purge 3, 6, and 12 casing volumes, respectively.

### 1.7. 59760 (OWRD Tag Number 107462)

Background:

Well 59760 was completed October 11, 1993, with 10-inch steel surface casing to an unknown depth and 6-inch PVC casing to a depth of 163 feet and PVC screen between 163 and 203 feet. The total completed well depth is reported to be 203 feet.

The static water level in the Well 59760 was measured at 86.11 feet bgl on May 31, 2012. With a calculated purge volume of 307 gallons, the well was pumped for 35 minutes at 9 gpm using the existing pump to adequately purge the well prior to sample collection.

RMEC Draft Report (2012) noted the well has a static water level of approximately 131 feet and is capable of producing less than 10 gpm of sustained flow.

Test Plan:

There is a permanent pump installed in Well 59760 so it will not be necessary to install a temporary pump for purging and testing. The pump size and setting depth are not known. RMEC Draft Report (2012) indicates a pump intake depth of 200 feet below the top of the casing. Based on testing conducted in May 2012, it is anticipated that the well will be pumped at approximately 9 gpm for at least 35 minutes to achieve the desired purge volume prior to sample collection.

### 1.8. 59761 (OWRD Tag Number 109400)

Background:

Well 59761 was completed October 4, 1993, with 8-inch steel surface casing to an unknown depth and 4-inch PVC casing to a depth of 97 feet and 4-inch PVC screen between 97 and 117 feet. The total completed well depth is reported to be 118 feet.

The static water level in the Well 59761 was measured at 86.45 feet bgl on May 31, 2012. With a calculated purge volume of 55 gallons, the well was pumped for 14 minutes at 4 gpm to adequately purge the well prior to sample collection.

RMEC Draft Report (2012) noted the well has a static water level of approximately 89 feet and is capable of producing 4 gpm of sustained flow.

Test Plan:

A temporary 3-inch Grundfos pump will be installed to an approximate depth of 110 feet. Based on testing conducted in May 2012, it is anticipated that the well will be pumped at approximately 4 gpm for at least 14 minutes to achieve the desired purge volume prior to sample collection.

### 1.9. 59763 (OWRD Tag Number 109356)

Background:

Well 59763 was completed October 15, 1993, with 10-inch steel surface casing to an unknown depth and 6-inch PVC casing to a depth of 293 feet and 6-inch PVC screen between 293 and 323 feet. The total completed well depth is reported to be 324 feet.

The static water level in the Well 59763 was measured at 277.63 feet bgl on May 30, 2012. With a calculated purge volume of 180 gallons, the well was pumped for 36 minutes at 6 gpm to adequately purge the well prior to sample collection.

RMEC Draft Report (2012) noted the well has a static water level of approximately 282 feet and is capable of producing 4 gpm of sustained flow.

Test Plan:

A temporary 3-inch Grundfos pump will be installed to a depth of approximately 320 feet. Based on testing conducted in May 2012, it is anticipated that the well will be pumped at approximately 6 gpm for at least 36 minutes to achieve the desired purge volume prior to sample collection.

### 1.10. 59766 (OWRD Tag Number 107468)

Background:

Well 59766 was completed October 2, 1993, with 8-inch steel surface casing to an unknown depth and 4-inch PVC casing to a depth of 25 feet and 4-inch PVC screen between 25 and 45 feet. The total completed well depth is reported to be 45 feet.

The static water level in the Well 59766 was measured at 24.06 feet bgl on June 1, 2012. With a calculated purge volume of 35 gallons, the well was pumped for 12 minutes at 3 gpm to adequately purge the well prior to sample collection.

RMEC Draft Report (2012) noted the well has a static water level of approximately 27 feet and is capable of producing 2 gpm of sustained flow with a clear-murky brown color.

Test Plan:

A temporary 2-inch or 3-inch Grundfos pump will be used. Anticipated setting depth is approximately 36.5 feet. Based on testing conducted in June 2012, it is anticipated that the well will be pumped at approximately 3 gpm for at least 12 minutes to achieve the desired purge volume prior to sample collection.

### 1.11. 59772 (OWRD Tag Number 109352)

Background:

Well 59772 was completed October 19, 1993, with 8-inch steel surface casing to an unknown depth and 4-inch PVC casing to a depth of 146 feet and 4-inch PVC screen between 146 and 206 feet. The total completed well depth is reported to be 207 feet.

The static water level in the Well 59772 was measured at 92.53 feet bgl on May 31, 2012. With a calculated purge volume of 390 gallons, the well was pumped for 20 minutes at 19.5 gpm to adequately purge the well prior to sample collection.

RMEC Draft Report (2012) noted the well has a static water level of approximately 94.6 feet and is estimated to be capable of producing 13 gpm of flow, and is reported as being a good well.

Test Plan:

A temporary 3-inch Grundfos pump will be installed to a depth of 120 feet. Based on testing conducted in May 2012, it is anticipated that the well will be pumped at approximately 19 gpm for at least 20 minutes to achieve the desired purge volume prior to sample collection.

### 1.12. Bishop Well

Background:

The Bishop Well was completed June 18, 1963, with 12-inch steel casing to a depth of 150 feet. The casing is perforated from 135 to 145 feet. The total completed well depth is reported to be 482 feet.

The static water level in the Bishop Well was measured at 105.43 feet bgl on June 1, 2012. With a calculated purge volume of 6,597 gallons, the well was pumped for 320 minutes at 20 gpm using the existing pump to adequately purge the well prior to sample collection.

Test Plan:

There is a functional pump installed in the well. Based on testing conducted in June 2012, it is anticipated that the well will be pumped at approximately 20 gpm for at least 320 minutes to achieve the desired purge volume prior to sample collection.

## 2. SPRING SITE SPECIFIC TESTING PLAN

A site specific testing plan for each of the seven (7) springs proposed for sampling for the baseline monitoring program is included below.

### 2.1. Government Corral Springs

Background:

Government Corral Springs was visited and sampled on May 31, 2012. The springs feed stock tanks. Upon arrival at the Government Corral Springs (Figure 2), there was no flow to the stock tanks. A valve was opened and allowed to flow to the tank for approximately 10 minutes prior to measuring field parameters and collecting water samples. Flow was initially very turbid, but gradually cleared. Flow rate declined over time, and was determined at the time of sampling by measuring the time required to fill a 1-liter bottle. Flow was measured to be 1.3 gpm. The valve was shut following sample collection.

Figure 1. Photographs of Government Corral Springs

Test Plan:

Government Corral Springs is normally valved off, so the isolation valve will be opened and the spring will be allowed to flow for a minimum of 15 minutes prior to field water quality measurements and sample collection. Samples will be collected directly from the discharge pipe above the stock tank.

## 2.2. Sagebrush Springs

Background:

Sagebrush Springs was visited and sampled on May 31, 2012. Sagebrush Springs consists of surface flow through a vegetated channel to a reservoir created by an earthen embankment, both located north of the access road. In addition, there are stock tanks located north of the road. After initially examining discharge to Sagebrush pond (low pond inflow rate, stagnant pond conditions), continuous spring discharge to the stock tanks (Figure 3) was identified approximately 500 feet south of Sagebrush pond. Since steady state flowing conditions were present, field parameters were immediately measured and samples collected. Flow rate was determined by measuring the time required to fill a 1-liter bottle. Flow was measured to be 1.9 gpm.

Figure 2. Photographs of Sagebrush Springs

Test Plan:

Sagebrush Springs is continuously flowing, therefore field water quality measurements and sample collection will occur upon arrival at the site. Samples will be collected directly from the discharge pipe above the stock tank.

### 2.3. Grassy Springs Stock Tank

Background:

Grassy Springs was visited and sampled on June 7, 2012. The springs continuously feed a large round sheet metal watering tank. At the time of the visit, borderline low-flow conditions were observed (Figure 4). Since steady state flowing conditions were present, field parameters were immediately measured and samples collected. Flow rate was determined by measuring the time required to fill a 1-liter bottle. Flow was measured to be 0.2 gpm.

Figure 3. Photographs of Grassy Springs Stock Tank

Test Plan:

Grassy Springs is continuously flowing, therefore field water quality measurements and sample collection will occur upon arrival at the site. Samples will be collected directly from the discharge pipe above the watering tank.

## 2.4. Twin Springs North

Background:

Twin Springs North was visited and sampled on June 7, 2012. The springs continuously feed a stock tank (Figure 5). Since steady-state flowing conditions were present, field parameters were immediately measured and samples collected. Flow rate was determined by measuring the time required to fill a 1-liter bottle. Flow was measured to be 1.7 gpm.

Figure 4. Photograph of Twin Springs North Stock Tank

Test Plan:

Twin Springs North is continuously flowing, therefore field water quality measurements and sample collection will occur upon arrival at the site. Samples will be collected directly from the discharge pipe located above the stock tank.

## 2.5. Twin Springs South

Background:

Twin Springs South was visited and sampled on June 7, 2012. The springs continuously feed a stock tank (Figure 6). Since steady state flowing conditions were present, field parameters were immediately measured and samples collected. Flow rate was determined by measuring the time required to fill a 1-liter bottle. Flow was measured to be 9.4 gpm.

Figure 5. Photograph of Twin Springs South Stock Tank

Test Plan:

Twin Springs South is continuously flowing, therefore field water quality measurements and sample collection will occur upon arrival at the site. Samples will be collected directly from the discharge pipe located above the stock tank.

## 2.6. Sourdough Springs Upper

Background:

Sourdough Springs Upper was visited and sampled on June 7, 2012. The springs continuously feed a stock tank (Figure 7). Since steady state flowing conditions were present, field parameters were immediately measured and samples collected. Flow rate was determined by measuring the time required to fill a 1-liter bottle. Flow was measured to be 0.4 gpm.

Figure 6. Sourdough Springs Upper Stock Tank

Test Plan:

Sourdough Springs Upper is continuously flowing, therefore field water quality measurements and sample collection will occur upon arrival at the site. Samples will be collected directly from the discharge pipe located above the stock tank.

## 2.7. Whiskey Springs

Background:

Whiskey Springs was visited and sampled on June 7, 2012. The springs continuously feed a large circular stock tank (Figure 8). Since steady state flowing conditions were present, field parameters were immediately measured and samples collected. Flow rate was determined by measuring the time required to fill a 1-liter bottle. Flow was measured to be 0.9 gpm.

Figure 7. Photograph of Whiskey Springs Stock Tank

Test Plan:

Whiskey Springs is continuously flowing, therefore field water quality measurements and sample collection will occur upon arrival at the site. Samples will be collected directly from the discharge pipe located above the stock tank.

# Appendix D
## Field Data Forms

### Geology and Soils

- Rock and Soil Sampling Reporting Form

### Visual Resources

- BLM Visual Contrast Rating Worksheet

### Cultural Resources

- Oregon SHPO Survey Cover
- Oregon Archaeological Site Form

### Aquatic Resources

- DSL Streamflow Duration Field Assessment Form
- Amphibian and Reptile Time Constrained Collecting Data Form
- General Encounter (Visual Encounter) Data Form
- Wildlife Inventory QA Forms 1-7

### Terrestrial Vegetation

- Vegetation Survey Reporting Form
- Daubenmire Field Form

### Wetlands

- DSL Wetland Determination/Delineation Report Requirements Checklist
- DSL Wetland Delineation/Determination Report Cover Form
- USACE Wetland Determination Data Form – Arid West Region
- DSL Streamflow Duration Field Assessment Form

### Terrestrial Wildlife

- Greater Sage-grouse Lek Survey Data Form
- Greater Sage-grouse Encounter Transect Data Form
- Golden Eagle Nest Location Data Form
- Raptor Nest Location Data Form
- Bat Detection and Roost Data Forms
- Pygmy Rabbit Transect Data Form
- White-tailed rabbit (and other hares) Transect Data Form
- Avian Observation Data Sheet
- General Encounter (Visual Encounter) Data Form
- Wildlife Inventory QA Forms 1-7

# Geology and Soils Field Form

## *Calico Resources Grassy Mountain Project*
## *Rock and Soil Sampling Reporting Form*

| | |
|---|---|
| **Project:** Calico Resources – Grassy Mountain Exploration Project | **Sample Site #:** |
| | |
| Field Surveyor(s):<br>1.<br>2. | Date:<br>Time:<br>Weather: |
| Location Description: | GPS Coordinates<br><br>N:<br>E: |
| Section, Township, Range: | Datum: |
| Land Ownership (BLM, private): | Accuracy: |
| | |
| Description (rock or soil type/color/grain size/weathering-alteration/fractures/other): | |
| Sample # and Lab Analysis: | |
| Attitude: | |
| Slope: | |
| Contacts: | |
| **Additional Notes:** | |
| | |
| **Site Photographs** (Include Photo # and Direction)**:** | |
| | |
| | |
| | |
| | |
| | |
| | |

# Terrestrial Vegetation Field Forms

## *Calico Resources Grassy Mountain Project*
## *Vegetation* Survey *Reporting Form*

| **Project:** Calico Resources – Grassy Mountain Exploration Project | **Transect Name/#:** |
|---|---|
| | |
| Field Surveyor(s):<br>1.<br>2. | Date:<br>Time:<br>Weather: |
| Location Description: | GPS Coordinates<br>N:<br>E: |
| Vegetation Class: (i.e., sagebrush/grassland: grassland) | |
| Plot Size: | |
| Section, Township, Range: | Datum: |
| Land Ownership (BLM, private): | Accuracy: |
| | |
| Est. % bare ground: | Aspect: |
| Slope: | Vegetation Height: |
| Disturbance (grazing, roads, etc.): | |
| | |

| **Common Name** | **Botanical Name** | **Quantity** |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

## *Calico Resources Grassy Mountain Project*
## *Vegetation* Survey *Reporting Form*

**TES Species Observed** (circle one)**: YES NO**

☐ USFWS
☐ BLM
☐ State of Oregon

| Common Name | Botanical Name | Quantity |
|---|---|---|
| | | |
| | | |
| | | |

Population Notes:

**Noxious Weeds/Invasive Species Observed** (circle one)**: YES NO**

☐ Class A
☐ Class B
☐ Class C

| Common Name | Botanical Name | Quantity |
|---|---|---|
| | | |
| | | |
| | | |

Population Notes:

**Additional Vegetation Survey Notes:**

**Site Photographs** (include photo #, brief description and direction)**:**

## Daubenmire

Page ____ of ____

| Study Number | Date | Examiner | Allotment Name & Number | Pasture |
|---|---|---|---|---|
| Transect Number and Location | | | Number of Quadrats | |

| Plant Species | Quadrat | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |

| Plant Species | Quadrat | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |

Illustration 9

## Daubenmire Summary

Page ____ of ____

| Study Number | Date | Examiner | Allotment Name & Number | Pasture |
|---|---|---|---|---|
| | | | | |

| Study Location | Number of Quadrats |
|---|---|
| | |

| Cover Class | Mid-Point | Species | | Species | | Species | | Species | | Species | | Species | | Species | | Species | | Species | | Species | | Species | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | |
| | | Number | Product | Number | Product | Number | Product | Number | Product | Number | Product | Number | Product | Number | Product | Number | Product | Number | Product | Number | Product | Number | Product |
| 1 1-5% | 2.5 | | | | | | | | | | | | | | | | | | | | | | |
| 2 5-25% | 15 | | | | | | | | | | | | | | | | | | | | | | |
| 3 26-50% | 37.5 | | | | | | | | | | | | | | | | | | | | | | |
| 4 51-75% | 62.5 | | | | | | | | | | | | | | | | | | | | | | |
| 5 76-95% | 85 | | | | | | | | | | | | | | | | | | | | | | |
| 6 96-100% | 97.5 | | | | | | | | | | | | | | | | | | | | | | |
| Total canopy | | | | | | | | | | | | | | | | | | | | | | | |
| Number of Samples | | | | | | | | | | | | | | | | | | | | | | | |
| % canopy cover | | | | | | | | | | | | | | | | | | | | | | | |
| Species composition | | | | | | | | | | | | | | | | | | | | | | | |
| Frequency | | | | | | | | | | | | | | | | | | | | | | | |

Illustration 10

# Visual Resources Field Form

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

# VISUAL CONTRAST RATING WORKSHEET

Date

District

Resource Area

Activity (program)

## SECTION A. PROJECT INFORMATION

1. Project Name

2. Key Observation Point

3. VRM Class

4. Location
Township _____
Range _____
Section _____

5. Location Sketch

## SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

| | 1. LAND/WATER | 2. VEGETATION | 3. STRUCTURES |
|---|---|---|---|
| FORM | | | |
| LINE | | | |
| COLOR | | | |
| TEXTURE | | | |

## SECTION C. PROPOSED ACTIVITY DESCRIPTION

| | 1. LAND/WATER | 2. VEGETATION | 3. STRUCTURES |
|---|---|---|---|
| FORM | | | |
| LINE | | | |
| COLOR | | | |
| TEXTURE | | | |

## SECTION D. CONTRAST RATING ☐ SHORT TERM ☐ LONG TERM

1. DEGREE OF CONTRAST

| ELEMENTS | FEATURES: LAND/WATER BODY (1) | | | | VEGETATION (2) | | | | STRUCTURES (3) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Strong | Moderate | Weak | None | Strong | Moderate | Weak | None | Strong | Moderate | Weak | None |
| Form | | | | | | | | | | | | |
| Line | | | | | | | | | | | | |
| Color | | | | | | | | | | | | |
| Texture | | | | | | | | | | | | |

2. Does project design meet visual resource management objectives? ☐ Yes ☐ No
(Explain on reverse side)

3. Additional mitigating measures recommended?
☐ Yes ☐ No (Explain on reverse side)

Evaluators' Names Dates

SECTION D. (Continued)

Comments from item 2.

Additional Mitigating Measures (See item 3)

★US GOVERNMENT PRINTING OFFICE: 2002-773-001-46077

# Wetlands Field Forms

## WETLAND DELINEATION / DETERMINATION REPORT COVER FORM

This form must be included with any wetland delineation report submitted to the Department of State Lands for review and approval. A wetland delineation report submittal is not "complete" unless the fully completed and signed report cover form and the required fee are submitted. Attach this form to the front of an unbound report or include a hard copy of the completed form with a CD/DVD that includes a single PDF file of the report cover form and report (minimum 300 dpi resolution) and submit to: **Oregon Department of State Lands, 775 Summer Street NE, Suite 100, Salem, OR 97301-1279.** A single PDF attachment of the completed cover from and report may be e-mailed to **Wetland_Delineation@dsl.state.or.us**. For submittal of PDF files larger than 10 MB, e-mail instructions on how to access the file from your ftp or other file sharing website. Fees can be paid by check or credit card. Make the check payable to the Oregon Department of State Lands. To pay the fee by credit card, call 503-986-5200.

| | |
|---|---|
| ☐ Applicant ☐ Owner Name, Firm and Address: | Business phone #<br>Mobile phone # (optional)<br>E-mail: |
| ☐ Authorized Legal Agent, Name and Address: | Business phone #<br>Mobile phone #<br>E-mail: |

I either own the property described below or I have legal authority to allow access to the property. I authorize the Department to access the property for the purpose of confirming the information in the report, after prior notification to the primary contact.

Typed/Printed Name: _____ Signature: _____

Date: Special instructions regarding site access:

**Project and Site Information** (using decimal degree format for lat/long.,enter centroid of site or start & end points of linear project)

| | |
|---|---|
| Project Name: | Latitude: Longitude: |
| Proposed Use: | Tax Map # |
| Project Street Address (or other descriptive location): | Township Range Section QQ<br>Tax Lot(s) |
| City: County: | Waterway: River Mile:<br>NWI Quad(s): |

**Wetland Delineation Information**

| | |
|---|---|
| Wetland Consultant Name, Firm and Address: | Phone #<br>Mobile phone #<br>E-mail: |

The information and conclusions on this form and in the attached report are true and correct to the best of my knowledge.

Consultant Signature: Date:

**Primary Contact** for report review and site access is ☐ Consultant ☐ Applicant/Owner ☐ Authorized Agent

Wetland/Waters Present? ☐ Yes ☐ No | Study Area size: Total Wetland Acreage:

| **Check Box Below if Applicable:** | **Fees:** |
|---|---|
| ☐ R-F permit application submitted | ☐ Fee payment submitted **$** |
| ☐ Mitigation bank site | ☐ Fee ($100) for resubmittal of rejected report |
| ☐ Wetland restoration/enhancement project (not mitigation) | ☐ No fee for request for reissuance of an expired report |
| ☐ Industrial Land Certification Program Site | |
| ☐ Reissuance of a recently expired delineation | |
| Previous DSL # Expiration date _____ | |

| **Other Information:** | Y | N | |
|---|---|---|---|
| Has previous delineation/application been made on parcel? | ☐ | ☐ | If known, previous DSL # |
| Does LWI, if any, show wetland or waters on parcel? | ☐ | ☐ | |

**For Office Use Only**

| | | |
|---|---|---|
| DSL Reviewer: _____ | Fee Paid Date: ____ / ____ / ____ | DSL WD # _____ |
| Date Delineation Received: ___ / ____ / ____ | DSL Project # _____ | DSL Site # _____ |
| Scanned: ☐ Final Scan: ☐ | DSL WN # _____ | DSL App. # _____ |

**Oregon Department of State Lands**
**Wetland Determination/Delineation Report Requirements Checklist**
(This form summarizes requirements and is not meant to replace the rules, OAR 141-090-0005 to 0055).

Report Name: _____ City/County: _____
Consultant firm/Contact: _____ Firm's Project No.: _____
Department WD #: _____ Department Reviewer: _____
Other Department File #: _____ Phone: (503) 986-5_____ Date: _____
Date ☐ Mailed ☐ Faxed ☐ E-mailed to: Consultant _____ Applicant/Agent _____

☐ Report does not conform to many requirements (OAR 141-090-0005 to 0055) and cannot be approved. .
Please note the WD file number above if/when the report is revised and resubmitted. A complete new report and $100 fee is required for resubmittal of a rejected report.

*Items marked with an ☒ indicate that information provided within the report **does not** meet requirements, is not clear, or appears to be incorrect.*

**Technical Requirements:**

☐ Work conducted according to 1987 *Corps of Engineers Wetland Delineation Manual* including regional supplements and applicable guidance, and any supporting technical or guidance documents issued by the Department.

Comments:

**Cover Form** ☐ **Correct form and fully completed**
**Report Format** ☐ **Report conforms to the report format provided by the Department**
Comments:

## Text Order and Required Sections:

**A) Landscape Setting and Land Use**

☐ Detailed description of the study area, its landscape setting, and previous and current land uses

Comments:

**B) Site Alterations**

☐ Description, approx. year, and analysis of any site alterations that likely affected the presence, location or boundaries of any waters of the state in the study area

Comments:

**C) Precipitation Data and Analysis**

☐ Precipitation on the day of AND approximately 1- 2 weeks before the date(s) of the field investigation(s)
☐ Percent of normal precipitation for the water year to date AND monthly percent of normal precipitation using appropriate NRCS WETS table for each of the 3 months preceding the field investigation

Comments:

**D) Methods**

☐ Date(s) of the field investigation
☐ Site-specific methods for conducting the field investigation, selection of sample plot locations, determination of boundaries
☐ Data include a sample plot that best represents each wetland and best represents adjacent non-wetland(s)
☐Paired sample plots located close enough to either side of the wetland boundary to substantiate boundary location
☐ Data are provided for all mapped hydric soil units
☐If the study area does not contain wetlands, at least one sample plot was placed in each of the lowest topographic areas or other locations most likely to contain wetlands to document site conditions.
☐Field investigation of farmed site conducted in early growing season. If field work done at other time, appropriate method and requirements applied.
☐If other waters are present, methodology described for determination of OHWL or HMT.

Comments:

**E) Description of All Wetlands and Other Non-Wetland Waters**

☐ Wetland and other water characteristics and boundaries including whether they extend offsite

Comments:

**F) Deviation from LWI or NWI**

☐ If any deviation, wetland determination data and explanation provided

Comments:

**G) Mapping Method**

☐ Methodology described including mapping precision estimate

Comments:

**H) Additional Information**

☐ Documentation of fish presence or absence in a stream or ditch, using published maps or reports or information from an authoritative source (e.g., ODFW)

☐ Data sufficient to determine whether or not an identified water area is artificially created entirely from upland and/or the purpose for which it was created

☐ Hydrology monitoring data, including spring hydrology data for farmed sites

☐ Additional aerial photographs (e.g. historical aerials used as basis of jurisdictional determination)

☐ Data or other information on pre-disturbance conditions

Comments:

**I) ☐ Results and Conclusions**

Comments:

**J) ☐ Required Disclaimer**

## Appendices Requirements:

**A) Figures:**

☐ Location map showing the precise study area location

☐ Tax lot map showing the entire parcel(s)

☐ LWI map, if available, or NWI map(s), including map name(s) showing the study area

☐ County soil survey map showing the study area location/boundaries and a legend with all soil series mapped in the study area and hydric status

☐ Aerial photograph(s)-at least 1 recent photo labeled with month/year or at least 3 early growing season aerials for farmed sites

☐ Wetland map(s) comprising the wetland determination and/or delineation including:

- ☐ The boundaries of the entire parcel(s) subject to investigation; or if only a portion of the parcel(s) investigated, the study area boundary in relation to the parcel boundaries
- ☐ Existing structures, areas of fill, water diversions, or other major alterations
- ☐ All water features and their boundaries
- ☐ Numbered sample plots corresponding to data forms
- ☐ North arrow, scale bar,& legend
- ☐ Ground level photograph location and direction of view
- ☐ Wetland map(s) scale suitable for the study area size and for legibility
- ☐ Mapping method and precision statement

Comments:

**B) Data Forms:**

☐ Data forms from the appropriate regional Manual supplement, or provided by the Department

☐ Data form fully and correctly completed for each sample plot

☐ Data collected supports indicator selected and determination made

☐ Name(s) of field investigator(s)

☐ Standard NRCS soils terminology

☐ Soil profile description matches hydric soil indicator(s) selected, if any

☐ Latin botanical name for all plant species listed

☐ Wetland indicator status for all plant species listed and correct

☐ Correct method applied to determine dominant plant species

Comments:

**C) ☐ Ground Level Color Photographs submitted and with captions**

Comments:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: _____ City/County: _____ Sampling Date: _____

Applicant/Owner: _____ State: _____ Sampling Point: _____

Investigator(s): _____ Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | |
|---|---|
| Hydrophytic Vegetation Present? Yes _____ No _____<br>Hydric Soil Present? Yes _____ No _____<br>Wetland Hydrology Present? Yes _____ No _____ | **Is the Sampled Area within a Wetland?** **Yes** _____ **No** _____ |

Remarks:

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: _____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | _____ = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: _____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | _____ = Total Cover | | |
| **Herb Stratum** (Plot size: _____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | _____ = Total Cover | | |
| **Woody Vine Stratum** (Plot size: _____) | | | |
| 1. | | | |
| 2. | | | |
| | _____ = Total Cover | | |

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: _____ (A)

Total Number of Dominant Species Across All Strata: _____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: | |
|---|---|---|
| OBL species _____ | x 1 = | _____ |
| FACW species _____ | x 2 = | _____ |
| FAC species _____ | x 3 = | _____ |
| FACU species _____ | x 4 = | _____ |
| UPL species _____ | x 5 = | _____ |
| Column Totals: _____ (A) | | _____ (B) |

Prevalence Index = B/A = _____

**Hydrophytic Vegetation Indicators:**

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** **Yes** _____ **No** _____

Remarks:

## SOIL

Sampling Point: _____

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth | Matrix | | Redox Features | | | | | |
|---|---|---|---|---|---|---|---|---|
| (inches) | Color (moist) | % | Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: _____

Depth (inches): _____

**Hydric Soil Present? Yes _____ No _____**

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

**Wetland Hydrology Present? Yes _____ No _____**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# Streamflow Duration Field Assessment Form

| | | |
|---|---|---|
| Project # / Name | Assessor | |
| Address | | Date |
| Waterway Name | Coordinates at downstream end (ddd.mm.ss) Lat. N | |
| Reach Boundaries | Long. W | |
| Precipitation w/in 48 hours (cm) | Channel Width (m) | ☐ Disturbed Site / Difficult Situation (Describe in "Notes") |

**Observed Hydrology**

% of reach w/observed surface flow_____

% of reach w/any flow (surface or hyporheic) _____

# of pools observed_____

**Observations**

**Observed Wetland Plants (and indicator status):**

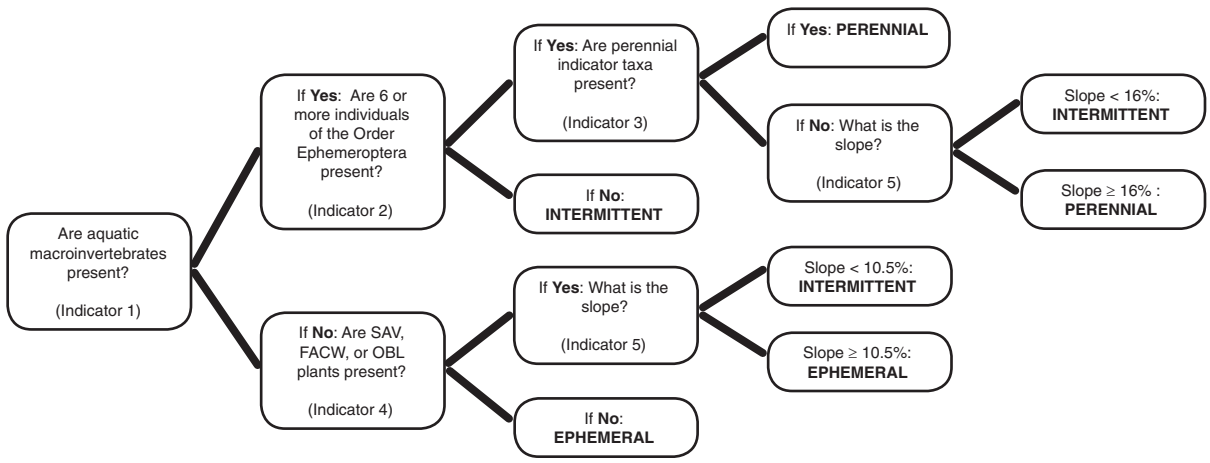
**Observed Macroinvertebrates:**

| Taxon | Indicator Status | Ephemer-optera? | # of Individuals |
|---|---|---|---|

**Indicators**

| | | |
|---|---|---|
| 1. Are aquatic macroinvertebrates present? | ☐ Yes | ☐ No |
| 2. Are 6 or more individuals of the Order Ephemeroptera present? | ☐ Yes | ☐ No |
| 3. Are perennial indicator taxa present? (refer to Table 1) | ☐ Yes | ☐ No |
| 4. Are FACW, OBL, or SAV plants present? (Within ½ channel width) | ☐ Yes | ☐ No |
| 5. What is the slope? (In percent, measured for the valley, not the stream) | _____ % | |

**Conclusions**




**Single Indicators:**

☐ Fish

☐ Amphibians

**Finding:**

☐ Ephemeral

☐ Intermittent

☐ Perennial

# Streamflow Duration Field Assessment Form

**Notes:** single indicator conclusions, description of disturbances or modifications that may interfere with indicators, etc.)

**Difficult Situation:**

Describe situation. For disturbed streams, note extent, type, and history of disturbance.

- ☐ Prolonged Abnormal Rainfall / Snowpack
  - ☐ Below Average
  - ☐ Above Average
- ☐ Natural or Anthropogenic Disturbance
- ☐ Other: _____

**Additional Notes:** (sketch of site, description of photos, comments on hydrological observations, etc.) Attach additional sheets as necessary.

**Ancillary Information:**

- ☐ Riparian Corridor
- ☐ Erosion and Deposition
- ☐ Floodplain Connectivity

**Observed Amphibians, Snake, and Fish:**

| Taxa | Life History Stage | Location Observed | Number of Individuals Observed |
|---|---|---|---|
| | | | |

# Cultural Resources Field Forms

# STATE OF OREGON
# CULTURAL RESOURCES SURVEY COVER

**Please submit reports unbound.**

Author(s) Name: Last _____ First _____
Title of Report: _____
Date: _____ District/Contractor: _____
Agency/Client: _____ Agency Report Number: _____

County (ies): _____ Township: _____N/S Range: _____E/W Section: _____
Quad(s): _____ Project Acres: _____ Survey Acres: _____

CD Submitted? _____Yes _____No Does this replace a draft? _____Yes _____No

Project activity: _____ Archaeological Permit No.: _____
Field note location: _____ Curation Location: _____ Accession # _____
Sites Found? _____Yes _____No Prehistoric #:_____ Historic #:_____
Historic Properties. Found? _____Yes _____No Historic Property #: _____
TCP(s) found? _____Yes _____No Isolates Found? _____Yes _____No Isolate #: _____

Keywords: _____

SHPO Trinomial #: Temporary site #

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

**REPORT CHECK LIST**

Report should contain the following items:

- Location, legal description (T,R,S) with USGS map
- Clear objectives and methods
- A summary of the results of the survey
- A report of where the survey records and data are stored
- A research design that:
  - Details survey objectives
  - Details specific methods
  - Details expected results
  - Details area surveyed including map(s) and legal location information
  - Details how results will feedback in the planning process (i.e., recommendations, future work)

**Please be sure that any electronic version of a report submitted to Oregon SHPO has its figures, appendices, attachments, correspondence, graphic elements, etc., compiled into one single PDF file. Thank you!**

# Site Identification

*Enter New Site Identifying information*

* = Required Field

**Smithsonian Trinomial** To be assigned

**Agency/Field ID** *

**Site Name**

**Recording Date** *

# Administrative Information

* = Required Field

Managing Office

Owners

| Owner | Former Owner? |
|---|---|

Site Ownership/Management Notes

National Register Status Statements

*Each Reviewing organization - including the field organization - can enter a status statement*

| Status | Role | Date | Statement Author |
|---|---|---|---|

# Site Type

* = Required Field

Dimensions

Length * Width * Units

Calculated Area

Depth of cultural deposit *

Site Type *

Features

Cultural Periods *

General Age *

# Location

* = Required Field

County *

*For sites in urban setting, give appropriate address in access description*

Cadastral Locations

Township * Range * Sec * 1/4 1/4 1/4 DLC# Meridian

Map References

Map Name * Revision Year *

UTM Coordinates *

Type * East * North * Method * Zone * Datum *

Describe access to site from permanent feature and how to find primary datum:

# Environmental Information

* = Required Field

Depositional Environment

Soil Description:

Culturally Signifigant Vegetation:

Culturally Signifigant Vegetation Description:

Water Sources

| Name of Water Body | Type | Stream Type | Stream Class | Distance | Direction |
|---|---|---|---|---|---|

Site Setting

*Discuss environmental setting of site relevant to site location, including on-site vegetation, topography, dated landforms and formation processes):*

Province/Basin

| | | | |
|---|---|---|---|
| Province | Elev From (ft) * | Elev to (ft) * | Aspect |
| Basin | Subbasin | | |
| Drainage Name | | | |

# Site Description

* = Required Field

Site Description and Site Function *
*Include discussion of site condition, found artifacts and other relevant information*

Date(s) of use
*(Be as specific as possible. 0 if unknown, may not leave blank.)*

From * To * BC/AD/BP * Dating Method *

Site Observations
*The following were observed:*

Artifacts Present * Quantity *

Estimated Counts

Historic Prehistoric

Rock Art

Rock Art Present

# Rock Art

* = Required Field

Number of Loci: *

Number of Panels: *

Panels are Situated on:

Panel Description

Panel Aspects

Type of Rock:

Formation name if known and additional information

Degree of Patination

Category and Techniques

Petroglyphs

Pictographs

Colors

Color Description

Rock Art Superimposed?

Superimposed art description

Natural Destructive Agents

Natural Destructive Agents Description

Other Destructive Agents

Other Destructive Agents Description

Detailed Description

## Site Condition

| * = Required Field<br>Visit Date * |
|---|
| Site Condition * |
| Recorder *(Name and Organization)* |
| Artifacts or Samples Collected? |
| Activities/Work Performed * |
| Impacts and Impact Agents |
| Protective Measures Recommended/Present Use & Expected |

## Bibliographic References

Bibliographic References

| Author | Publication Year | Title | Agency | Primary Reference? |
|---|---|---|---|---|
| | | | | |

# Aquatic Resources Field Forms

# Streamflow Duration Field Assessment Form

| | | |
|---|---|---|
| Project # / Name | Assessor | |
| Address | | Date |
| Waterway Name | Coordinates at downstream end (ddd.mm.ss) Lat. N | |
| Reach Boundaries | Long. W | |
| Precipitation w/in 48 hours (cm) | Channel Width (m) | ☐ Disturbed Site / Difficult Situation (Describe in "Notes") |

**Observed Hydrology**

% of reach w/observed surface flow_____

% of reach w/any flow (surface or hyporheic) _____

# of pools observed_____

**Observations**

**Observed Wetland Plants (and indicator status):**

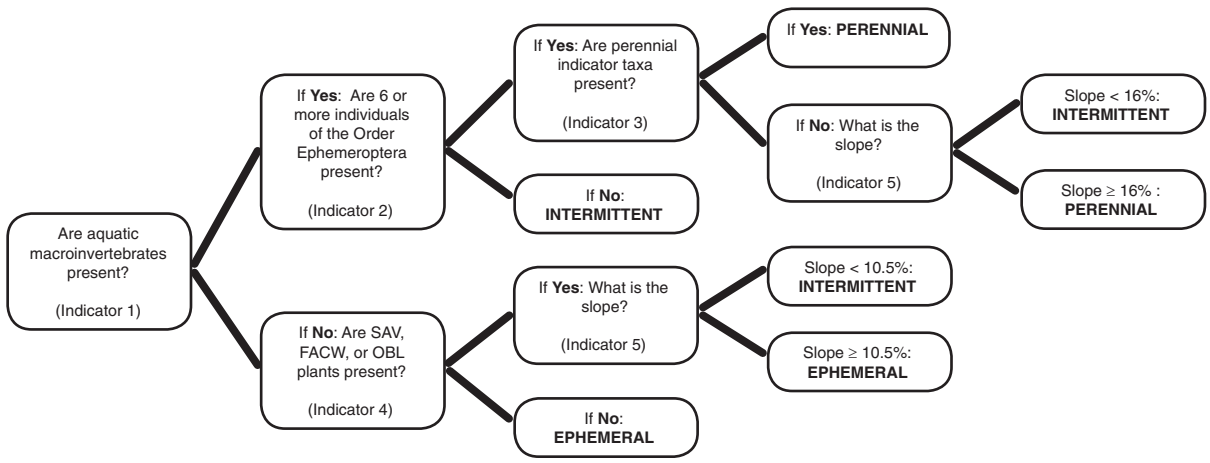
**Observed Macroinvertebrates:**

| Taxon | Indicator Status | Ephemer-optera? | # of Individuals |
|---|---|---|---|

**Indicators**

| | | |
|---|---|---|
| 1. Are aquatic macroinvertebrates present? | ☐ Yes | ☐ No |
| 2. Are 6 or more individuals of the Order Ephemeroptera present? | ☐ Yes | ☐ No |
| 3. Are perennial indicator taxa present? (refer to Table 1) | ☐ Yes | ☐ No |
| 4. Are FACW, OBL, or SAV plants present? (Within ½ channel width) | ☐ Yes | ☐ No |
| 5. What is the slope? (In percent, measured for the valley, not the stream) | _____ % | |

**Conclusions**




**Single Indicators:**

☐ Fish

☐ Amphibians

**Finding:**

☐ Ephemeral

☐ Intermittent

☐ Perennial

# Streamflow Duration Field Assessment Form

**Notes:** single indicator conclusions, description of disturbances or modifications that may interfere with indicators, etc.)

**Difficult Situation:**

Describe situation. For disturbed streams, note extent, type, and history of disturbance.

- ☐ Prolonged Abnormal Rainfall / Snowpack
  - ☐ Below Average
  - ☐ Above Average
- ☐ Natural or Anthropogenic Disturbance
- ☐ Other: _____

**Additional Notes:** (sketch of site, description of photos, comments on hydrological observations, etc.) Attach additional sheets as necessary.

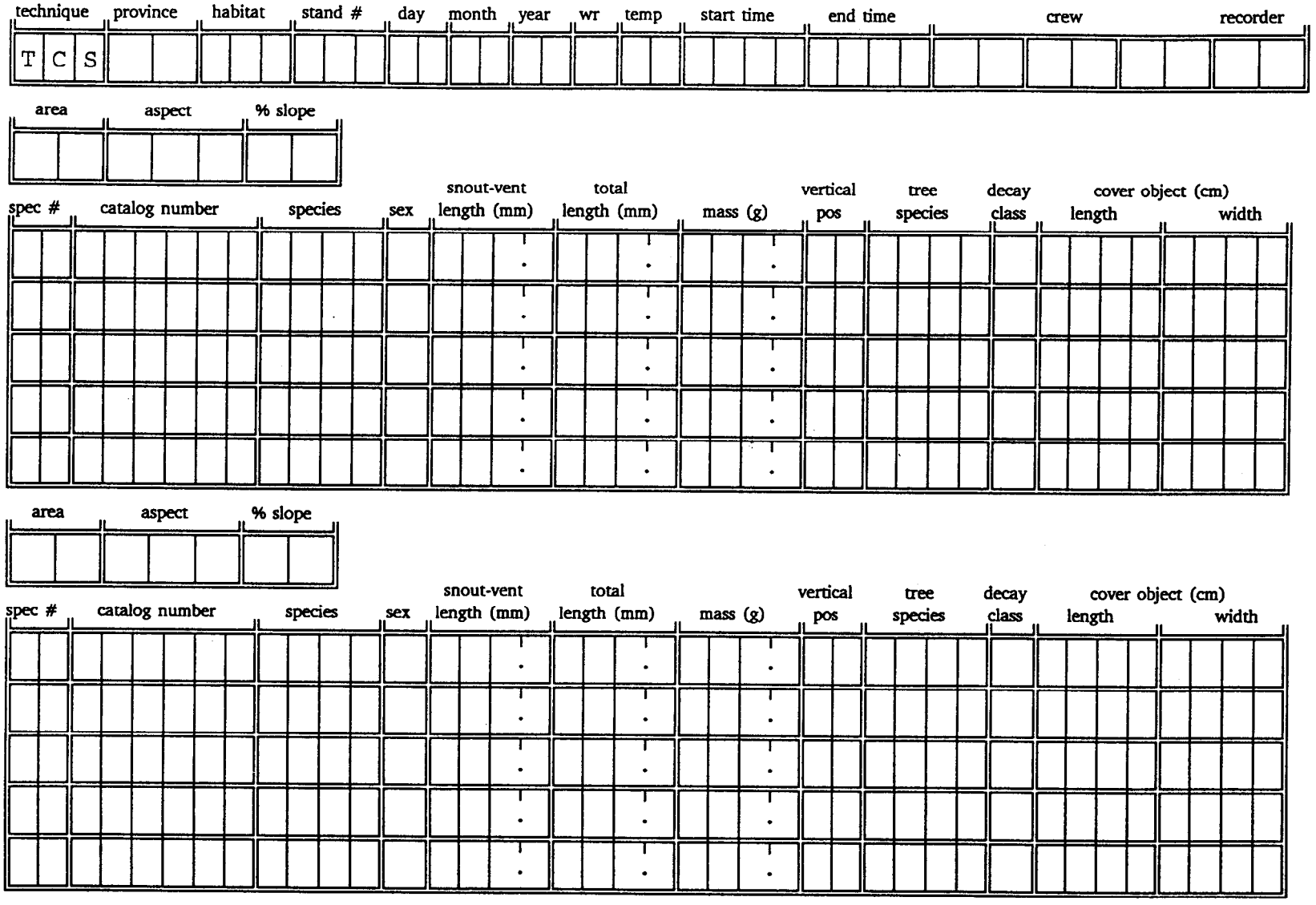
**Ancillary Information:**

- ☐ Riparian Corridor
- ☐ Erosion and Deposition
- ☐ Floodplain Connectivity

**Observed Amphibians, Snake, and Fish:**

| Taxa | Life History Stage | Location Observed | Number of Individuals Observed |
|---|---|---|---|
| | | | |

# TIME-CONSTRAINED COLLECTING DATA




VERTICAL POSITION:

1 - On Surface
2 - Under Rock (not in talus)
3 - Under Rock in Talus
4 - Under Log
5 - In Log
6 - Under Bark on Snag
7 - Under Bark on Log
8 - Under Bark on Ground < 1 m from Snag
9 - Under Bark on Ground < 1 m from Log
10 - Under Bark on Ground (> 1 m from log or snag)
11 - Other

WEATHER:

1 - Clear
2 - Partly Cloudy
3 - Overcast
4 - Fog Only
5 - Drizzle
6 - Showers
7 - Rain
8 - Snow

Figure 7—Data sheet for recording information from time-constrained surveys. This sheet should be on waterproof paper.

## VISUAL ENCOUNTER SURVEYS

DATE _____ (M/D/Y)



MONITORING POINT # _____ OBS _____

START TIME _____ SEARCH SIDE _____ (W or E)

END TIME _____ SURVEY/VISIT # _____

SEARCH TIME TOTAL _____ SEASON (circle one): Spring Summer Fall

CLOUDS (%) _____

PRECIPITATION _____

TEMP _____

WIND _____

* Indicate the number of individuals using dot count method (TALLY), then write total in SUM column
* WIND = none, lvs moving, twigs moving, sm branches, large branches, trees moving
* TEMP = describe temp to nearest 10 degrees F
* CLOUDS = nearest 10%
* PRECIPITATION = none, drizzle, sprinkle, rain, snow

| AMPHIBIAN AND REPTILE SPECIES | TAXACODE (4-letter) | TALLY # | SUM | DETECTION | SUBSTR & LOC | SNOUT-VENT | AGE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

HERPETOFAUNA ONLY: Snout-Vent length (cm), Age (Adult / Subadult / Juvenile), Location along transect (nearest m) noted in Comments

LANDBIRD TVES: Songbirds, woodpeckers and sign; RAPTOR TVES: Raptors and rare woodpeckers (e.g. Pileated) and sign

| BIRD SPECIES | TAXACODE | | DETECTION | COMMENTS |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

MEDIUM AND LARGE MAMMAL TVES: All mammals and reptiles and their sign

| MAMMAL SPECIES | TAXACODE | | DETECTION | COMMENTS |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

INCIDENTAL SIGHTINGS: what, where, when, how many (observations outside of search time)

DETECTION: individual, scat, track, burrow, haypile, pellet , whitewash, cone pile, scratch marks, feathers, prey remains, etc.
SUBSTRATE: GR = ground, GS = grass, RK = rock, BG = bare ground, TR = tree, SH = shrub, LG = log, etc.

Entered by: _____ Date entered: _____

Checked by: _____ Date checked: _____

# Wildlife Inventory QA Form 1: Prefield QA

**Project Name:**

**Inventory Contractor:**

**Date of Submission:** **Submission #:**

The intent of the Pre-field QA is to ensure the existing data review is complete and accurate, and to approve the project plan and study design. **The QA auditor must sign off the Pre-field QA before any fieldwork can begin.** Therefore, enough turnaround time must be provided between the Pre-field QA and the start of field work to allow any changes or modifications identified through the QA process to be completed without delaying the start of field work.

## Summary of Existing Information

The intent of QA of existing data is to ensure that all relevant existing data have been used in the current inventory project. Known information can affect project needs and project planning.

1. Review of existing data sources (including interviewing local experts/species specialists) adequately covers the information known to be available for the species and project area or similar habitat, and, if relevant, has been used in the project plan. ❑Yes ❑No

   Comments/Recommendations:

## Study Design

The intent of QA of the study design is to ensure that the design adequately covers the requirements and objectives of the inventory.

1. Study objectives are clearly defined, and appropriate given the Summary of Existing Information. ❑Yes ❑No

   Comments/Recommendations:

2. Level of intensity (Presence/Not Detected, Relative Abundance, and Absolute Abundance) is appropriate for the stated objectives. ❑Yes ❑No

   Comments/Recommendations:

3. Survey methods are appropriate for the objectives stated in the project plan and are provided in sufficient detail including an explanation and description of the sampling design, with the assumptions clearly stated and an explanation of how the sampling design will be applied (e.g., random, stratified, systematic, etc.). ❑Yes ❑No

   Comments/Recommendations:

4. Study area boundaries are appropriately outlined on maps. ❑Yes ❑No

   Comments/Recommendations:

5. Locations of design components have been mapped[1]. ❑Yes ❑No

   If this is not possible prior to fieldwork, the methods for determining locations in the field are appropriate. ❑Yes ❑No

   Comments/Recommendations:

6. Is stratification necessary? ❑Yes ❑No

   If no, a justification has been provided. ❑Yes ❑No

   If yes:

   The appropriate habitats have been properly stratified and identified for sampling and the stratification scheme used has been explained adequately. ❑Yes ❑No

   A pre-study field check has been conducted to confirm habitat stratification. ❑Yes ❑No

   The appropriate strata have been mapped. ❑Yes ❑No

   Comments/Recommendations:

[1] For an explanation of the survey design hierarchy, please see Section 2 in *Species Inventory Fundamentals* (RIC 1998).

7. Are the primary and secondary target taxa listed in the project plan? ❑Yes ❑No

   Comments/Recommendations:

8. The problems/questions and resulting hypotheses are clearly stated and sufficient data will be collected to test the hypothesis or provide meaningful conclusions. ❑Yes ❑No

   Comments/Recommendations:

9. Required sample size has been correctly calculated or method is in place to determine when sampling is complete. ❑Yes ❑No

   Comments/Recommendations:

10. Statistical tests of significance being used are appropriate for interpreting the final results. ❑Yes ❑No

    Comments/Recommendations:

11. Sources of bias have been identified and managed appropriately, measures of possible error have been used and appropriate levels of accuracy and precision have been identified. ❑Yes ❑No

    Comments/Recommendations:

12. Survey timing is appropriate for the species life history, survey objectives and project area characteristics (e.g. winter accessibility). ❑Yes ❑No

    Comments/Recommendations:

13. A contingency plan is in place for the field component (e.g. in case of access problems due to helicopter unavailability during fire season, poor weather conditions, difficult terrain, etc.). ❑Yes ❑No

    Comments/Recommendations:

## Personnel and Equipment

The intent of QA on personnel and equipment is to ensure that the field crew has appropriate expertise as listed in the project plan, that the crew has the required permits, and that each crew member has the appropriate certifications and training.

1. Each member of the field crew has the appropriate expertise for the species to be inventoried. ❑Yes ❑No

   Comments/Recommendations:

2. Equipment being used is appropriate for the survey methods. ❑Yes ❑No

   Comments/Recommendations:

3. Pre-season testing and training has been completed on all equipment and for all techniques. ❑Yes ❑No

   Comments/Recommendations:

## Data Form Preparation

The intent of the Data Form Preparation QA is to ensure that (1) field crews are equipped with a process for recording accurate, meaningful field data, regardless of whether they use hardcopy or electronic dataforms, and (2) the resulting data can be entered into an appropriate WSI Data Capture Template using appropriate data-fields and codes.

1. Do field crews have a dataform(s) containing data-fields relevant to their recording needs? ❑Yes ❑No

   Comments/Recommendations:

2. Do field crews have immediate access to all definitions of data-fields and codes? ❑Yes ❑No

   Comments/Recommendations:

3. If required by the contract requirements, do field crews have a dataform for recording incidental observations? For example, some contracts require that observations of any non-target red or blue-listed species encountered during an inventory must be recorded. ❑Yes ❑No

   Comments/Recommendations:

# Wildlife Inventory QA Form 2: Prefield QA Summary

**Project Name:**
**Inventory Contractor:**
**Date of Submission:** **Submission #:**

Please provide a summary of the overall QA of the inventory and include any additional comments not covered in the forms above. If project deliverables are unacceptable, a new summary form must be completed for each subsequent submission, including the submission number, date of submission and comments as to whether or not the recommendations have been adequately incorporated.

## Summary of Existing Information

❑ Acceptable ❑ Unacceptable (see recommendations below)

Comments/Recommendations:

## Study Design

❑ Acceptable ❑ Unacceptable (see recommendations below)

Comments/Recommendations:

## Personnel and Equipment

❑ Acceptable ❑ Unacceptable (see recommendations below)

Comments/Recommendations:

## Data Form Preparation

❑ Acceptable ❑ Unacceptable (see recommendations below)

Comments/Recommendations:

## Wildlife Inventory QA Form 3: Pre-field QA Sign-off

**Project Name:**

**Inventory Contractor:**

**Date of Submission:** **Submission #:**

The prefield preparations and study design are acceptable and field work can begin.

Print Name of QA Contractor Signature Date

## Wildlife Inventory QA Form 4: Field QA Checklist

**Project Name:**

**Inventory Contractor:**

**Date of Submission:** **Submission #:**

The intent of the field QA is to detect and prevent potential errors in field data collection. Errors that occur in the field are difficult if not impossible to detect after the fact, and are extremely expensive to correct. In order to avoid cumulative errors in the data, the field QA should occur at the very beginning of the field season. The QA team should be able to arrange the field check on short notice in order to accommodate the inventory contract schedule and weather dependent field opportunities. Feedback from the **QA auditor** must be provided to the crew leader and contract monitor immediately if there are problems.

1. Data forms have been completed correctly using the correct codes and fields (according to the specifications in the WSI Data Capture Template). ❑Yes ❑No

   Comments/Recommendations:

2. Data have been collected using the proper methods and techniques including proper and accurate use of field equipment. ❑Yes ❑No

   Comments/Recommendations:

3. Experimental design has not been altered in the field (i.e. no statistical violations have been made). ❑Yes ❑No

   Comments/Recommendations:

4. Complete UTM coordinates based on NAD83 data have been recorded for all design components, and any wildlife observations, or attempted observations (i.e. Null observations). ❑Yes ❑No

   Comments/Recommendations:

5. If required by contract, encounters with non-target red or blue-listed species are being recorded (UTM coordinates, date, observer name) if observed in the field. ❑Yes ❑No

   Comments/Recommendations:

# Wildlife Inventory QA Form 5: Reporting QA Checklist

**Project Name:**

**Inventory Contractor:**

**Date of Submission:** **Submission #:**

The QA team should review the final deliverables to ensure that all project requirements have been met and that all data and products are consistent and correct. This includes ensuring that the original data are received, that data are entered correctly into the project database, and that data are consistent between original data forms, data capture templates, maps and reports. To reduce the likelihood of major revisions being required on the final products, the contract monitor may wish to have the QA auditor review draft deliverables before reviewing the final deliverables. A review of the final report by an external reviewer (i.e. a peer review) is highly recommended.

## Data Entry and Analysis

1. Electronic data are captured in the digital database ❑Yes ❑No

   All mandatory columns have been filled out. ❑Yes ❑No

   All UTMs are based on the NAD 83 datum. ❑Yes ❑No

   All UTMs have a zone, easting and northing. ❑Yes ❑No

   Entered a label and UTM coordinates for each survey. ❑Yes ❑No

   All user-defined data-fields and codes have been described in the metedata. ❑Yes ❑No

   Any additional information required by the standards is included as separate spreadsheets in Excel, and final report has been included as a single PDF document. ❑Yes ❑No

   Comments/Recommendations:

   _____

   _____

2. Excel data capture templates have been compared with data forms for data entry errors, and have been found to be accurate. ❑Yes ❑No

   A total of _____ data forms have been checked to ensure accuracy.

   Comments/Recommendations:

   _____

   _____

3. All GIS spatial data complies with the specifications described in *the selected species methodology*. ❑Yes ❑No

   Comments/Recommendations:

## Final Report

1. The report presents a strong case in support of the conclusions reached. ❑Yes ❑No

   Comments/Recommendations:

2. There is sufficient background in the introduction to provide context including adequate background references. ❑Yes ❑No

   Comments/Recommendations:

3. There are references to similar methods that have been properly used and to which adequate comparisons have been made. ❑Yes ❑No

   Comments/Recommendations:

4. Methods are clearly explained and were not altered or modified. ❑Yes ❑No

   If altered or modified, the alteration/modification was explained and justified. ❑Yes ❑No

   Comments/Recommendations:

5. There is a clear presentation of results, and these results are clearly separated from discussion or conjecture. ❑Yes ❑No

   Comments/Recommendations:

6. Statements of method, literature references, or conjecture are in the appropriate section (i.e. not in the Results section when they should properly be a part of another section). ❑Yes ❑No

   Comments/Recommendations:

7. There is proper use of statistics (i.e., tests of significance are used where possible and appropriate). ❑Yes ❑No

   Comments/Recommendations:

8. The discussion adequately addresses issues or points relative to the results, and attention has been paid to potential weaknesses and to errors or limitations of the project. ❑Yes ❑No

   Comments/Recommendations:

9. The report has been grammar and spell-checked, the writing style is concise and coherent and the report follows appropriate formats. ❑Yes ❑No

   Comments/Recommendations:

## Wildlife Inventory QA Form 6: Field QA and Reporting QA Summary

**Project Name:**

**Inventory Contractor:**

**Date of Submission:** **Submission #:**

### Field QA *(Not Mandatory)*

❑ Acceptable ❑ Unacceptable (see recommendations below)

Comments/Recommendations:

### Reporting QA

**Data Entry and Analysis**

❑ Acceptable ❑ Unacceptable (see recommendations below)

Comments/Recommendations:

**Final Report**

Comments/Recommendations:

**Additional Comments**

## Wildlife Inventory QA Form 7: Project QA Sign-off

**Project Name:**

**Inventory Contractor:**

**Date of Submission:** **Submission #:**

All project deliverables are complete and acceptable. ❑Yes ❑No

Print Name of QA Contractor Signature Date

# Terrestrial Wildlife Field Forms

# Greater Sage-grouse Lek Survey Data Form

| | |
|---|---|
| ❑ Sage Grouse ❑ Sharp-tailed Grouse | County: |
| Lek Route Name (or enter 'none'): | Date of Survey: |
| Observer: | Official Sunrise: |
| Weather (temp, wind, precip, cloud cover): | Start Time: End Time: |
| Summary: Active Leks | Comments: |
| Total Males Counted | |

| | | | | | Lek Location* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | UTM Datum_____ UTM Zone_____ | | PREFFERED WGS 84 Decimal Degrees | | |
| Time | Statewide Lek ID | Lek Name | # Males (or total birds for sharp-tails) | # Females | Easting | Northing | Latitude | Longitude | Comments |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

*Record location if lek has moved, if previously recorded location is inaccurate, or if lek is new. The preferred location format is WGS 84 decimal degrees.

**Animal Observation Form – Greater Sage-Grouse Encounter Transect** **Page ___/___**

**Project** _____ **Survey** _____ **Study Area** _____

**Transect Label** _____ Stratum _____ BEU _____ Trans Comment _____

Trans: Lgth _____ Bearing _____ UTM: Start ____/_____/_____ End ____/_____/_____

**Obs Date** _____/____/____

| Obs Day | Time | Ceiling | CC | Wind | Precip | Temp |
|---|---|---|---|---|---|---|
| Start | | | | | | |
| End | | | | | | |

Surveyors

_____

| Obs # | Time | Spp | Spp Desc | | | | | | | | | Detection UTM | | | BEU | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | UC | | | J | | | A | | | Zone | East | North | | |
| | | | UC | M | F | UC | M | F | UC | M | F | | | | | |
| | | **B-** | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |
| | | B- | | | | | | | | | | | | | | |

## Coding Instructions for the Animal Observation Form- Upland Gamebird Encounter Transect

| Field Name | Description | Requirement |
|---|---|---|
| Project (Name) | The name of the project as it has been specified on the Wildlife Inventory Project Description Form (freeform text). | Mandatory |
| Survey (Name) | The name of the survey as it has been specified on the Wildlife Inventory Survey Description Form (freeform text). | Mandatory |
| Study Area (Name) | The name of the Study Area as it has been specified on the Wildlife Inventory Survey Description Form (freeform text). | Mandatory |
| Transect Label | The label of the transect within which animal observations are made. Transects must be labelled so that each transect is unique within a project. A reused transect within a project takes the original label given to that transect, (regardless whether it is used for the same survey or not). | Mandatory |
| Stratum | The name of the stratum (from the list on the Wildlife Inventory Survey Description Form) in which the Design Component is established. | Mandatory if Design Component stratified. |
| BEU | The Broad Ecosystem Unit within which the Design Component is located. Codes: refer to "Broad Ecosystem Units of British Columbia" (by Lea et al.) available on the FTP site; ftp://wldux2.env.gov.bc.ca/pub/TEM/beu3app.doc | Mandatory |
| Trans Comment | A description of the area in which the transect occurs (freeform text). e.g. road; railroad; seismic line. | Mandatory |
| Trans Lgth [km] | The distance from the start to the end point of the transect (km). | Mandatory: RA/AA Optional: PN |
| Trans Bearing | The orientation of the transect (degrees, values 0 to 360). | Mandatory if transect is a straight line. |
| Transect UTM: Start / End | The start/end location of the transect using UTM grid location. Record UTM as zone, easting, and northing. A map (and/or aerial photograph) showing the transects delineated must accompany this data form. | Mandatory |
| Obs Date | The year/month/day (YYYY/MM/DD) on which the data on the form were gathered in the field. e.g. 1995/04/17. | Mandatory |
| Time Start/End | The time at which surveying the specified Design Component commences and finishes. Use the 24 hour clock. | Mandatory |
| Ceiling | The height of cloud cover. Record the height at the start and end of the survey. Codes: a/b tt = above/ below tree tops; a/b r = above/below ridges; or h/v h = high/ very high. | Optional |

| Field Name | Description | Requirement |
|---|---|---|
| CC | The extent of cloud cover at the start and end of the survey. Codes: 1 = clear; 2 = scattered clouds (<50%); 3 = scattered clouds (>50%); 4 = unbroken clouds. | Mandatory |
| Wind | The strength of wind at the start and end of the survey using the Beaufort Scale. Codes: 0 = calm (< 2 km/h); 1 = light air (2-5 km/h); 2 = light breeze, leaves rustle (6-12 km/h); 3 = gentle breeze, leaves and twigs constantly move 13-19 km/h); 4 = moderate breeze, small branches move, dust rises (20-29 km/h); 5 = fresh breeze, small trees sway (30-39 km/h); 6 = strong breeze, large branches moving, wind whistling (40-50 km/h). | Mandatory |
| Precip | The type of precipitation at the start and end of the survey. Codes: N = None; F = Fog; M = Misty drizzle; D = Drizzle; LR = Light Rain; HR = Hard Rain; S = Snow. | Mandatory |
| Temp | The temperature at the start and end of the survey (degrees Celsius). | Mandatory |
| Surveyors | The names of the people conducting the survey during the specified Design Component Visit. The full name is not required, but initials should be provided to identify the person as one of the surveyors listed on the Wildlife Inventory Survey Description form. | Mandatory |
| Obs # | Observations must be numbered so that each is unique within a transect. For each new transect, start at 1 and continue numbering observations sequentially. | Mandatory |
| Time | The time the observation was made. Use the 24 hour clock. | Mandatory |
| Spp | The 5-letter code that uniquely identifies the taxa of the observed animal (the first letter has already been filled in). Species codes: see manual No. 2, Vertebrates of BC. If it is not possible to identify the animal in the field, record the best taxonomic description possible. | Mandatory |
| Spp Desc | The number of birds (of a given species) according to age class and sex present in a flock. Age Class: J= Juvenile; A = Adult; UC = Unclassified. Sex : M = Male; F = Female; UC = Unclassified. | Mandatory |
| Detection UTM | The UTM grid location of the detected animal. Record UTM as zone, easting, and northing. A map (and/or aerial photograph) must accompany this data form that shows the location of the detected animal(s). | Mandatory: RA/AA<br>Optional: PN |

| Field Name | Description | Requirement |
|---|---|---|
| BEU | The Broad Ecosystem Unit within which the animal observations are being made. Codes: refer to “Broad Ecosystem Units of British Columbia” (by Lea et al.) available on the FTP site; ftp://wldux2.env.gov.bc.ca/pub/TEM/beu3app.doc | Mandatory |
| Comments | Additional information that may be relevant to the observation (freeform text). | Optional |

# Golden Eagle Nest Report Form

Return to: Frank B. Isaacs, 24178 Cardwell Hill Dr., Philomath, OR 97370 or fbisaacs@peak.org (541-929-7154)

**Obs. Method** (circle)**:** Boat, Fixed Wing Aircraft , Ground, Helicopter, Webcam.
**Start Time:** _____ **End Time:** _____
**Duration of Obs:** _____
**Weather** (circle best descriptions)**:**
**Temperature Range:** _____
**Precipitation:** Dry, Fog, Misty Rain, Rain, Sleet/Hail, Snow.
**Wind:** Calm, Gusty, Light, Moderate, Windy
**Wind Direction:** Variable
**or From:** N, NE, E, SE, S, SW, W, NW
**Visibility:** Excellent, Good, Fair, Poor
**Do you think weather or lighting had a negative effect on your observation?** Yes, No

**Observation Date:** _____
**Site Name:** _____
**Breeding Area Number:** _____
(*From annual report, or to be assigned if new this year*)
**Nest Number(s):** _____
(*From annual report, or to be assigned if new this year*)
**Primary Observer Name:** _____
_____
**Affiliation:** _____
**Phone Number:** _____
**E-Mail:** _____
**Other Observers:** _____
_____

**Obs. Point & Nest Locations** (We request NAD83, decimal degrees. Please note if using another format.)
**Obs. Point Coordinates: Datum:** _____ **Lat. DD:** _____ **Long. DD:** _____
**Bearing & Distance to Nest (**Magnetic or True North?)**:** _____
(Record any additional Observation Point locations, and bearings, distance & distance units to nest(s) in Note field.)
**Note:** _____
_____
_____

**Nest Coordinates** (for the nest that is being used)**:** Estimated, Actual
**Datum:** _____ **Lat. DD:** _____ **Long. DD:** _____
**Access Directions** (provide details if access is complicated by unmarked roads or private property)**:**
_____
_____
_____

**Do you suspect the eagles are using an unseen nest?** Yes, No, Maybe
**Mapping done?** Yes, No **Photo?** Yes, No **Sketch?** Yes, No
(Please attach maps, sketches or photos to the field form. Items of interest include nest & perch locations, flight paths.)

**Observation Information**
**Number of Breeding Adults: ___ Total # of Golden Eagles: _____ Estimated?** Yes, No
**Nest Substrate:** Cliff, Tree, Other Nest Structure (if manmade structure, describe on next line)
**Nest Substrate Note:** _____
**Tree species:** _____ **Tree is:** Alive, Dead-Topped, Dead
**Other Species at Cliff** (circle)**:** American Kestrel, Bald Eagle, Bighorn Sheep, Great Horned Owl, Peregrine Falcon, Prairie Falcon, Raven, Red-tailed Hawk, Turkey Vulture - Other (explain in Notes)
**Were eagles disturbed by human activities?** Yes, No **If so, explain in notes.**
**Field Notes** (describe what you saw here or attach copies of original field notes):
_____
_____
_____
_____
_____
_____(Continue Field Notes on back/page 2 at bottom.)

# Golden Eagle Nest Report Form

## GOLDEN EAGLE DETAILS

(Please use appropriate values from the lists provided.)

**Look for leg bands or other markers on each eagle and include details in notes if observed.**

**Adults & Subadults:** Age = Adult or Subadult / Gender = Female, Male or Unknown

***Activities:*** *Aggression at Another GE or Other Species, Brooding Position, Copulation, Delivering Prey, Disturbed, Drinking, Eating, Feeding Young, Flying, Hunting, Incubating Position, Nestbuilding, Perching, Standing on Nest, Vocalizing, Other (explain in notes).*

| | Age | Gender | Primary Activity (describe other activities in notes) |
|---|---|---|---|
| **Eagle 1** | | | |
| **Eagle 2** | | | |
| **Eagle 3** | | | |
| **Eagle 4** | | | |

If more than 4 (excluding nestlings), describe additional eagles in notes.

**Nestlings:** If nestling(s) observed, age according to the following Age Guide (from Hoechlin 1976):

| |
|---|
| 0-7 days - Short grayish-white down. |
| 8-14 days - Long wooly white down developing. |
| 15-21 days - Long wooly white down nearly complete. |
| 22-28 days - Pin feathers begin to show as dark spots on edges of wings and tail. |
| 29-35 days - Body evenly mottled dark and white; head and neck white. |
| 36-42 days - Body nearly feathered (dark) except for head and legs. |
| 43-49 days - Body nearly feathered and head partly feathered. |
| 50-56 days - Feathers nearly complete; tufts of down on head. |
| 57-63 days - Feathers complete; "golden" hackles and white at base of tail visible. |
| 64+ days - Feathered and ready to fledge. |

***Nestling Activities:*** *Aggression At Sibling, Begging, Being Fed, Eating, Flapping, Flapping & Hopping, Lying On Nest, Perched Out Of Nest, Standing On Nest, Vocalizing, Other (explain in notes).*

| | Age | Primary Activity (describe other activities in notes) |
|---|---|---|
| **Nestling 1** | | |
| **Nestling 2** | | |
| **Nestling 3** | | |

**Do you suspect there could be more nestlings than were observed?** Yes, No

**Field Notes** (Continued from front/page 1)**:**

( Please attach additional field notes, maps, photos, sketches, etc.)

**RAPTOR NEST LOCATION**

Greater Sage-grouse Lek Survey Data Form

## Raptor Inventory Data Sheet

**Raptor Nest ID*:**_____ **Date First Observed*:**_____

**Species:**_____ **Observed By:**_____

**Location:** Township _____ N S, Range _____ E W **Ownership:** P S FS BLM LU Other____

Section _____, _____ ¼ _____ ¼ Nest Substrate*: _____

UTM Zone:_____ Height of Substrate (ft.):_____

Geo. Datum (circle one): NAD 27 NAD 83 Nest Height On/In Substrate (ft.):_____

Northing: _____, Easting:_____ Nest Exposure: _____

Nest Site Elevation: _____ Vegetation Type*:_____

USGS Quad Name: _____ Remarks/Comments: Physical Relationship to Other Nests, Proximity to Potential Disturbances, Etc.:

BLM Map Name: _____ _____

County: _____ _____

Nest Status*: _____ _____

Nest Condition*: _____ _____

Number of young: _____ _____

* Use existing data codes ſ Historic Nest Record Monitoring of Nest Activity on Reverse Side

**Map/Photo**

## NEST HISTORY

**Nest Number _____**

| * Date MM/DD/YY | * Nest Status | * Nest Condition | Number Of Eggs | Number Of Young | Observer Name | Remarks |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

*** Use existing data codes.**

**Taxonomic Code Form - Bats**

**Project** _____ **Survey** _____

**Taxonomic Group Codes for Bat Surveys.** ***Detection ☐ / Capture ☐**

| Taxon Code | Species Code: M- | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MYCA | MYCI | MYEV | MYKE | MYLU | MYSE | MYTH | MYVO | MYYU | PLTO | ANPA | EPFU | EUMA | LANO | LABL | LACI |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

[1]Create codes for bat 'taxonomic groups', then indicate what species belong to each group by marking the appropriate fields in the table above.

Comments _____

_____

**Example Taxonomic Group Code** ***Detection ☐ / Capture ☐**

| Taxon Code | Species Code: M- | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MYCA | MYCI | MYEV | MYKE | MYLU | MYSE | MYTH | MYVO | MYYU | PLTO | ANPA | EPFU | EUMA | LANO | LABL | LACI |
| MY10 | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

[1] Form Explanation: This form is used when bats observed, detected, or captured can not be determined to species. In these circumstances taxonomic group codes are created to capture as much taxonomic detail as possible (e.g. observer knows and can record that the bat is one of 2 species, instead of only recording *Myotis* in the Spp field).

**Taxonomic Code Form - Bats**

**Project** _____ **Survey** _____

**Taxonomic Group Codes for Bat Surveys.** ***Detection ☐ / Capture ☐**

| Taxon Code | Species Code: M- | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MYCA | MYCI | MYEV | MYKE | MYLU | MYSE | MYTH | MYVO | MYYU | PLTO | ANPA | EPFU | EUMA | LANO | LABL | LACI |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

[1]Create codes for bat 'taxonomic groups', then indicate what species belong to each group by marking the appropriate fields in the table above.

Comments _____

_____

**Example Taxonomic Group Code** ***Detection ☐ / Capture ☐**

| Taxon Code | Species Code: M- | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MYCA | MYCI | MYEV | MYKE | MYLU | MYSE | MYTH | MYVO | MYYU | PLTO | ANPA | EPFU | EUMA | LANO | LABL | LACI |
| MY10 | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

[1] Form Explanation: This form is used when bats observed, detected, or captured can not be determined to species. In these circumstances taxonomic group codes are created to capture as much taxonomic detail as possible (e.g. observer knows and can record that the bat is one of 2 species, instead of only recording *Myotis* in the Spp field).

**Animal Observation Form - Bat Detection** **Page___/___**

**Project** _____ **Survey** _____ **Study Area** _____

**Detect Stat Label** _____ Stratum _____ UTM _____/_____/_____ Ecosystem Form: Type / # _____/_____

Detector Type _____ Band: Broad ☐ /Narrow ☐; Hand Held ☐ /Remote ☐; *If Remote:* Night Sensitive Switch Y ☐ /N ☐ ; Timer Y ☐ /N ☐

| | Date | Time | Time | Time | Time | CC | Wind | Precip | Temp | Lunar Phase |
|---|---|---|---|---|---|---|---|---|---|---|
| **Start** | _____/____/___ | | | | | | | | | |
| **End** | _____/____/___ | | | | | | | | | |

Surveyors _____

| Obs # | Time Start | Time End | Freq KHz | Pass | Buzz | Spp | Taxon Code | Comments / Reference Recording |
|---|---|---|---|---|---|---|---|---|
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |

[Use the back side of this form if additional lines are needed for observations associated with the station labelled at the top of this form.]

**Animal Observation Form - Bat Detection** **Page___/___**

**Project** _____ **Survey** _____ **Study Area** _____

**Detect Stat Label** _____ **Obs Date Start** _____/____/___

| Obs # | Time Start / End | | Freq KHz | Pass / Buzz | | Spp | Taxon Code | Comments / Reference Recording |
|---|---|---|---|---|---|---|---|---|
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |
| | | | | | | M- | | |

[Use this side of the form only when additional lines are needed for observations associated with the station labelled on the reverse side of this form.]

**Animal Observation Form - Bat Roost Count -*Part A*** **Page___/___**

**Project** _____ **Survey** _____ **Study Area** _____

**Roost Label** _____ Stratum _____ UTM _____/_____/_____ Ecosystem Form: Type / # _____/_____

Roost: Type_____ Characteristics _____ Tot Roost Area _____

| | Date | Time | CC | Wind | Precip | Temp | Lunar Phase |
|---|---|---|---|---|---|---|---|
| **Start** | _____/____/___ | | | | | | |
| **End** | _____/____/___ | | | | | | |

Surveyors

***Roost Interior Count*** Area _____ $m^2$

| Obs # | Spp | Taxon Code | Cnt | Comments |
|---|---|---|---|---|
| | M- | | | |
| | M- | | | |
| | M- | | | |
| | M- | | | |

***Roost Emergence Patterns***

| Obs # | Time | Cnt In /Out | | Spp | Taxon Code | Comments |
|---|---|---|---|---|---|---|
| | | | | M- | | |
| | | | | M- | | |
| | | | | M- | | |
| | | | | M- | | |
| | | | | M- | | |
| | | | | M- | | |
| | | | | M- | | |
| | | | | M- | | |
| | | | | M- | | |
| | | | | M- | | |
| | | | | M- | | |
| | | | | M- | | |
| | | | | M- | | |

**Animal Observation Form - Bat Roost Count -*Part B*** **Page___/___**

**Project** _____ **Survey** _____ **Study Area** _____

DC

**Roost Label** _____ Stratum _____ UTM _____/_____/_____ Ecosystem Form: Type / # _____/_____

Roost: Type_____ Characteristics _____ Tot Roost Area _____

**Roost Diagram** (include exits/entrances)

## Coding Instructions for the Taxonomic Code Form - Bat

Form Explanation: This form is used when bats observed, detected, or captured can not be determined to species. In these circumstances taxonomic group codes are created to capture as much taxonomic detail as possible (e.g. observer knows and can record that the bat is one of 2 species, instead of only recording *Myotis* in the Spp field).

| Field Name | Description | Requirement |
|---|---|---|
| Project (Name) | The name of the project as it has been specified on the Wildlife Inventory Project Description Form (freeform text). | Mandatory |
| Survey (Name) | The name of the survey as it has been specified on the Wildlife Inventory Survey Description Form (freeform text). | Mandatory |
| Taxonomic Group Codes | Indicate for what type of survey these codes will be applied by marking the appropriate box. Create codes to represent bat 'taxonomic groups', then indicate what species belong to each group by marking the appropriate fields. | Mandatory |
| Comments | Additional information that may be relevant to the taxonomic group codes (freeform text). | Optional |

## Coding Instructions for the Animal Observation Form - Bat Detection

| Field Name | Description | Requirement |
|---|---|---|
| Project (Name) | The name of the project as it has been specified on the Wildlife Inventory Project Description Form (freeform text). | Mandatory |
| Survey (Name) | The name of the survey as it has been specified on the Wildlife Inventory Survey Description Form (freeform text). | Mandatory |
| Study Area (Name) | The name of the Study Area as it has been specified on the Wildlife Inventory Survey Description Form (freeform text). | Mandatory |
| Detection Sta Label | The label of the station at which bat observations are made. Stations must be labelled so that each station is unique within a project. | Mandatory |
| Stratum | The name of the stratum (from the list on the Wildlife Inventory Survey Description Form) in which the Station is established. | Mandatory if Station stratified. |
| UTM | The UTM grid location at the center of the Design Component. Record UTM as zone, easting, and northing. A map (and/or aerial photograph) delineating the Design Component must accompany this data form. | Mandatory |
| Ecosystem Form Type / # | The type of habitat form used to record environmental attributes at that location. Codes: GIF = Ground Inspection Form; EFF = Ecosystem Field Form; OTHER = list it. Also record the pre-printed form number from the associated Ecosystem Field Form, or | Mandatory |

| Field Name | Description | Requirement |
|---|---|---|
| | the plot # from the Ground Inspection Form. | |
| Detector Type | The brand name and model of bat detector used (freeform text). | Mandatory |
| Band: Broad / Narrow | Indicate whether a broad or narrow band bat detector was used by marking the appropriate box. | Mandatory |
| Hand Held / Remote | Indicate whether a hand held or remote bat detector was used by marking the appropriate box. | Mandatory |
| Night Sensitive Switch | Indicate whether a Night Sensitive Switch was used with the remote bat detector by marking the appropriate box. Codes: Y = Yes; N = No. | Mandatory if a remote bat detector used. |
| Timer | Indicate whether a timer was used with the remote bat detector by marking the appropriate box. Codes: Y = Yes; N = No. Note: if a timer was used, record the intervals that the detector was active in the extra start and end time fields. | Mandatory if a remote bat detector used. |
| Obs Dates Start/End | The year/month/day (YYYY/MM/DD) on which the gathering of the data on the form commences and finishes. e.g. 1995/04/17. | Mandatory |
| Time Start/End | The time at which surveying the specified Design Component commences and finishes. Use the 24 hour clock. Note: if a timer was used, record the intervals that the detector was active in the extra start and end time fields. | Mandatory |
| CC | The extent of cloud cover at the start and end of the survey. Codes: 1 = clear; 2 = scattered clouds (<50%); 3 = scattered clouds (>50%); 4 = unbroken clouds. | Mandatory |
| Wind | The strength of wind at the start and end of the survey using the Beaufort Scale. Codes: 0 = calm (< 2 km/h); 1 = light air (2-5 km/h); 2 = light breeze, leaves rustle (6-12 km/h); 3 = gentle breeze, leaves and twigs constantly move 13-19 km/h); 4 = moderate breeze, small branches move, dust rises (20-29 km/h); 5 = fresh breeze, small trees sway (30-39 km/h); 6 = strong breeze, large branches moving, wind whistling (40-50 km/h). | Mandatory |
| Precip | The type of precipitation at the start and end of the survey. Codes: N = None; F = Fog; M = Misty drizzle; D = Drizzle; LR = Light Rain; HR = Hard Rain; S = Snow. | Mandatory |
| Temp | The temperature at the start and end of the survey (degrees Celsius). | Mandatory |
| Lunar Phase | The phase of the moon during the capture period. Codes: NM=New Moon; FQ=First Quarter; SQ=Second Quarter; TQ=Third Quarter; FM=Full Moon. | Optional |
| Surveyors | The names of the people conducting the survey during | Mandatory |

| Field Name | Description | Requirement |
|---|---|---|
| | the specified Design Component Visit. The full name is not required, but initials should be provided to identify the person as one of the surveyors listed on the Wildlife Inventory Survey Description form. | |
| Obs # | Observations must be numbered so that each is unique within a station. For each new station, start at 1 and continue numbering observations sequentially. | Mandatory |
| Time Start/End | The start and end time of a bat detection period when using a hand held tunable detector. Generally this corresponds to an interval that the detector is left at a specific frequency. Use the 24 hour clock. Note: if a remote bat detector is used, only record the time that a detection was recorded in the 'time start' field. | Mandatory for hand held detectors; only 'time start' field mandatory for remote bat detectors. |
| Freq [KHz] | The frequency of the bat detector when the bat detection was made (KHz). | Mandatory for narrow band tunable bat detectors only. |
| Pass/Buzz | The number of passes and feeding buzzes detected in the specified time interval. One pass is a series of continuous sounds unbroken by silence or a feeding buzz. | Mandatory |
| Spp | The 5-letter code that uniquely identifies the taxa of the observed animal (the first letter has already been filled in). Species codes: see manual No. 2, Vertebrates of BC. If it is not possible to identify the animal in the field, record the best taxonomic description possible. | Mandatory |
| Taxon Code | Record the appropriate taxon code. This code must correspond to one of the codes already assigned for a Survey on the Taxonomic Code Form. | Mandatory |
| Comments | Additional information that may be relevant to the observation (freeform text). | Optional |
| Reference Recording | Reference recordings are listed if a good recording has been made and can be used as a reference either to aid in the identification of a species, or to document a possible rare and endangered species. Record the filename (if captured digitally by computer), or provide a reference to the audio tape on which it is recorded (freeform text). | Mandatory |

**Coding Instructions for the Animal Observation Form - Bat Roost Count**

Explanation of Form: the 'Roost Interior Count' section is only used when it is possible to observe and count the bats at the roost. The 'Roost Emergence Pattern' section is used for all observations made near the roost and is used to document information on emergence patterns.

**Part A**

| Field Name | Description | Requirement |
|---|---|---|
| Project (Name) | The name of the project as it has been specified on the Wildlife Inventory Project Description Form (freeform text). | Mandatory |
| Survey (Name) | The name of the survey as it has been specified on the Wildlife Inventory Survey Description Form (freeform text). | Mandatory |
| Study Area (Name) | The name of the Study Area as it has been specified on the Wildlife Inventory Survey Description Form (freeform text). | Mandatory |
| Roost Label | The number of the roost at which the observations are made. Roosts must be numbered so that each is unique within a project. | Mandatory |
| Stratum | The name of the stratum (from the list on the Wildlife Inventory Survey Description Form) in which the Station is established. | Mandatory if Station stratified. |
| UTM | The UTM grid location at the center of the Design Component. Record UTM as zone, easting, and northing. A map (and/or aerial photograph) delineating the Design Component must accompany this data form. | Mandatory |
| Ecosystem Form Type / # | The type of habitat form used to record environmental attributes at that location. Codes: GIF = Ground Inspection Form; EFF = Ecosystem Field Form; OTHER = list it. Also record the pre-printed form number from the associated Ecosystem Field Form, or the plot # from the Ground Inspection Form. | Mandatory |
| Roost Type | The type of roost that the bat(s) are observed in. Note: more than one code may be used when appropriate. Codes: CLIFFS = Cliffs; RKCREV = Rock Crevices; CAVES = Caves; MINES = Mines; BUILD = Building; HOLTRE = Hollow Tree; HTUBA = Hollow Trees under bark; TRECAV = Tree Cavities; FOLIAG = Foliage; OTHER = Record in field. | Mandatory |
| Roost Characteristics | The characteristics of a roost the bat(s) are observed in. Note: more than one code may be used when appropriate. Codes: HIB = Hibernaculum; SDR = Summer Day Roost; SNR = Summer Night Roost; MAC = Maternity Colony; MAR = Male Roost; OTHER = Record in field. | Mandatory |
| Tot Roost Area [m x m] | The total area of the roosting location (square meters). e.g. Cliff side or cave ceiling. | Mandatory |

| Field Name | Description | Requirement |
|---|---|---|
| Obs Dates Start/End | The year/month/day (YYYY/MM/DD) on which the gathering of the data on the form commences and finishes. e.g. 1995/04/17. | Mandatory |
| Time Start/End | The time at which surveying the specified Design Component commences and finishes. Use the 24 hour clock. | Mandatory |
| CC | The extent of cloud cover at the start and end of the survey. Codes: 1 = clear; 2 = scattered clouds (<50%); 3 = scattered clouds (>50%); 4 = unbroken clouds. | Mandatory |
| Wind | The strength of wind at the start and end of the survey using the Beaufort Scale. Codes: 0 = calm (< 2 km/h); 1 = light air (2-5 km/h); 2 = light breeze, leaves rustle (6-12 km/h); 3 = gentle breeze, leaves and twigs constantly move 13-19 km/h); 4 = moderate breeze, small branches move, dust rises (20-29 km/h); 5 = fresh breeze, small trees sway (30-39 km/h); 6 = strong breeze, large branches moving, wind whistling (40-50 km/h). | Mandatory |
| Precip | The type of precipitation at the start and end of the survey. Codes: N = None; F = Fog; M = Misty drizzle; D = Drizzle; LR = Light Rain; HR = Hard Rain; S = Snow. | Mandatory |
| Temp | The temperature at the start and end of the survey (degrees Celsius). | Mandatory |
| Lunar Phase | The phase of the moon during the capture period. Codes: NM=New Moon; FQ=First Quarter; SQ=Second Quarter; TQ=Third Quarter; FM=Full Moon. | Optional |
| Surveyors | The names of the people conducting the survey during the specified Design Component Visit. The full name is not required, but initials should be provided to identify the person as one of the surveyors listed on the Wildlife Inventory Survey Description form. | Mandatory |
| Area [m x m] | The area of the roost in which the bat observations are being made (square meters). | Mandatory |
| Obs # | Observations must be numbered so that each is unique within a roost. For each new roost, start at 1 and continue numbering observations sequentially. | Mandatory |
| Spp | The 5-letter code that uniquely identifies the taxa of the observed animal (the first letter has already been filled in). Species codes: see manual No. 2, Vertebrates of BC. If it is not possible to identify the animal in the field, record the best taxonomic description possible. | Mandatory |

| Field Name | Description | Requirement |
|---|---|---|
| Taxon Code | Record the appropriate taxon code. This code must correspond to one of the codes already assigned for a survey on the Taxonomic Code Form. | Mandatory |
| Cnt | The number of bats (recorded by species or taxon group) observed at the roost site. | Mandatory |
| Comments | Additional information that may be relevant to the observation (freeform text). | Optional |
| Obs # | Observations must be numbered so that each is unique within a roost. For each new roost, start at 1 and continue numbering observations sequentially. | Mandatory |
| Time | The time the observation was made. Use the 24 hour clock. | Mandatory |
| Cnt: In / Out | The number of bats (recorded by species or taxon group) observed entering the roost (going In) or emerging from the roost (moving Out). | Mandatory |
| Spp | The 5-letter code that uniquely identifies the taxa of the observed animal (the first letter has already been filled in). Species codes: see manual No. 2, Vertebrates of BC. If it is not possible to identify the animal in the field, record the best taxonomic description possible. | Mandatory |
| Taxon Code | Record the appropriate taxon code. This code must correspond to one of the codes already assigned for a survey on the Taxonomic Code Form. | Mandatory |
| Comments | Additional information that may be relevant to the observation (freeform text). | Optional |
| Project (Name) | The name of the project as it has been specified on the Wildlife Inventory Project Description Form (freeform text). | Mandatory |
| Survey (Name) | The name of the survey as it has been specified on the Wildlife Inventory Survey Description Form (freeform text). | Mandatory |
| Study Area (Name) | The name of the Study Area as it has been specified on the Wildlife Inventory Survey Description Form (freeform text). | Mandatory |
| Roost Label | The number of the roost at which the observations are made. Roosts must be numbered so that each is unique within a project. | Mandatory |
| Stratum | The name of the stratum (from the list on the Wildlife Inventory Survey Description Form) in which the Station is established. | Mandatory if Station stratified. |
| UTM | The UTM grid location at the center of the Design Component. Record UTM as zone, easting, and northing. A map (and/or aerial photograph) delineating the Design Component must accompany this data form. | Mandatory |

**Part B**

| Field Name | Description | Requirement |
|---|---|---|
| Ecosystem Form Type / # | The type of habitat form used to record environmental attributes at that location. Codes: GIF = Ground Inspection Form; EFF = Ecosystem Field Form; OTHER = list it. Also record the pre-printed form number from the associated Ecosystem Field Form, or the plot # from the Ground Inspection Form. | Mandatory |
| Roost Type | The type of roost that the bat(s) are observed in. Note: more than one code may be used when appropriate. Codes: CLIFFS = Cliffs; RKCREV = Rock Crevices; CAVES = Caves; MINES = Mines; BUILD = Building; HOLTRE = Hollow Tree; HTUBA = Hollow Trees under bark; TRECAV = Tree Cavities; FOLIAG = Foliage; OTHER = Record in field. | Mandatory |
| Roost Characteristics | The characteristics of a roost the bat(s) are observed in. Note: more than one code may be used when appropriate. Codes: HIB = Hibernaculum; SDR = Summer Day Roost; SNR = Summer Night Roost; MAC = Maternity Colony; MAR = Male Roost; OTHER = Record in field. | Mandatory |
| Tot Roost Area [m x m] | The total area of the roosting location (square meters). e.g. Cliff side or cave ceiling. | Mandatory |
| Roost Diagram | Sketch a diagram of the roost at which observations were made. Include exits and entrances to the roost. Note: only 1 sketch per roost per survey is required, unless the roost site changes in some way. | Mandatory |

# PYGMY RABBIT SURVEY FORM

Observer(s): _____ Affiliation: _____
Address: _____ Phone: _____
Observation Date: _____ Site Name: _____ Co.: _____ State: _____ Site #: _____
Township: _____ Range: _____ Meridian: _____ Section: _____ Quarter/Quarter: _____ of Quarter: _____
Project / Transect ID #: _____ Field Map ID: _____
Survey Method: _____ Search Time: Start: _____ Stop: _____

**GPS Data**

Projection: Decimal Degrees ☐ Decimal Minutes ☐ Degrees/Minutes/Seconds ☐ UTM Zone: 10 ☐ 11 ☐
Datum: NAD27 ☐ NAD83 ☐ WGS84 ☐
Coordinates:
Starting point Easting _____ Northing _____ Elevation _____
Accuracy: PDOP _____ FOM _____ +/- _____ Feet ☐ Meters ☐

**Land Ownership:** State ☐ BLM ☐ USFS ☐ USFWS ☐ Private* ☐ (state below)
Tribal ☐ Military ☐ Nat. Park ☐ Other: _____

*Private landowner / Address / Phone: _____

**Potential Threats to Area:** Agriculture☐ Fire☐ Development ☐ Grazing ☐ OHV ☐ None Other: _____

**Summary of Results for Survey Route** Pellets collected? Yes ☐ No ☐

| | |
|---|---|
| Pygmy rabbit observed? Yes☐ No ☐ | Pygmy Rabbit sign observed? Yes ☐ No ☐ Possible burrows ☐ Possible Pellets ☐ |
| Summary of numbers of burrows | B+FP: _ B+OP: B: _ _ UB+FP: Col: _ _ B+dig:__ FP alone: _ ____ |
| Length of survey route | Miles: Feet: Meters: |
| Predators (T- tracks, S–scat, V-visual) | Coyote T S V Fox T S V Badger T S V Weasel T S V Bobcat T S V<br>Raptor T S V Other |

**Notes.** *Provide directions, describe landscape setting, note other animals, explain why if no pygmy rabbits were found, describe behavior of any pygmy rabbits seen, etc.*

**CODES FOR DATA**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Burrow Status** | **B+FP –** used burrow plus brown, green, or black pellets | **B+OP** – burrow plus grey pellets | **B –** open burrow, no pellets | **UB +FP** Unused burrow, fresh pellets | **Col –** collapsed burrow | **B+dig –** burrow, fresh digging, no pellets | **FP –** fresh pellets alone | **Poss** Possible PR burrow |
| **Burrow Details** | **T** –Clean trail **O** – Open **Col** – Collapsed **Deb-** Debris filled **Dig** - Fresh digging<br>**TS** – tracks in snow **US** – Untracked snow **B** - At base of bush **R** - At base of rock **E**– Enlarged by predator | | | | | | | |
| **Pellet Quantity** | **H –** high**,** lots, a carpet **M –** moderate **F-** few | | | | | | | |
| **Soil** | **L** - Loam **S** - sand **C** - Clay **G** - Gravelly **R** - Rocky | | | | | | | |
| **CanopyCover** (20 ft radius) | **S –** shrubs **F** - Forbs **G** – grass **B** - bare ground<br>**0** –(0 – Trace) **1** - (1-10%) **2** - (11-25%) **3** - (26-50%) **4** - (51-75%) **5** – (76-100% | | | | | | | |
| **Grazing use level** | **0** - None **1** - slight **2** - light **3** - moderate **4** - heavy **5** – severe *Use descriptions from BLM's Landscape Appearance Method* | | | | | | | |

| **Burrow #** | **UTM Easting** | **UTM Northing** | **Status** | **Burrow details** | **Pellets** | **Soil** | **Canopy Cover** | | | | **Grass Use** | **Pygmy rab** | **# of entrances** | **Comments** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | **Shrub** | **Grass** | **Forbs** | **Bare** | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

**BLM's Landscape Appearance Method for classifying Grazing Use Level:**

1. **None** (0-5 %). The rangeland shows no evidence of grazing use; or the rangeland has the appearance of negligible grazing.
2. **Slight** (6-20%). The rangeland has the appearance of very light grazing. The key herbaceous forage plants may be topped or slightly used. Current seedstalks and young plants of key herbaceous species are little disturbed.
3. **Light** (21-40%). The rangeland may be topped, skimmed, or grazed in patches. The low value herbaceous plants are ungrazed and 60 to 80 % of the number of current seedstalks of key herbaceous plants remain intact. Most ground plants are undamaged.
4. **Moderate** (41-60%). The rangeland appears entirely covered as uniformly as natural features and facilities will allow. Fifteen to 20 % of the number of current seedstalks of key herbaceous species remains intact. No more than 10 % of the number of low value herbaceous forage plants are utilized. (Moderate use does not imply proper use.)
5. **Heavy** (61-80%). The rangeland has the appearance of complete search. Key herbaceous species are almost completely utilized with less than 10 % of the current seedstalks remaining. Shoots of rhizomatous grasses are missing. More than 10 % of the number of low value herbaceous forage plants have been utilized.
6. **Severe** (81-100%). The rangeland has a mown appearance and there are indications of repeated coverage. There is no evidence of reproduction or current seedstalks of key herbaceous species. Key herbaceous forage species are completely utilized. The remaining stubble of preferred grasses is grazed to the soil surface.

# Pygmy Rabbit Summary Sheet

## Burrows

- 5-10 inches in diameter
- Placed under sagebrush
- In relatively tall dense sage

**Pellets**

| Pygmy Rabbit | Cottontail | Jackrabbit |
|---|---|---|
| 4-6 mm – in carpets near burrow is diagnostic | 6-10 mm | 9-12 mm |

**Tracks – length of hind foot**

| | | |
|---|---|---|
| 46-71 mm | 77-90 mm | 90-103 mm |

**Visual**

| Pygmy Rabbit | Cottontail | Jackrabbit |
|---|---|---|
| Brown tail | White tail, obvious from rear | Black-tipped tail (blacktail) or whitish tail (whitetail) |
| Ears 2 ¼-2 ½ in, about length of head | Ears 2 1/5-1 3/5 in, about length of head | Ears 5-7 in, way longer than head, and black tipped |
| Won't run far, zigzags, often stops at sagebrush or burrow | Bolts fast and far | Bolts far and fast |
| Small – 8 ½-11 in | Medium – 12-14 in | Large – 17-21 in blacktail;<br>18-22 in whitetail |

**Animal Observation Form White-tailed jackrabbit Transect** **Page ___/___**

**Project** _____ **Survey** _____ **Study Area** _____

**Transect Label** _____ Stratum _____ BEU _____ Trans Comment _____

Trans: Lgth _____ Trans: Bearing _____ UTM: Start ____/_____/_____ End ____/_____/_____

**Obs Date** _____/_____/_____ Roadside Survey: Y ☐ / N ☐

| Obs Day | Time | CC | Wind | Precip | Temp |
|---|---|---|---|---|---|
| Start | | | | | |
| End | | | | | |

Surveyors _____

| | | | Sign | | | Spp Desc | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Obs # | Sta Lbl | Spp | Sign / Activity | Des | No | UC UC | A UC | A M | A F | J UC | J M | J F | Detection UTM Zone/East/North | | | Comments / Voucher Label |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |

[Use the back side of this form if additional lines are needed for observations associated with the transect labelled at the top of this form.]

**Animal Observation Form – White-tailed jackrabbit Transect** **Page ___/___**

**Project** _____ **Survey** _____ **Study Area** _____

**Transect Label** _____ **Obs Date** _____/_____/_____

OBS

| | | | Sign | | | Spp Desc | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Obs # | Sta Lbl | Spp | Sign / Activity | Des | No | UC UC | A UC | A M | A F | J UC | J M | J F | Detection UTM Zone/East/North | | | Comments / Voucher Label |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |
| | | M- | | | | | | | | | | | | | | |

[Use this side of the form only when additional lines are needed for observations associated with the transect labelled on the reverse side of this form.]

**Animal Observation Form – white-tailed jackrabbit - Pellet Count** **Page ___/___**

**Project** _____ **Survey** _____ **Study Area** _____

Transect Label _____ Stratum _____ BEU _____ Trans Comment _____

Trans: Lgth _____ Bearing _____ UTM: Start ____/_____/_____ End ____/_____/_____ Interstation Dist _____

| Plot Label | UTM (Zone/East/North) | | | Ecosystem Form Type /# | | Comments | Plot Label | UTM (Zone/East/North) | | | Ecosystem Form Type /# | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

**Obs Date** _____/_____/_____

| Obs Day | Time | CC | Wind | Precip | Temp |
|---|---|---|---|---|---|
| Start | | | | | |
| End | | | | | |

Surveyors _____

| Plot Label | Obs # | Spp | Pellet Grp: Running Cnt / Total Cnt | | Sign | Des | No | Comments / Voucher Label |
|---|---|---|---|---|---|---|---|---|
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |

[Use the back side of this form if additional lines are needed for observations associated with the transect/plots labelled at the top of this form.]

**Animal Observation Form – White-tailed jackrabbit - Pellet Count** **Page ___/___**

**Project** _____ **Survey** _____ **Study Area** _____

Transect Label _____ **Obs Date** _____/_____/_____

OBS

| Plot Label | Obs # | Spp | Pellet Grp: Running Cnt / Total Cnt | | Sign | Des | No | Comments / Voucher Label |
|---|---|---|---|---|---|---|---|---|
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |
| | | M- | | | | | | |

[Use this side of the form only when additional lines are needed for observations associated with the transect/plots labelled on the reverse side of this form.]

**Coding Instructions for the Animal Observation Form - White-tailed jackrabbit - Transect**

| Field Name | Description | Requirement |
|---|---|---|
| Project (Name) | The name of the project as it has been specified on the Wildlife Inventory Project Description Form (freeform text). | Mandatory |
| Survey (Name) | The name of the survey as it has been specified on the Wildlife Inventory Survey Description Form (freeform text). | Mandatory |
| Study Area (Name) | The name of the Study Area as it has been specified on the Wildlife Inventory Survey Description Form (freeform text). | Mandatory |
| Transect Label | The label of the transect within which animal observations are made. Transects must be labelled so that each transect is unique within a project. A reused transect within a project takes the original label given to that transect, (regardless whether it is used for the same survey or not). | Mandatory |
| Stratum | The name of the stratum (from the list on the Wildlife Inventory Survey Description Form) in which the Design Component is established. | Mandatory if Design Component stratified. |
| BEU | The Broad Ecosystem Unit within which the Design Component is located. Codes: refer to "Broad Ecosystem Units of British Columbia" (by Lea et al.) available on the FTP site; ftp://wldux2.env.gov.bc.ca/pub/TEM/beu3app.doc | Mandatory |
| Trans Comment | A description of the area in which the transect occurs (freeform text). e.g. road; railroad; seismic line. | Mandatory |
| Trans Lgth [km] | The distance from the start to the end point of the transect (km). | Mandatory: RA/AA Optional: PN |
| Trans Width [m] | The fixed-width of the transect being sampled (m). | Mandatory |
| Trans Bearing | The orientation of the transect (degrees, values 0 to 360). | Mandatory if transect is a straight line. |
| Transect UTM: Start / End | The start/end location of the transect using UTM grid location. Record UTM as zone, easting, and northing. A map (and/or aerial photograph) showing the transects delineated must accompany this data form. | Mandatory |
| Obs Date | The year/month/day (YYYY/MM/DD) on which the data on the form were gathered in the field. e.g. 1995/04/17. | Mandatory |
| Roadside Survey | Indicate whether a roadside survey was conducted. Codes: Y = Yes; N = No. | Mandatory |
| Time Start/End | The time at which surveying the specified Design Component commences and finishes. Use the 24 hour clock. | Mandatory |
| CC | The extent of cloud cover at the start and end of the survey. Codes: 1 = clear; 2 = scattered clouds (<50%); 3 = scattered clouds (>50%); 4 = unbroken clouds. | Mandatory |

| Field Name | Description | Requirement |
|---|---|---|
| Wind | The strength of wind at the start and end of the survey using the Beaufort Scale. Codes: 0 = calm (< 2 km/h); 1 = light air (2-5 km/h); 2 = light breeze, leaves rustle (6-12 km/h); 3 = gentle breeze, leaves and twigs constantly move 13-19 km/h); 4 = moderate breeze, small branches move, dust rises (20-29 km/h); 5 = fresh breeze, small trees sway (30-39 km/h); 6 = strong breeze, large branches moving, wind whistling (40-50 km/h). | Mandatory |
| Precip | The type of precipitation at the start and end of the survey. Codes: N = None; F = Fog; M = Misty drizzle; D = Drizzle; LR = Light Rain; HR = Hard Rain; S = Snow. | Mandatory |
| Temp | The temperature at the start and end of the survey (degrees Celsius). | Mandatory |
| Surveyors | The names of the people conducting the survey during the specified Design Component Visit. The full name is not required, but initials should be provided to identify the person as one of the surveyors listed on the Wildlife Inventory Survey Description form. | Mandatory |
| Obs # | Observations must be numbered so that each is unique within a transect. For each new transect, start at 1 and continue numbering observations sequentially. | Mandatory |
| Sta Label | The label of the station at which animal observations are made. Stations must be labelled so that each station is unique within a project. | Mandatory |
| Spp | The 5-letter code that uniquely identifies the taxa of the observed animal (the first letter has already been filled in). Species codes: see manual No. 2, Vertebrates of BC. If it is not possible to identify the animal in the field, record the best taxonomic description possible. | Mandatory |
| Activity / Sign | The activity of the animal when it was first detected or the sign of activity. Codes: refer to Species Inventory Fundamentals No. 1 [Forms]. | Mandatory |
| Des | The descriptor that best describes the activity / sign of activity of the animal observed. Codes: refer to Species Inventory Fundamentals No. 1 [Forms]. | Mandatory: RA/AA<br>Optional: PN |
| No | The number of sign elements. | Mandatory if sign observed. |
| Spp Desc | The number of animals (of a given species) according to age class and sex present in a group/herd. Age Class: J= Juvenile; A = Adult; UC = Unclassified. Sex : M = Male; F = Female; UC = Unclassified. | Mandatory |
| Detection UTM | The UTM grid location of the detected animal. Record UTM as zone, easting, and northing. A map (and/or aerial photograph) must accompany this data form that shows the location of the detected animal(s). | Mandatory: RA/AA<br>Optional: PN |
| Comments | Additional information that may be relevant to the observation (freeform text). | Optional |

| Field Name | Description | Requirement |
|---|---|---|
| Voucher Label | A unique label (within a project) assigned to a voucher specimen. This label should be meaningful with respect to the Design Component in which it was found. e.g. a mouse found on grid A, station A, with an observation # could be recorded as A/A/#. | Mandatory if collection made. |

**Coding Instructions for the Animal Observation Form - White-tailed jackrabbit - Pellet Count**

| Field Name | Description | Requirement |
|---|---|---|
| Project (Name) | The name of the project as it has been specified on the Wildlife Inventory Project Description Form (freeform text). | Mandatory |
| Survey (Name) | The name of the survey as it has been specified on the Wildlife Inventory Survey Description Form (freeform text). | Mandatory |
| Study Area (Name) | The name of the Study Area as it has been specified on the Wildlife Inventory Survey Description Form (freeform text). | Mandatory |
| Transect Label | The label of the transect within which animal observations are made. Transects must be labelled so that each transect is unique within a project. A reused transect within a project takes the original label given to that transect, (regardless whether it is used for the same survey or not). | Mandatory |
| Stratum | The name of the stratum (from the list on the Wildlife Inventory Survey Description Form) in which the Design Component is established. | Mandatory if Design Component stratified. |
| BEU | The Broad Ecosystem Unit within which the Design Component is located. Codes: refer to "Broad Ecosystem Units of British Columbia" (by Lea et al.) available on the FTP site; ftp://wldux2.env.gov.bc.ca/pub/TEM/beu3app.doc | Mandatory |
| Trans Comment | A description of the area in which the transect occurs (freeform text). e.g. road; railroad; seismic line. | Optional |
| Trans Lgth [km] | The distance from the start to the end point of the transect (km). | Mandatory: RA/AA Optional: PN |
| Trans Bearing | The orientation of the transect (degrees, values 0 to 360). | Mandatory if transect is a straight line. |
| Transect UTM: Start / End | The start/end location of the transect using UTM grid location. Record UTM as zone, easting, and northing. A map (and/or aerial photograph) showing the transects delineated must accompany this data form. | Mandatory |
| Interstation Dist [m] | The standard distance between stations (m). Note: record the distance between stations in both the X and Y dimensions when grids are used. | Mandatory |
| Plot Label | The label of the plot in which observations are made. Plots must be labelled so that they are unique within a project. | Mandatory |
| UTM | The UTM grid location at the center of the Design Component. Record UTM as zone, easting, and | Mandatory |

| Field Name | Description | Requirement |
|---|---|---|
| | northing. A map (and/or aerial photograph) delineating the Design Component must accompany this data form. | |
| Ecosystem Form Type / # | The type of habitat form used to record environmental attributes at that location. Codes: GIF = Ground Inspection Form; EFF = Ecosystem Field Form; OTHER = list it. Also record the pre-printed form number from the associated Ecosystem Field Form, or the plot # from the Ground Inspection Form. | Mandatory |
| Comments | Additional information that may be relevant to the Design Component (freeform text). | Optional |
| Obs Date | The year/month/day (YYYY/MM/DD) on which the data on the form were gathered in the field. e.g. 1995/04/17. | Mandatory |
| Time Start/End | The time at which surveying the specified Design Component commences and finishes. Use the 24 hour clock. | Mandatory |
| CC | The extent of cloud cover at the start and end of the survey. Codes: 1 = clear; 2 = scattered clouds (<50%); 3 = scattered clouds (>50%); 4 = unbroken clouds. | Mandatory |
| Wind | The strength of wind at the start and end of the survey using the Beaufort Scale. Codes: 0 = calm (< 2 km/h); 1 = light air (2-5 km/h); 2 = light breeze, leaves rustle (6-12 km/h); 3 = gentle breeze, leaves and twigs constantly move 13-19 km/h); 4 = moderate breeze, small branches move, dust rises (20-29 km/h); 5 = fresh breeze, small trees sway (30-39 km/h); 6 = strong breeze, large branches moving, wind whistling (40-50 km/h). | Mandatory |
| Precip | The type of precipitation at the start and end of the survey. Codes: N = None; F = Fog; M = Misty drizzle; D = Drizzle; LR = Light Rain; HR = Hard Rain; S = Snow. | Mandatory |
| Temp | The temperature at the start and end of the survey (degrees Celsius). | Mandatory |
| Surveyors | The names of the people conducting the survey during the specified Design Component Visit. The full name is not required, but initials should be provided to identify the person as one of the surveyors listed on the Wildlife Inventory Survey Description form. | Mandatory |
| Plot Label | The label of the Plot at which observations are made. This label must correspond to one of the previously assigned Plot labels found in the Design Component section. | Mandatory |
| Obs # | Observations must be numbered so that each is unique within a Transect/Plot. For each new Transect/Plot, start at 1 and continue numbering observations sequentially. | Mandatory |

| Field Name | Description | Requirement |
|---|---|---|
| Spp | The 5-letter code that uniquely identifies the taxa of the observed animal (the first letter has already been filled in). Species codes: see manual No. 2, Vertebrates of BC. If it is not possible to identify the animal in the field, record the best taxonomic description possible. | Mandatory |
| Pellet Grp: Running Cnt | Record the running count of the number of pellet groups present in a plot for a given species (freeform text). Note: this field exists to make counting pellet groups easier, (it is not for database use), any method may be used to record pellet groups. | Optional |
| Pellet Grp: Total Cnt | The total count of the number of pellet groups present in a plot for a given species. | Mandatory |
| Activity / Sign | The activity of the animal when it was first detected or the sign of activity. Codes: refer to Species Inventory Fundamentals No. 1 [Forms]. | Mandatory |
| Des | The descriptor that best describes the activity / sign of activity of the animal observed. Codes: refer to Species Inventory Fundamentals No. 1 [Forms]. | Mandatory: RA/AA<br>Optional: PN |
| No | The number of sign elements. | Mandatory if sign observed. |
| Comments | Additional information that may be relevant to the observation (freeform text). | Optional |
| Voucher Label | A unique label (within a project) assigned to a voucher specimen. This label should be meaningful with respect to the Design Component in which it was found. e.g. a mouse found on grid A, station A, with an observation # could be recorded as A/A/#. | Mandatory if collection made. |

AVIAN OBSERVATION DATA SHEET Grassy Mountain Plot __D__

DATE _____ OBSERVER_____ START TIME_____ END TIME_____ Page_____of_____

WEATHER: VISIBILITY (circle one) good fair poor CLOUD COVER (%)_____ TEMP_____ (C) (F) (circle one)

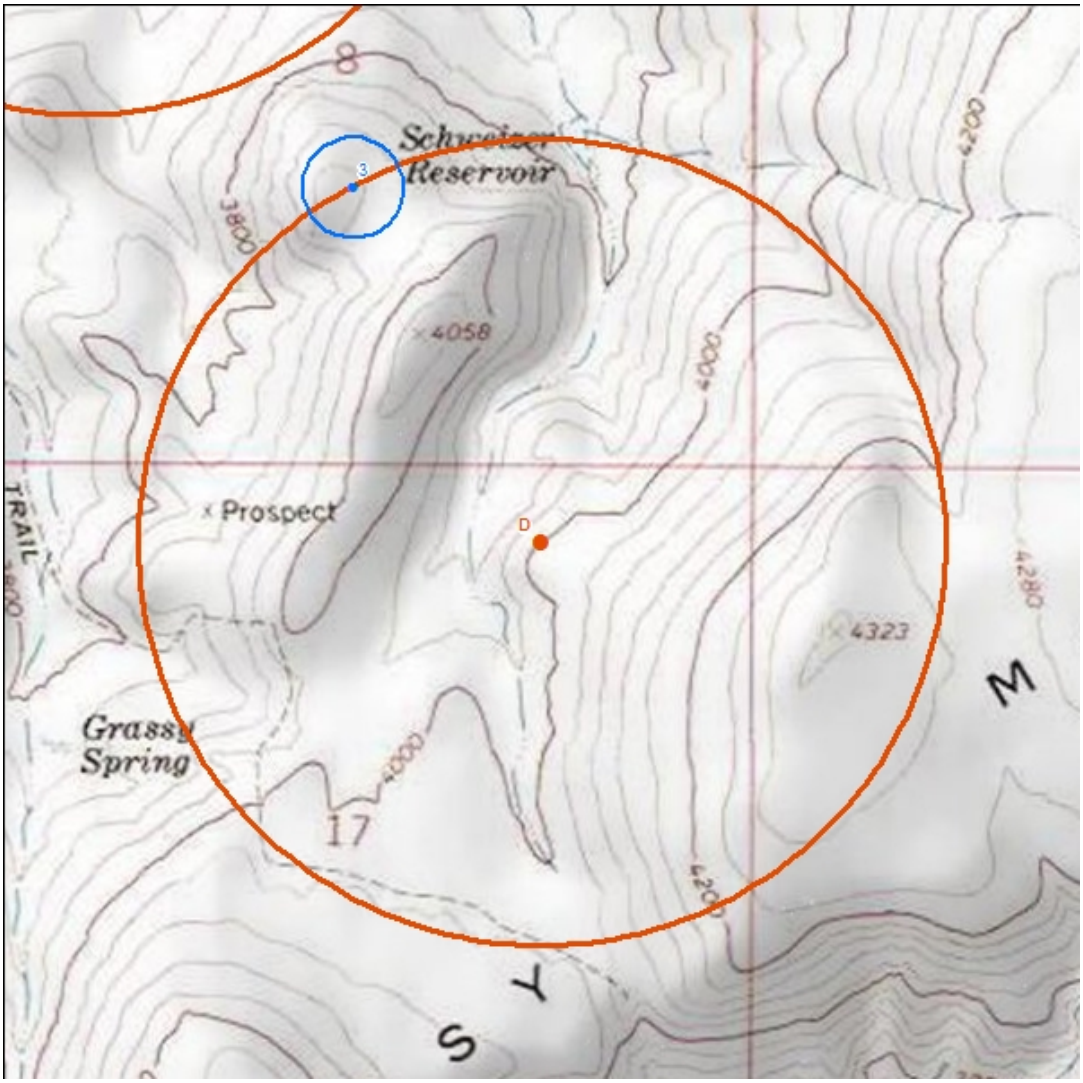
WIND: DIRECTION (circle one) N NE E SE S SW W NW n/a SPEED Low:_____ High:_____ (kph) (mph) (circle one)

PRECIPITATION (circle one) none light rain rain light snow snow sleet hail other

| Obs. No. | Species | Sex | Age | No. of ind. | Dist.(m) from obs. 1st//closest | Activity | | | Flight Height (meters) 1st | low | high | Flight Dir. | Habitat | | | | Inst. Count (height/distance) I1 | I2 | I3 | | AT | 1st 2nd | Exposure Minutes/ Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | PE | SO | FL | | | | | GR | SS | RO | UT | | | | | | | |
| | | | | | | CS | HU | OT | | | | | AD | RI | DE | OT | | | | | | | |
| 2 | | | | | | PE | SO | FL | | | | | GR | SS | RO | UT | | | | | | | |
| | | | | | | CS | HU | OT | | | | | AD | RI | DE | OT | | | | | | | |
| 3 | | | | | | PE | SO | FL | | | | | GR | SS | RO | UT | | | | | | | |
| | | | | | | CS | HU | OT | | | | | AD | RI | DE | OT | | | | | | | |
| 4 | | | | | | PE | SO | FL | | | | | GR | SS | RO | UT | | | | | | | |
| | | | | | | CS | HU | OT | | | | | AD | RI | DE | OT | | | | | | | |
| 5 | | | | | | PE | SO | FL | | | | | GR | SS | RO | UT | | | | | | | |
| | | | | | | CS | HU | OT | | | | | AD | RI | DE | OT | | | | | | | |
| 6 | | | | | | PE | SO | FL | | | | | GR | SS | RO | UT | | | | | | | |
| | | | | | | CS | HU | OT | | | | | AD | RI | DE | OT | | | | | | | |
| 7 | | | | | | PE | SO | FL | | | | | GR | SS | RO | UT | | | | | | | |
| | | | | | | CS | HU | OT | | | | | AD | RI | DE | OT | | | | | | | |
| 8 | | | | | | PE | SO | FL | | | | | GR | SS | RO | UT | | | | | | | |
| | | | | | | CS | HU | OT | | | | | AD | RI | DE | OT | | | | | | | |
| 9 | | | | | | PE | SO | FL | | | | | GR | SS | RO | UT | | | | | | | |
| | | | | | | CS | HU | OT | | | | | AD | RI | DE | OT | | | | | | | |
| 10 | | | | | | PE | SO | FL | | | | | GR | SS | RO | UT | | | | | | | |
| | | | | | | CS | HU | OT | | | | | AD | RI | DE | OT | | | | | | | |

Big Game-

Notes-



## VISUAL ENCOUNTER SURVEYS

DATE _____ (M/D/Y)



MONITORING POINT # _____ OBS _____

START TIME _____ SEARCH SIDE _____ (W or E)

END TIME _____ SURVEY/VISIT # _____

SEARCH TIME TOTAL _____ SEASON (circle one): Spring Summer Fall

CLOUDS (%) _____

PRECIPITATION _____

TEMP _____

WIND _____

* Indicate the number of individuals using dot count method (TALLY), then write total in SUM column
* WIND = none, lvs moving, twigs moving, sm branches, large branches, trees moving
* TEMP = describe temp to nearest 10 degrees F
* CLOUDS = nearest 10%
* PRECIPITATION = none, drizzle, sprinkle, rain, snow

| AMPHIBIAN AND REPTILE SPECIES | TAXACODE (4-letter) | TALLY # | SUM | DETECTION | SUBSTR & LOC | SNOUT-VENT | AGE | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

HERPETOFAUNA ONLY: Snout-Vent length (cm), Age (Adult / Subadult / Juvenile), Location along transect (nearest m) noted in Comments

LANDBIRD TVES: Songbirds, woodpeckers and sign; RAPTOR TVES: Raptors and rare woodpeckers (e.g. Pileated) and sign

| BIRD SPECIES | TAXACODE | | DETECTION | COMMENTS |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

MEDIUM AND LARGE MAMMAL TVES: All mammals and reptiles and their sign

| MAMMAL SPECIES | TAXACODE | | DETECTION | COMMENTS |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

INCIDENTAL SIGHTINGS: what, where, when, how many (observations outside of search time)

DETECTION: individual, scat, track, burrow, haypile, pellet , whitewash, cone pile, scratch marks, feathers, prey remains, etc.
SUBSTRATE: GR = ground, GS = grass, RK = rock, BG = bare ground, TR = tree, SH = shrub, LG = log, etc.

Entered by: _____ Date entered: _____

Checked by: _____ Date checked: _____

# Wildlife Inventory QA Form 1: Prefield QA

**Project Name:**

**Inventory Contractor:**

**Date of Submission:** **Submission #:**

The intent of the Pre-field QA is to ensure the existing data review is complete and accurate, and to approve the project plan and study design. **The QA auditor must sign off the Pre-field QA before any fieldwork can begin.** Therefore, enough turnaround time must be provided between the Pre-field QA and the start of field work to allow any changes or modifications identified through the QA process to be completed without delaying the start of field work.

## Summary of Existing Information

The intent of QA of existing data is to ensure that all relevant existing data have been used in the current inventory project. Known information can affect project needs and project planning.

1. Review of existing data sources (including interviewing local experts/species specialists) adequately covers the information known to be available for the species and project area or similar habitat, and, if relevant, has been used in the project plan. ❑Yes ❑No

   Comments/Recommendations:

## Study Design

The intent of QA of the study design is to ensure that the design adequately covers the requirements and objectives of the inventory.

1. Study objectives are clearly defined, and appropriate given the Summary of Existing Information. ❑Yes ❑No

   Comments/Recommendations:

2. Level of intensity (Presence/Not Detected, Relative Abundance, and Absolute Abundance) is appropriate for the stated objectives. ❑Yes ❑No

   Comments/Recommendations:

3. Survey methods are appropriate for the objectives stated in the project plan and are provided in sufficient detail including an explanation and description of the sampling design, with the assumptions clearly stated and an explanation of how the sampling design will be applied (e.g., random, stratified, systematic, etc.). ❑Yes ❑No

   Comments/Recommendations:

4. Study area boundaries are appropriately outlined on maps. ❑Yes ❑No

   Comments/Recommendations:

5. Locations of design components have been mapped[1]. ❑Yes ❑No

   If this is not possible prior to fieldwork, the methods for determining locations in the field are appropriate. ❑Yes ❑No

   Comments/Recommendations:

6. Is stratification necessary? ❑Yes ❑No

   If no, a justification has been provided. ❑Yes ❑No

   If yes:

   The appropriate habitats have been properly stratified and identified for sampling and the stratification scheme used has been explained adequately. ❑Yes ❑No

   A pre-study field check has been conducted to confirm habitat stratification. ❑Yes ❑No

   The appropriate strata have been mapped. ❑Yes ❑No

   Comments/Recommendations:

[1] For an explanation of the survey design hierarchy, please see Section 2 in *Species Inventory Fundamentals* (RIC 1998).

7. Are the primary and secondary target taxa listed in the project plan? ❑Yes ❑No

   Comments/Recommendations:

8. The problems/questions and resulting hypotheses are clearly stated and sufficient data will be collected to test the hypothesis or provide meaningful conclusions. ❑Yes ❑No

   Comments/Recommendations:

9. Required sample size has been correctly calculated or method is in place to determine when sampling is complete. ❑Yes ❑No

   Comments/Recommendations:

10. Statistical tests of significance being used are appropriate for interpreting the final results. ❑Yes ❑No

    Comments/Recommendations:

11. Sources of bias have been identified and managed appropriately, measures of possible error have been used and appropriate levels of accuracy and precision have been identified. ❑Yes ❑No

    Comments/Recommendations:

12. Survey timing is appropriate for the species life history, survey objectives and project area characteristics (e.g. winter accessibility). ❑Yes ❑No

    Comments/Recommendations:

13. A contingency plan is in place for the field component (e.g. in case of access problems due to helicopter unavailability during fire season, poor weather conditions, difficult terrain, etc.). ❑Yes ❑No

    Comments/Recommendations:

## Personnel and Equipment

The intent of QA on personnel and equipment is to ensure that the field crew has appropriate expertise as listed in the project plan, that the crew has the required permits, and that each crew member has the appropriate certifications and training.

1. Each member of the field crew has the appropriate expertise for the species to be inventoried. ❑Yes ❑No

   Comments/Recommendations:

2. Equipment being used is appropriate for the survey methods. ❑Yes ❑No

   Comments/Recommendations:

3. Pre-season testing and training has been completed on all equipment and for all techniques. ❑Yes ❑No

   Comments/Recommendations:

## Data Form Preparation

The intent of the Data Form Preparation QA is to ensure that (1) field crews are equipped with a process for recording accurate, meaningful field data, regardless of whether they use hardcopy or electronic dataforms, and (2) the resulting data can be entered into an appropriate WSI Data Capture Template using appropriate data-fields and codes.

1. Do field crews have a dataform(s) containing data-fields relevant to their recording needs? ❑Yes ❑No

   Comments/Recommendations:

2. Do field crews have immediate access to all definitions of data-fields and codes? ❑Yes ❑No

   Comments/Recommendations:

3. If required by the contract requirements, do field crews have a dataform for recording incidental observations? For example, some contracts require that observations of any non-target red or blue-listed species encountered during an inventory must be recorded. ❑Yes ❑No

   Comments/Recommendations:

# Wildlife Inventory QA Form 2: Prefield QA Summary

**Project Name:**
**Inventory Contractor:**
**Date of Submission:** **Submission #:**

Please provide a summary of the overall QA of the inventory and include any additional comments not covered in the forms above. If project deliverables are unacceptable, a new summary form must be completed for each subsequent submission, including the submission number, date of submission and comments as to whether or not the recommendations have been adequately incorporated.

## Summary of Existing Information

❑ Acceptable ❑ Unacceptable (see recommendations below)

Comments/Recommendations:

## Study Design

❑ Acceptable ❑ Unacceptable (see recommendations below)

Comments/Recommendations:

## Personnel and Equipment

❑ Acceptable ❑ Unacceptable (see recommendations below)

Comments/Recommendations:

## Data Form Preparation

❑ Acceptable ❑ Unacceptable (see recommendations below)

Comments/Recommendations:

## Wildlife Inventory QA Form 3: Pre-field QA Sign-off

**Project Name:**

**Inventory Contractor:**

**Date of Submission:** **Submission #:**

The prefield preparations and study design are acceptable and field work can begin.

Print Name of QA Contractor Signature Date

## Wildlife Inventory QA Form 4: Field QA Checklist

**Project Name:**

**Inventory Contractor:**

**Date of Submission:** **Submission #:**

The intent of the field QA is to detect and prevent potential errors in field data collection. Errors that occur in the field are difficult if not impossible to detect after the fact, and are extremely expensive to correct. In order to avoid cumulative errors in the data, the field QA should occur at the very beginning of the field season. The QA team should be able to arrange the field check on short notice in order to accommodate the inventory contract schedule and weather dependent field opportunities. Feedback from the **QA auditor** must be provided to the crew leader and contract monitor immediately if there are problems.

1. Data forms have been completed correctly using the correct codes and fields (according to the specifications in the WSI Data Capture Template). ❑Yes ❑No

   Comments/Recommendations:

2. Data have been collected using the proper methods and techniques including proper and accurate use of field equipment. ❑Yes ❑No

   Comments/Recommendations:

3. Experimental design has not been altered in the field (i.e. no statistical violations have been made). ❑Yes ❑No

   Comments/Recommendations:

4. Complete UTM coordinates based on NAD83 data have been recorded for all design components, and any wildlife observations, or attempted observations (i.e. Null observations). ❑Yes ❑No

   Comments/Recommendations:

5. If required by contract, encounters with non-target red or blue-listed species are being recorded (UTM coordinates, date, observer name) if observed in the field. ❑Yes ❑No

   Comments/Recommendations:

# Wildlife Inventory QA Form 5: Reporting QA Checklist

**Project Name:**

**Inventory Contractor:**

**Date of Submission:** **Submission #:**

The QA team should review the final deliverables to ensure that all project requirements have been met and that all data and products are consistent and correct. This includes ensuring that the original data are received, that data are entered correctly into the project database, and that data are consistent between original data forms, data capture templates, maps and reports. To reduce the likelihood of major revisions being required on the final products, the contract monitor may wish to have the QA auditor review draft deliverables before reviewing the final deliverables. A review of the final report by an external reviewer (i.e. a peer review) is highly recommended.

## Data Entry and Analysis

1. Electronic data are captured in the digital database ❑Yes ❑No

   All mandatory columns have been filled out. ❑Yes ❑No

   All UTMs are based on the NAD 83 datum. ❑Yes ❑No

   All UTMs have a zone, easting and northing. ❑Yes ❑No

   Entered a label and UTM coordinates for each survey. ❑Yes ❑No

   All user-defined data-fields and codes have been described in the metedata. ❑Yes ❑No

   Any additional information required by the standards is included as separate spreadsheets in Excel, and final report has been included as a single PDF document. ❑Yes ❑No

   Comments/Recommendations:

   _____

   _____

2. Excel data capture templates have been compared with data forms for data entry errors, and have been found to be accurate. ❑Yes ❑No

   A total of _____ data forms have been checked to ensure accuracy.

   Comments/Recommendations:

   _____

   _____

3. All GIS spatial data complies with the specifications described in *the selected species methodology*. ❑Yes ❑No

   Comments/Recommendations:

## Final Report

1. The report presents a strong case in support of the conclusions reached. ❑Yes ❑No

   Comments/Recommendations:

2. There is sufficient background in the introduction to provide context including adequate background references. ❑Yes ❑No

   Comments/Recommendations:

3. There are references to similar methods that have been properly used and to which adequate comparisons have been made. ❑Yes ❑No

   Comments/Recommendations:

4. Methods are clearly explained and were not altered or modified. ❑Yes ❑No

   If altered or modified, the alteration/modification was explained and justified. ❑Yes ❑No

   Comments/Recommendations:

5. There is a clear presentation of results, and these results are clearly separated from discussion or conjecture. ❑Yes ❑No

   Comments/Recommendations:

6. Statements of method, literature references, or conjecture are in the appropriate section (i.e. not in the Results section when they should properly be a part of another section). ❑Yes ❑No

   Comments/Recommendations:

7. There is proper use of statistics (i.e., tests of significance are used where possible and appropriate). ❑Yes ❑No

   Comments/Recommendations:

8. The discussion adequately addresses issues or points relative to the results, and attention has been paid to potential weaknesses and to errors or limitations of the project. ❑Yes ❑No

   Comments/Recommendations:

9. The report has been grammar and spell-checked, the writing style is concise and coherent and the report follows appropriate formats. ❑Yes ❑No

   Comments/Recommendations:

## Wildlife Inventory QA Form 6: Field QA and Reporting QA Summary

**Project Name:**

**Inventory Contractor:**

**Date of Submission:** **Submission #:**

### Field QA *(Not Mandatory)*

❑ Acceptable ❑ Unacceptable (see recommendations below)

Comments/Recommendations:

### Reporting QA

**Data Entry and Analysis**

❑ Acceptable ❑ Unacceptable (see recommendations below)

Comments/Recommendations:

**Final Report**

Comments/Recommendations:

**Additional Comments**

## Wildlife Inventory QA Form 7: Project QA Sign-off

**Project Name:**

**Inventory Contractor:**

**Date of Submission:** **Submission #:**

All project deliverables are complete and acceptable. ❑Yes ❑No

Print Name of QA Contractor Signature Date

# Appendix E

## Grassy Mountain Gold Project Water Resources Baseline Study Winter 2013 Monitoring Plan

# Grassy Mountain Gold Project
# Water Resources Baseline Study
# Winter 2013 Monitoring Plan

*Prepared for*

**Calico Resources**
**122 A Street East**
**P.O. Box Q**
**Vale, Oregon 97918**

*Prepared by*

**SPF Water Engineering, LLC**
**300 East Mallard, Suite 350**
**Boise, Idaho 83706**
**(208) 383-4140**

**January 2013**

# Table of Contents


1. Introduction ..... 1

2. Grassy Mountain Monitoring Wells ..... 3
   - 2.1. Wells for Water Level and Water Quality Sampling ..... 3
   - 2.2. Wells for Manual Water Level Measurements ..... 5
   - 2.3. Wells for Continuous Water Level Measurements ..... 7

3. Grassy Mountain Springs ..... 8

4. Surface Water ..... 9

5. Personnel ..... 10

6. Sampling schedule ..... 10

7. Sampling Procedures ..... 11
   - 7.1. GPS Coordinates ..... 12
   - 7.2. Photographs ..... 12
   - 7.3. Water Level Measurements (Wells) ..... 12
     - 7.3.1. Manual Water Level Measurements ..... 12
     - 7.3.2. Continuous Water Level Measurements ..... 13
   - 7.4. Flow Measurement (Springs) ..... 13
   - 7.5. Dedicated Pump Installation ..... 14
     - 7.5.1. Pump and Equipment Description ..... 14
     - 7.5.2. Pump Decontamination and QA/QC ..... 15
   - 7.6. Field Water Quality Testing Manifold ..... 15
   - 7.7. Purge Pumping ..... 17
     - 7.7.1. General Procedure ..... 17
     - 7.7.2. BLM (Owyhee Ridge) Well ..... 17
   - 7.8. Ground Water Quality Data Collection ..... 17
     - 7.8.1. Field Water Quality Parameters ..... 17
     - 7.8.2. Water Quality Sample Collection ..... 18
     - 7.8.3. Quality Assurance / Quality Control ..... 22
   - 7.9. Spring Water Quality Data Collection ..... 23
     - 7.9.1. Field Water Quality Parameters ..... 23
     - 7.9.2. Water Quality Sample Collection ..... 23
     - 7.9.3. Quality Assurance / Quality Control ..... 24
   - 7.10. Surface Water Quality Data Collection ..... 26
     - 7.10.1. Field Water Quality Parameters ..... 26
     - 7.10.2. Water Quality Sample Collection ..... 26
     - 7.10.3. Quality Assurance / Quality Control ..... 27

8. Spring Site Specific Testing Plan ..... 27
   - 8.1. Government Corral Spring ..... 27
   - 8.2. Sagebrush Spring ..... 28
   - 8.3. Grassy Springs Stock Tank ..... 29

8.4. Twin Spring North ..... 30
8.5. Twin Spring South ..... 31
8.6. Sourdough Spring Upper ..... 32
8.7. Whiskey Spring ..... 33
9. References ..... 35
10. Attachments ..... 35

## List of Figures

Figure 1. Discharge testing manifold photograph and diagram ..... 16
Figure 2. Photographs of Government Corral Spring ..... 28
Figure 3. Photographs of Sagebrush Spring ..... 29
Figure 4. Photographs of Grassy Spring Stock Tank ..... 30
Figure 5. Photograph of Twin Spring North Stock Tank ..... 31
Figure 6. Photograph of Twin Spring South Stock Tank ..... 32
Figure 7. Sourdough Spring Upper Stock Tank ..... 33
Figure 8. Photograph of Whiskey Spring Stock Tank ..... 34

## List of Tables

Table 1. Grassy Mountain Monitoring Wells and Construction Details ..... 4
Table 2. GPS Coordinates for Grassy Mountain Monitoring Wells ..... 4
Table 3. Grassy Mountain Monitoring Well Groundwater Elevations ..... 5
Table 4. Grassy Mountain Water Level Monitoring Wells and Construction Details ..... 6
Table 5. GPS Coordinates for Grassy Mountain Water Level Monitoring Wells ..... 6
Table 6. Grassy Mountain Water Level Monitoring Well Groundwater Elevations ..... 7
Table 7. Grassy Mountain Wells Proposed for Continuous Water Level Monitoring ..... 8
Table 8. Grassy Mountain GPS Coordinates and Flow ..... 9
Table 9. Schedule for Sampling Events ..... 11

Table 10. Grassy Mountain Monitoring Well Dedicated Pumps .....14
Table 11. List of Water Quality Analytes and Testing Methods .....19
Table 12. List of Water Quality Analytes, Hold Times, and Preservatives .....20

# 1. INTRODUCTION

This report details the Winter 2013 sampling event monitoring plan for the Grassy Mountain Gold Project Water Resources Baseline Study (Baseline Study). The monitoring plan involves collecting baseline ground water quality and level data from select monitoring wells and water quality and flow data from select springs located within the Water Resources Study Area (Study Area) for the Grassy Mountain Gold Project (Project). The report also includes baseline surface water sampling from the Owyhee Lake/River.

The objective of the Baseline Study is to collect data to characterize existing (pre-project) water resources within the Study Area. This baseline characterization will ultimately be used in future evaluations to determine whether the project could adversely impact water resources. The Baseline Study is intended to meet the requirements of Division 37 Chemical Process Mining, OAR 632-037-0055, Existing Environment-Baseline Data and related Oregon Department of Environmental Quality (ODEQ) Division 43 Chemical Mining Rules.

The Baseline Study will achieve the stated objective of characterizing the water resources within the Study Area to meet Division 37 and Division 43 permitting process requirements by accomplishing the following tasks:

1. Collect adequate data to describe ground water quality and levels.
2. Collect adequate data to describe spring water quality and flows.
3. Collect adequate data to describe surface water quality and flows.
4. Evaluate ground water quality data in the Study Area, including by use of graphical presentation of chemical analyses (i.e. Stiff pattern, Piper diagram) to differentiate ground water sources and determine the extent of hydraulic connections.
5. Develop water elevation contours (potentiometric surface) using ground water surface elevations.
6. Establish a reference baseline of water quality, ground water level, and spring flow data.
7. Identify any naturally occurring variables or trends affecting water quality, ground water levels, or spring flows.
8. Utilize sampling techniques and analytical methods suitable to meet Oregon Department of Environmental Quality requirements.

The Grassy Mountain Gold Project site is located approximately 25 miles south of Vale, Oregon, encompassing portions of Section 32, Township 21 South, Range 44 East; Sections 1 and 12, Township 22 South, Range 43 East; Sections 5, 6, 7, and 8, Township 22 South, Range 44 West.

Background information for this monitoring plan was obtained from: (1) a data collection effort by SPF Water Engineering (SPF) in late May/early June 2012 (SPF 2012); (2) a previous hydrologic testing program at the Grassy Mountain site completed by Rocky Mountain Environmental Corporation and SRK Consultants

(RMEC 2012); and (3) the 2013 Third Draft Environmental Baseline Study Work Plans, Grassy Mountain Project prepared by RTR Resource Management and HDR Engineering (RTR 2013).

In addition to the studies mentioned above, there have been a number of other monitoring events conducted over the years at the Grassy Mountain Gold Project site. Several of the more extensive and applicable monitoring efforts are summarized below:

- Western Technologies, Inc. (WTI) oversaw the installation of three monitoring wells (GW-1, GW-2, and GW-3) and one production well (Prod-1) on the site in 1988. WTI collected water quality samples from the four wells, the BLM Owyhee Ridge Well, and from four surface water locations in 1989.

- In 1989 and 1990, SRK oversaw the installation of monitoring well GW-4 and the production wells (PW-1 and PW-4). Water quality samples were collected from these wells and test pumping was performed on the production wells. Results were presented to Atlas from SRK in a 1989 report.

- In 1991, J.M. Montgomery, Consulting Engineers, Inc. collected data in support of a ground water supply study for the then proposed Grassy Mountain Gold Project. The work including construction of three monitoring wells (GW-3A, GW-5, and GW-6), construction of one piezometer (GW-3B), measurement of groundwater levels and spring flow rates, and conducting pumping tests on three wells (Prod-1, PW-1, Bishop Well).

- In 1992, Adrian Brown Consultants prepared a Water Resources Technical Memorandum for Atlas as part of the Grassy Mountain Project Environmental Impact Statement. The memorandum describes the geology and geochemistry of the project site, monitoring and production wells completed at the time, historical ground and surface water quality data, results of ground water modeling, and discusses the potential impacts of mining on ground and surface water resources.

- In June 1993, ACZ Inc. collected groundwater data from several springs and wells (GW-1, GW-6, BLM, Prod-1, 57-1, and 89-2). In September 1993, 12 new test and monitoring wells were installed, with work documented by Hydro-Geo Consultants, Inc. Water quality samples were also collected from these new wells. Hydro-Geo Consultants, Inc. also participated in rising head permeability testing of seven (7) of the new wells, slug tests of four (4) of the new wells, and pumping tests of two (2) of the new wells. Results of this testing are currently unavailable.

# 2. GRASSY MOUNTAIN MONITORING WELLS

## 2.1. Wells for Water Level and Water Quality Sampling

There are twelve (12) wells proposed for water level measurement and water quality sampling for the Winter 2013 sampling event. These wells are listed in Table 1, along with construction details. These wells are also shown on the Grassy Mountain site map (Attachment A). The site map also includes the boundary of the proposed Water Resources Study Area. Both the well name from Calico historical records and well logs and the associated well tag number from the Oregon Water Resources Department (OWRD) are identified in Table 1. This table also includes completion depth, screened interval, and well casing diameter. Well driller's reports for these twelve (12) monitoring wells are provided in Attachment D.

All twelve (12) monitoring wells proposed for the Winter 2013 sampling event were also sampled in late May/early June 2012 as described in SPF 2012. During that sampling event, these wells were located by GPS using a Garmin GPS unit (Etrex Vista HCX). The UTM coordinates (Zone 11N, NAD 83) are provided in Table 2.

These 12 (twelve) wells were selected for water level and water quality baseline monitoring based on a November 2011 evaluation of the construction, condition, productivity, and water quality of fifteen (15) monitoring wells as described in RMEC 2012. Based on that evaluation, RMEC identified eleven (11) wells as suitable for baseline monitoring. In addition to these wells, the Bishop Well is also included as a baseline monitoring location due to its proximity to the proposed mine processing area.

Table 1. Grassy Mountain Water Quality Monitoring Wells and Construction Details

| Calico Well ID | OWRD Well Tag Number | Alternate Name | Well Const. Depth (ft) | Screened Interval (ft) | Well Casing Diameter (in) |
|---|---|---|---|---|---|
| GW-1 | 107469 | 47-1 | 155.5 | 135.5-155.5 | 4 |
| GW-4 | 107460 | | 370 | 280-350 | 4 |
| Prod 1 | 107457 | | 425 | 145-255 | 4 |
| | | | | 325-355 | |
| | | | | 380-420 | |
| PW-1 | 109353 | | 550 | 320-340 | 6 |
| | | | | 400-420 | |
| PW-4 | 109351 | | 375 | 280-300 | 6 |
| | | | | 340-360 | |
| BLM | 109398 | Owyhee Ridge | 175 | 159-166 | 6 |
| 59760 | 107462 | Middle Sweizer, TW-1 | 203 | 163-203 | 6 |
| 59761 | 109400 | Lower Sweizer, MW-2 | 118 | 97-117 | 4 |
| 59763 | 109356 | TW-4 | 323 | 293-323 | 6 |
| 59766 | 107468 | MWS-8 | 45 | 25-45 | 4 |
| 59772 | 109352 | Upper Sweizer, MWS-13 | 207 | 146-206 | 4 |
| Bishop Well | None | Rye Field | 482 | 135-145 | 12 |

Table 2. GPS Coordinates for Grassy Mountain Monitoring Wells

| Calico Well ID | OWRD Well Tag Number | Northing (UTM 11N, NAD83) | Easting (UTM 11N, NAD 83) |
|---|---|---|---|
| GW-1 | 107469 | 4835644 | 471460 |
| GW-4 | 107460 | 4838740 | 470557 |
| Prod 1 | 107457 | 4837684 | 470904 |
| PW-1 | 109353 | 4835627 | 471431 |
| PW-4 | 109351 | 4838778 | 470535 |
| BLM | 109398 | 4835898 | 470406 |
| 59760 | 107462 | 4835250 | 471497 |
| 59761 | 109400 | 4835286 | 471532 |
| 59763 | 109356 | 4835105 | 469094 |
| 59766 | 107468 | 4836380 | 469927 |
| 59772 | 109352 | 4835229 | 471504 |
| Bishop Well | None | 4833564 | 466562 |

Static water levels were measured in these twelve (12) wells in late May/early June 2012 by SPF (SPF 2012). SPF also measured ground elevation of each monitoring well using a handheld Garmin GPS unit (Etrex Vista HCX). These elevations are not survey-grade quality, and vertical errors associated with a standard-grade GPS is generally considered to be +/- 10 to 20 meters. There are future plans to survey all of the monitoring wells to achieve more accurate well elevations. Using the measured ground elevation and static water levels, the groundwater surface elevation in each well can be calculated. The ground elevation, static water level, and groundwater elevation for each of the twelve (12) monitoring wells are summarized in Table 3.

Table 3. Grassy Mountain Monitoring Well Groundwater Elevations

| Calico Well ID | OWRD Well Tag Number | May/June 2012 Static WL (ft bgl) | Ground Elevation (ft)[1] | May/June Groundwater Elevation (ft bgl) |
|---|---|---|---|---|
| GW-1 | 107469 | 51.98 | 3,715 | 3,663 |
| GW-4 | 107460 | 80.93 | 3,347 | 3,266 |
| Prod 1 | 107457 | Flowing | 3,447 | NA |
| PW-1 | 109353 | 51.96 | 3,709 | 3,657 |
| PW-4 | 109351 | 77.27 | 3,343 | 3,266 |
| BLM | 109398 | 156.30 | 3,584 | 3,428 |
| 59760 | 107462 | 86.11 | 3,779 | 3,693 |
| 59761 | 109400 | 86.45 | 3,761 | 3,675 |
| 59763 | 109356 | 277.63 | 3,519 | 3,241 |
| 59766 | 107468 | 24.06 | 3,462 | 3,438 |
| 59772 | 109352 | 92.53 | 3,796 | 3,703 |
| Bishop Well | None | 105.43 | 3,400 | 3,295 |

1 - Ground Elevation from SPF (2012) using Garmin Etrex Vista HCX

## 2.2. Wells for Manual Water Level Measurements

In addition to the twelve (12) wells proposed for water level and water quality monitoring, there are an additional 7 (seven) monitoring wells proposed for water level measurements for the Winter 2013 sampling event. These wells are listed in Table 4, along with construction details. These wells are also shown on the Grassy Mountain site map (Attachment A). Table 4 includes OWRD well tag number, completion depth,

screened interval, and well casing diameter. Well driller's reports for these seven (7) monitoring wells are provided in Attachment D. The OWRD has located these wells using a hand-held GPS, and reported the locations as latitude and longitude to SPF. The latitude and longitude as reported by OWRD and the converted UTM coordinates (Zone 11N, NAD 83) for these wells are provided in Table 5.

Static water levels were not measured in these seven (7) wells by SPF during the May/June 2012 sampling event. Static water levels have been measured in these wells during previous monitoring efforts and these are reported in Table 6, along with reported surface elevation and groundwater elevation and the source of the data. During the Winter 2013 sampling event, well locations and elevations will be identified using a handheld Garmin GPS unit (Etrex Vista HCX). There are future plans to survey all of the monitoring wells to achieve more accurate well elevations.

Table 4. Grassy Mountain Water Level Monitoring Wells and Construction Details

| Calico Well ID | OWRD Well Tag Number | Alternate Name | Well Const. Depth (ft) | Screened Interval (ft) | Well Casing Diameter (in) |
|---|---|---|---|---|---|
| GW-2 | 109357 | 47-2 | 325 | 290-320 | 4 |
| GW-3 | 107467 | 47-3 | 350 | 320-350 | 4 |
| GW-6 | 109368 | | 340 | 300-340 | 2 |
| 89-2 | 109360 | | 425 | 386-406 | unknown |
| 59762 | 109371 | MW-3 | 700 | 550-660 | 4 |
| 59764 | 107466 | MW-5 | 305 | 279-299 | 4 |
| 26-092-915 | 109354 | | 915 | 228-268 | 2 |

Table 5. GPS Coordinates for Grassy Mountain Water Level Monitoring Wells

| Calico Well ID | OWRD Well Tag Number | Latitude[1] | Longitude[1] | Northing (UTM 11N, NAD83)[2] | Easting (UTM 11N, NAD 83)[2] |
|---|---|---|---|---|---|
| GW-2 | 109357 | 43.659110 | -117.367150 | 470396 | 4834077 |
| GW-3 | 107467 | 43.672780 | -117.365150 | 470563 | 4835595 |
| GW-6 | 109368 | 43.672880 | -117.392810 | 468334 | 4835616 |
| 89-2 | 109360 | 43.683350 | -117.397060 | 467997 | 4836780 |
| 59762 | 109371 | 43.673890 | -117.359760 | 470999 | 4835716 |
| 59764 | 107466 | 43.668270 | -117.384100 | 469034 | 4835101 |
| 26-092-915 | 109354 | 43.672440 | -117.355860 | 471312 | 4835554 |

1 - Latitude and longitude reported by OWRD

2 - Northing and Easting converted from latitude and longitude

Table 6. Grassy Mountain Water Level Monitoring Well Groundwater Elevations

| Calico Well ID | OWRD Well Tag Number | Reported Static WL (ft bgl) | Ground Elevation (ft) | Groundwater Elevation (ft bgl) | Source |
|---|---|---|---|---|---|
| GW-2 | 109357 | 164 | 3,822 | 3,658 | JMM 1991 |
| GW-3 | 107467 | 230 | 3,626 | 3,396 | JMM 1991 |
| GW-6 | 109368 | 138 | 3,365 | 3,227 | JMM 1991 |
| 89-2 | 109360 | 59 | 3,300 | 3,241 | JMM 1991 |
| 59762 | 109371 | 600 | 3,718 | 3,118 | Hydro-Geo 1993 |
| 59764 | 107466 | 271 | 3,519 | 3,248 | Hydro-Geo 1993 |
| 26-092-915 | 109354 | 56 | 3,704 | 3,648 | JMM 1991 |

These seven (7) wells were selected for water level monitoring to provide additional baseline water level data and to better define groundwater flow within the Study Area. These wells were not selected for water quality monitoring because either the well has been reported as unsuitable for water quality sampling (RMEC 2012, JMM 1991), the well has not been evaluated for condition in the last 20 years, or the well is considered to be redundant to a well that is being sampled (constructed similarly with similar water levels and located in close proximity to a well that will be sampled).

In addition to the wells proposed for monitoring, there are also two (2) wells known to be dry, these are 59765 (MW-6, OWRD well tag number 109355) and GW-3A. These wells are shown on the Grassy Mountain site map (Attachment A).

## 2.3. Wells for Continuous Water Level Measurements

Three (3) monitoring wells will be used for continuous baseline water level measurements using water level pressure transducers. Water level transducers will be installed during the Winter 2013 sampling event. Measuring water levels at a higher frequency will provide a more complete description of seasonal groundwater level trends.

The wells selected for continuous water level measurements have different completion depths, groundwater elevations, and are located around the project site in an attempt to collect water level data from different water-bearing zones and at various locations throughout the Study Area. The wells proposed for continuous water level monitoring are listed in Table 7. Well GW-2 is currently proposed for continuous water level

measurements, but this well has not been visited by SPF to confirm location, condition, and access. If GW-2 cannot be used, then well 59763 will be used instead.

Table 7. Grassy Mountain Wells Proposed for Continuous Water Level Monitoring

| Calico Well ID | OWRD Well Tag Number | Well Const. Depth (ft) | Screened Interval (ft) | Groundwater Elevation (ft bgl) |
|---|---|---|---|---|
| GW-1 | 107469 | 155.5 | 135.5-155.5 | 3,663 |
| GW-4 | 107460 | 370 | 280-350 | 3,266 |
| GW-2 | 109357 | 325 | 290-320 | 3,658 |
| OR | | | | |
| 59763 | 109356 | 323 | 293-323 | 3,241 |

# 3. GRASSY MOUNTAIN SPRINGS

There are numerous springs located within the proposed Water Resources Study Area. During the May/June 2012 sampling event, SPF visited eleven (11) springs in the Study Area. Seven (7) of these springs had measurable flow and a location suitable for collecting samples. These springs were sampled during the May/June 2012 event. These springs were also located by GPS using a Garmin GPS unit (Etrex Vista HCX). Three (3) of the springs appeared to be dry, and another spring (Poison Spring) did not have a defined source and location appropriate for sampling.

The springs visited in 2012 are listed in Table 8, along with the May/June 2012 measured flow rate and the UTM coordinates (Zone 11N, NAD 83). These springs are also shown on the Grassy Mountain site map (Attachment A). These eleven (11) springs will be visited during the Winter 2013 sampling event, and water quality samples will be collected and flow measured if flow is observed. Only springs with a minimum flow of approximately ¼ liter per minute will be sampled, any flow less than that is considered unsuitable for collecting samples. Similarly, diffuse flow that cannot be captured and measured will not be sampled. At Poison Spring, an attempt will be made to collect samples if a suitable location can be identified.

Table 8. Grassy Mountain GPS Coordinates and Flow

| Spring | Northing (UTM 11N, NAD83) | Easting (UTM 11N, NAD 83) | Flow Rate (gpm) |
|---|---|---|---|
| Government Corral Spring | 4838649 | 472953 | 1.3 |
| Sagebrush Spring | 4839227 | 474047 | 1.9 |
| Grassy Spring Stock Tank | 4836114 | 470717 | 0.2 |
| Twin Springs North | 4829624 | 466218 | 1.7 |
| Twin Springs South | 4829253 | 466389 | 9.4 |
| Sourdough Spring Upper | 4833121 | 463632 | 0.4 |
| Whiskey Spring | 4829321 | 469195 | 0.9 |
| Sourdough Spring Lower | --- | --- | Dry |
| Grassy Spring | --- | --- | Dry |
| Lowe Spring | --- | --- | Dry |
| Poison Spring | 4839604 | 467781 | No Measurement |

# 4. SURFACE WATER

The Water Resources Study Area for the Grassy Mountain Gold Project includes a main study area boundary near the project and also two separate and smaller study areas on the Owyhee River/Lake. A map of the proposed Water Resources Study Area is included on the Grassy Mountain site map (Attachment A). In the main Study Area, there are not perennial surface waters other than ponds formed by spring flows. The two smaller study areas were added to include surface water sampling locations on the Owyhee River/Lake upstream and downstream of any potential impacts from the project.

The downstream sampling site is located 4 miles downstream of the Owyhee Dam and has been used by the Oregon Department of Environmental Quality (DEQ) for water quality sampling in the past (Station 11048). The upstream sampling site is located at Leslie Gulch, approximately 30 miles upstream of Owyhee Dam and approximately 20 miles upstream of Dry Creek Arm. The location at Leslie Gulch was selected to provide a sampling site readily-accessible by vehicle and well upstream of any potential influence from the project.

The upstream and downstream sites on the Owyhee River/Lake will not be sampled during the Winter 2013 sampling event. Sampling at these locations will occur biannually during the spring and fall.

# 5. PERSONNEL

Personnel from SPF will conduct the field work, data analyses, and reporting associated with the Winter 2013 sampling event. Personnel are listed below, along with anticipated responsibilities. At this time, no other personnel from SPF are planned to participate in the Water Resources Baseline Study.

- Terry Scanlan, P.E., P.G., Lead Project Engineer

  Responsibilities include:

  1. Project management
  2. Quality assurance and quality control (QA/QC)
  3. Final review and sealing of Monitoring Report

- Jason Thompson, P.E., Project Engineer

  Responsibilities include:

  1. Project management
  2. Field work
  3. Data analyses and review
  4. Monitoring Report preparation

- Erik Boe, E.I.T, Associate Engineer

  Responsibilities include:

  1. Field work
  2. Data analyses and review
  3. Monitoring Report preparation

# 6. SAMPLING SCHEDULE

The Water Resources Baseline Study will include quarterly sampling events annually during the baseline data collection period. The sampling event will be planned for the mid-point of each quarter, indicated on the sampling schedule in Table 9. The Winter 2013 event is currently scheduled for February 2013. The schedule may vary due to poor weather and limited access to the site. However, a minimum of three (3) weeks

will separate each sampling event. Due to the relative flexibility of the schedule, it is very unlikely that a quarterly sampling event will be completely missed.

Table 9. Schedule for Sampling Events

| Sampling Event | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec |
| Winter | | | | | | | | | | | | |
| Spring | | | | | | | | | | | | |
| Summer | | | | | | | | | | | | |
| Fall | | | | | | | | | | | | |

Quarterly Sampling Period
Mid-Point of Quarter

During each sampling event, water quality and water levels will be collected from the wells identified in Table 1, water levels will be measured in the wells identified in Table 4, and water quality and flow will be measured in the springs identified in Table 8. Continuous water level data will be collected from the wells identified in Table 7. The two locations on the Owyhee River/Lake will be sampled biannually during the spring and fall, sampling will not occur during the Winter 2013 event.

# 7. SAMPLING PROCEDURES

Standard hydrologic field procedures and methodologies will be utilized to ensure accurate and reliable data collection. Where applicable, sampling procedures will follow the Oregon DEQ Field Sampling Reference Guide (Oregon DEQ 2010) and the Oregon DEQ Water Monitoring and Assessment Mode of Operations Manual (Oregon DEQ 2009).

Quality assurance and quality control (QA/QC) are an important component of the monitoring plan, and the QA/QC protocols described in the Oregon DEQ Water Monitoring and Assessment Mode of Operations Manual (Oregon DEQ 2009) and the Oregon DEQ Quality Manual (Oregon DEQ 2011) will be followed. Specific QA/QC details are described in Sections 7.8.2, 7.9.2, and 7.10.2.

Monitoring well, spring, and surface water data collection forms have been developed for recording field data. Copies of the forms are included in Attachment B.

The general sampling procedure is described in the Sections below:

## 7.1. GPS Coordinates

Discrepancies associated with monitoring well locations were identified during an initial review of background information. Therefore, during the May/June 2012 sampling event a Garmin GPS unit was used to mark and validate UTM coordinates (Zone 11, NAD 83) of each sampling site (wells and springs) to ensure accuracy. The updated locations are illustrated in the Grassy Mountain site map (Attachment A). Well GPS coordinates collected in May/June 2012 are very similar to coordinates collected independently by OWRD. Any additional wells or springs that were not located during May/June 2012 will be located with a GPS unit. The two surface water sampling sites on the Owyhee Lake/River will also be marked with a GPS unit.

## 7.2. Photographs

Digital photographs of each monitoring well and spring were taken when the sites were visited in May/June 2012 (SPF 2012). Digital photographs will be taken of any additional wells that may be visited in the future and of surface water sampling sites. Digital photographs of springs will be taken during each sampling event to document spring appearance and sampling location.

## 7.3. Water Level Measurements (Wells)

### 7.3.1. Manual Water Level Measurements

The static water level of each well will be measured prior to purge pumping using an electric-line sounder relative to the top of the outer well casing, as described by RMEC 2012. The measurement point on each well casing shall be marked for consistency. If the well cap is not vented, then measurements will be taken after the static water level has had adequate time to reach equilibrium.

A data collection form has been developed for recording important field data, a copy is included in Attachment B. Static water level will be recorded on the data collection form along with the well name, OWRD well tag number (if present), date, time, height of outer well casing relative to ground surface, measurement point (MP) description, well condition, and other relevant information. For the well condition assessment, the well casing(s) and concrete pad (if present) will be visually examined for damage. The area around the well will be examined for standing water. These measurements and observations will occur prior to the start of purge pumping.

The electric line well sounder unit used for each measurement shall be identified. Calibration information for each well sounder utilized shall be provided with the measurement report. Both raw and adjusted (based on calibration) measurements shall be provided. SPF currently uses a Waterline electric-line sounder that is calibrated annually (at a minimum) with a steel tape.

The well designated as Prod-1 has artesian flow, and is allowed to flow continuously for stockwater use. Accurate measurement of static water level would require that the well be shut-in for an extended period (days or weeks) to allow the water-level to equilibrate. Rather than shut the well in, the well can best be monitored similar to a spring, with artesian flow rate measured at the time of each sampling event.

### 7.3.2. Continuous Water Level Measurements

To continuously record water levels, water level and barometric pressure transducers will be installed in three (3) monitoring wells (GW-1, GW-4, GW-2 or 59763). Solinst Levelogger Edge (Model 3001) pressure transducers will be installed in each monitoring well to continuously record water level and temperature data. A single Solinst Barologger (Model 3001) will be installed in GW-1 (a centrally located monitoring well) to compensate water level observations for fluctuations in atmospheric pressure. Equipment accuracy of the Solinst Levelogger Edge is listed at 0.05% over the full scale length of 10 meters.

At each monitoring well, the Levelogger will be suspended via a stainless steel cable attached to an I-bolt affixed to the top of the well casing. The Levelogger will be placed approximately 4 meters (13 feet) below the ground water surface. At the centrally located monitoring well (GW-1), the Barologger will be attached to a 1 meter section of stainless steel cable affixed to the I-bolt to ensure it is above the water table. Prior to installation, the Leveloggers and Barologger will be setup for recording data using standard manufacturer software. All Levelogger pressure transducers will be set to record water level (or barometric pressure for the Barologger) at 30 minute intervals.

At the time of installation of the Levelogger, a calibrated electric line sounder will be used to manually measure the depth to water relative to the top of the well casing. Manual water level measurements will occur at the wells where transducers are installed on a quarterly basis. The manually recorded depth to water, along with barometric data, will be used to generate a calibrated time series of ground water elevation. Levelogger data retrieval will coincide with manual observations of ground water level on a quarterly basis to allow for recalibration of each quarterly data set. SPF uses a Waterline electric line sounder that is calibrated annually with a steel tape.

## 7.4. Flow Measurement (Springs)

The flow from each spring will be measured using a container of known volume and a stopwatch. Flow measurements will be accomplished without altering the spring or disturbing the area around the spring. A general description of the spring and any associated stock tanks or ponds will be recorded (along with photographic documentation, Section 7.2 above).

## 7.5. Dedicated Pump Installation

### 7.5.1. Pump and Equipment Description

Permanent, dedicated pumps will be installed in the eight (8) monitoring wells that do not already have pumps installed and where water quality samples will be collected. The Bishop Well and wells PW-1 (109353), Prod-1 (107457), and 59760 (107462, Middle Sweizer, or TW-1) already have permanent pumps. The new pumps will be installed prior to the Winter 2013 sampling event.

A 3-inch submersible pump manufactured by Grundfos will be installed in each of the eight (8) wells. The pumps are constructed of stainless steel and synthetic materials. The pumps do not contain mercury. Pumps were selected for each well based on well capacity and available drawdown, so that the time required to purge each well can be minimized. The pumps will be set on 1.25-inch diameter Schedule 80 PVC drop pipe with stainless steel couplers. The pump to be installed in each of the eight (8) wells is listed in Table 10, along with motor horsepower, design criteria, drop pipe diameter, and setting depth. This information will be recorded on the data collection form during each sampling event. Each pump will be powered by a portable generator with a 240V 30 amp breaker. A hole will be drilled in each pump check valve to allow water to slowly drain from the drop pipe to prevent freezing.

Table 10. Grassy Mountain Monitoring Well Dedicated Pumps

| Well No. | Well Casing Diameter [in] | Constructed Well Depth [ft] | Design Pumping Rate [gpm] | Drop Pipe Diam [in] | Setting Depth Below Casing [ft] | TDH [ft] | Recom Grundfos Pump | Motor HP |
|---|---|---|---|---|---|---|---|---|
| GW-1 | 4 | 156 | 20 | 1.25 | 105 | 98 | 22SQ-120 | 0.75 |
| GW-4 | 4 | 370 | 30 | 1.25 | 126 | 133 | 22SQ-220 | 1.5 |
| PW-4 | 6 | 375 | 30 | 1.25 | 147 | 144 | 22SQ-220 | 1.5 |
| BLM | 6 | 175 | 5 | 1.25 | 168 | 170 | 5SQ-180 | 0.5 |
| 59761 | 4 | 118 | 10 | 1.25 | 105 | 99 | 10SQ-110 | 0.5 |
| 59763 | 6 | 323 | 3 | 1.25 | 322 | 302 | 5SQ-230 | 0.75 |
| 59766 | 4 | 45 | 3 | 1.25 | 42 | 36 | 5SQ-90 | 0.5 |
| 59772 | 4 | 207 | 26 | 1.25 | 126 | 133 | 22SQ-160 | 0.75 |

At the time of pump installation, the following additional equipment will also be installed:

- A cast iron sanitary well seal installed on the top of the well casing inside the outer protective surface casing. The well seal (Baker cast iron well seal or equal) will have double holes and access port. One hole will be used for drop pipe penetration, one hole will be used for accessing the sounding tube, and the access

port will be used for access to the pump motor electrical cable. The access port will provide venting for the well, and additional venting will be provided by cutting slots in the sounding tube above the static water level.

- A stainless steel tee installed on top of the well seal, with the bottom vertical leg supporting the pump drop pipe by a threaded connection, the top vertical leg capped but available for connection to the field water quality testing/flow bypass manifold (see Section 7.6 below), and the horizontal leg fitted with a stainless steel ball valve and barbed fitting available for connection to temporary Tygon tubing for water quality sampling.
- 1-inch Shedule 40 PVC sounding tube, placed from the top of the casing to the top of the pump and strapped to the drop pipe at each joint with stainless steel straps. The sounding tube shall be accessed at the surface through the well seal.

### 7.5.2. Pump Decontamination and QA/QC

Prior to installation of the permanent pumps, one of the pumps will be set on one (1) piece of PVC drop pipe and lowered into a 30-gallon container of deionized water. A stainless steel tee, ball valve, and barbed fitting will be installed on top of the drop pipe. A piece of Tygon tubing will be connected to the barbed fitting. All equipment will be decontaminated using deionized water. The pump will be turned on, and deionized water will be pumped through the pump, drop pipe, tee, ball valve, barbed fitting, and tubing. An equipment blank will be collected from this pumped deionized water and submitted to the laboratory for analysis of all the analytes listed in Table 11. An transfer/equipment blank will also be collected directly from the 30-gallon container of deionized water to determine if the deionized water is contaminated prior to pumping through the equipment.

Collection of the pumping system equipment blank will be used to evaluate the effectiveness of the decontamination procedure and to assess any potential contamination resulting from the pump and associated equipment. It is anticipated that analytical results from the equipment blank will be received and evaluated prior to installation of the pumps in the monitoring wells. If the laboratory analyses indicates the presence of any of the analytes outside acceptable laboratory accuracy control limits, then corrective action will be taken, which may include decontaminating the pumping equipment again and collecting another equipment blank.

All pumps, drop pipe, and other equipment will be decontaminated and rinsed with deionized water prior to installation in the monitoring wells.

## 7.6. Field Water Quality Testing Manifold

To allow for measurement of field water quality parameters directly from the pump discharge, a testing manifold will be connected to the top vertical leg of the stainless steel tee installed above the well seal in each monitoring well. This testing manifold will also provide an outlet for bypass and purge flows from the pump. A photo of the

testing manifold is provided in Figure 1. Discharge manifold piping and valves in contact with water samples are constructed of inert PVC.

This testing manifold provides a flush line for purge flows and a connection to a field water quality sampling port and multi-probe flow container. A third leg originally intended to provide a connection to a water quality sampling port with filter will no longer be used. When purging the well prior to sample collection, the stainless steel ball valve located on the horizontal leg of the tee will be closed and the PVC ball valve on the manifold flush line will be opened. When field water quality parameters are to be measured, the PVC ball valve on the manifold field water quality line will be opened to direct flow to the multi-probe flow container. When water quality samples are to be collected for laboratory analyses, the stainless steel ball valve located on the horizontal leg of the tee will be opened to direct flow to temporary tubing and a filter (when dissolved samples are collected). The 0.45 μm filter has a maximum pressure rating of 23 psi, so the PVC ball valve on the main testing manifold line can be opened as needed to prevent excessive pressure through the filter.

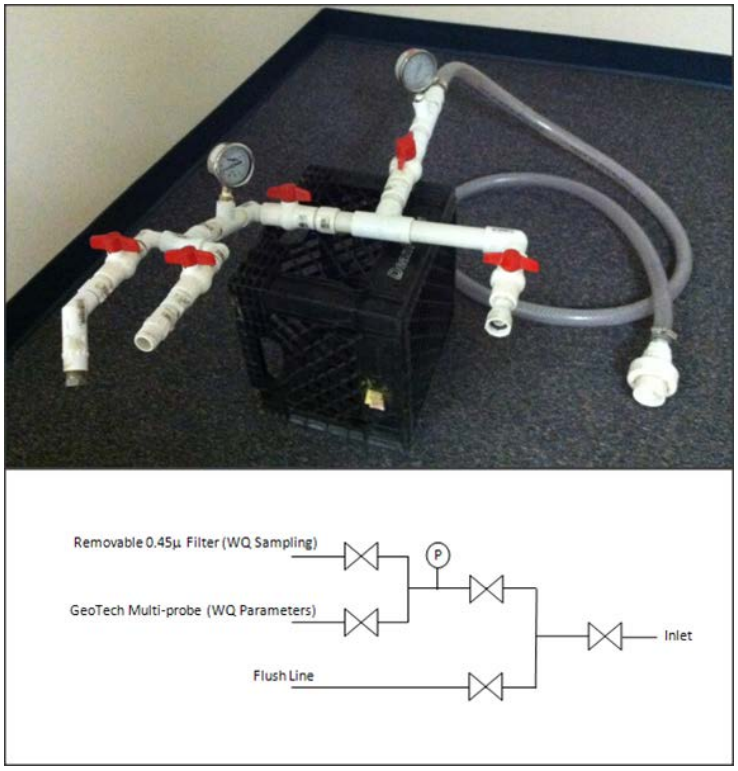



Figure 1. Discharge testing manifold photograph and diagram

## 7.7. Purge Pumping

### 7.7.1. General Procedure

Each monitoring well will be pumped to purge a minimum of three (3) casing volumes of water from the well, standard practice to remove stagnant water prior to ground water sample collection. The BLM (Owyhee Ridge) Well will be pumped for a longer duration, see Section 7.7.2. Purge water will be discharged to waste at the well site through the field water quality testing manifold.

During pumping, the pumping rate will be measured using a five-gallon bucket and stopwatch. Pumping volume will be calculated from the pumping rate and pumping duration. Pumping rate and volume will recorded on the field data collection form. Additionally, field water quality parameters will be measured and recorded on the data collection form as described below in Section 7.8.1. The appearance and odor of the purged water will be noted.

After a minimum of three (3) casing volumes have been pumped and once field water quality parameters have stabilized, water quality samples will be collected as described in Section 6.7.2. The anticipated time required for purging each well can be calculated based on the design pumping rate of the pump that will be installed and the casing volume of each well. This information is presented in a summary table of monitoring well construction and purge pumping calculations included as Attachment C. Note that because Prod-1 continuously flows by artesian pressure, this well will not be purged and samples will be collected directly from the artesian flow.

### 7.7.2. BLM (Owyhee Ridge) Well

The BLM (Owyhee Ridge) Well will be pumped for a longer duration (minimum of 2 hours), with samples collected for select analytes after purging approximately 3, 6, and 12 casing volumes. The intent of this extended testing is to determine whether or not water quality parameters vary with pumping duration. Past sampling efforts have indicated variability in concentrations of arsenic, calcium, iron, manganese, and sulfate that may be due to this well drawing water from different water-bearing zones over time.

If water quality does vary, this may reduce the reliability and consistency of data collected from the well and make the well unacceptable as a baseline monitoring location.

## 7.8. Ground Water Quality Data Collection

### 7.8.1. Field Water Quality Parameters

Purge water will be discharged from the pump into the testing manifold and part of the flow will be diverted through the Geotech multiprobe flow container. This flow container allows for continuous measurement of field parameters (pH,

temperature, electrical conductivity, specific conductance) without aeration of the sample. Field parameters will be monitored during purging to ensure parameters are stable prior to sampling. Parameters will be considered stable when consecutive measurements taken a maximum of one (1) casing volume apart meet the following conditions: temperature within one (1) degree Celsius, pH within 0.3 standard pH units, and specific conductance measurements within 10% of each other (Oregon DEQ 2009). Dissolved oxygen will be measured in a separate purge water container (clean plastic bucket). At least two measurements of field water quality data will be recorded on the data collection form.

The testing manifold and flow container will only be used for measuring field water quality parameters, water collected for laboratory analyses will not pass through the manifold but will instead be diverted through the horizontal leg of the stainless steel tee at the well head. Therefore, decontamination and collection of equipment blanks from the testing manifold is not considered necessary.

The field equipment that will be used for measuring field water quality parameters is listed below, along with the equipment calibration procedure. Personnel performing equipment calibration will be adequately trained, and results of calibration will be recorded on the calibration form include as Attachment E.

- The pH (S.U.) will be measured using a YSI EcoSense Model pH100 meter. Calibration will be performed according to manufacturer recommendations prior to the sampling event and will be checked again on the morning of each sampling day. A 2-point calibration will be performed using pH 4, 7, or 10 standard solutions.
- Specific Conductance (SC, µS/cm @ 25$^{o}$C) will be measured using a YSI EcoSense Model EC300 meter. Calibration will be performed according to manufacturer recommendations prior to the sampling event and checked again on the morning of each sampling day.
- Electrical Conductivity (EC, µS/cm) will be measured using a YSI EcoSense Model EC300 meter.
- Temperature (°C) will be measured using the YSI Model EC300 meter.
- Dissolved Oxygen (mg/L) will be measured using an OxyGuard Handy Polaris 2 Portable DO meter. This DO meter automatically compensates for temperature and barometric pressure, and has an automatic calibration with stability check. The calibration of the instrument will be checked on a daily basis to ensure that the meter is operating within the acceptable range.

### 7.8.2. Water Quality Sample Collection

Water quality samples will be collected for analysis at the laboratory after a minimum of three (3) casing volumes have been purged and the field water

quality parameters have stabilized as evidenced by the conditions described in Section 7.8.1. The constituents that will be sampled from each well for analysis at the laboratory are listed in Table 11. Table 11 also includes the laboratory testing method, the laboratory detection limit, and the reporting limit. The laboratory that will be used for sample analysis is ACZ Laboratories in Colorado.

For metals, samples for both total and dissolved metals will be collected. These are identified in Table 11. For the other parameters, only total samples will be collected. The preservatives used by the laboratory and the recommended holding times for each testing method are summarized in Table 12.

This list of constituents is quite extensive, and some may be removed from the list after a number of sampling events demonstrate that the constituent is not of concern.

Table 11. List of Water Quality Analytes and Testing Methods

| Parameter | Laboratory Method of Analyses | Detection Limit | Reporting Limit | Sample Type |
|---|---|---|---|---|
| Aluminum, Al | EPA 200.7 | 0.03 mg/L | 0.15 mg/L | total and dissolved |
| Total Arsenic | EPA 200.8 | 0.0002 mg/L | 0.001 mg/L | total and dissolved |
| Inorganic Arsenic | As speciation by HPLC ICP/MS | 0.5 ug/L | 0.5 ug/L | total and dissolved |
| Barium, Ba | EPA 200.7 | 0.003 mg/L | 0.015 mg/L | total and dissolved |
| Cadmium Low | EPA 200.8 | 0.0001 mg/L | 0.0005 mg/L | total and dissolved |
| Calcium, Ca | EPA 200.7 | 0.2 mg/L | 1 mg/L | total and dissolved |
| Chromium Low | EPA 200.8 | 0.0005 mg/L | 0.002 mg/L | total and dissolved |
| Copper Low | EPA 200.8 | 0.0005 mg/L | 0.0025 mg/L | total and dissolved |
| Iron, Fe | EPA 200.7 | 0.02 mg/L | 0.05 mg/L | total and dissolved |
| Lead Low | EPA 200.8 | 0.0001 mg/L | 0.0005 mg/L | total and dissolved |
| Magnesium, Mg | EPA 200.7 | 0.2 mg/L | 1 mg/L | total and dissolved |
| Manganese Low | EPA 200.8 | 0.0005 mg/L | 0.0025 mg/L | total and dissolved |
| Mercury, Hg (Low Level) | 1631E | 0.2 ng/L | 0.5 ng/L | total and dissolved |
| Nickel Low | EPA 200.8 | 0.0006 mg/L | 0.003 mg/L | total and dissolved |
| Potassium, K | EPA 200.7 | 0.3 mg/L | 1.5 mg/L | total and dissolved |
| Selenium Low | EPA 200.8 | 0.0001 mg/L | 0.00025 mg/L | total and dissolved |
| Silver Low | EPA 200.8 | 0.00005 mg/L | 0.00025 mg/L | total and dissolved |
| Sodium, Na | EPA 200.7 | 0.3 mg/L | 1.5 mg/L | total and dissolved |
| Zinc, Zn | EPA 200.7 | 0.01 mg/L | 0.05 mg/L | total and dissolved |
| Antimony | EPA 200.8 | 0.0004 mg/L | 0.002 mg/L | total and dissolved |
| Beryllium | EPA 200.8 | 0.00005 mg/L | 0.00025 mg/L | total and dissolved |
| Bismuth | EPA 200.7 | 0.04 mg/L | 0.2 mg/L | total and dissolved |
| Boron | EPA 200.8 | 0.0005 mg/L | 0.001 mg/L | total and dissolved |
| Cobalt | EPA 200.8 | 0.00005 mg/L | 0.00025 mg/L | total and dissolved |
| Gallium | EPA 200.7 | 0.1 mg/L | 0.5 mg/L | total and dissolved |
| Lithium | EPA 200.7 | 0.02 mg/L | 0.1 mg/L | total and dissolved |
| Molybdenum | EPA 200.8 | 0.0005 mg/L | 0.0025 mg/L | total and dissolved |
| Scandium | EPA 200.7 | 0.1 mg/L | 0.5 mg/L | total and dissolved |
| Strontium | EPA 200.7 | 0.01 mg/L | 0.05 mg/L | total and dissolved |
| Thallium | EPA 200.8 | 0.0001 mg/L | 0.0005 mg/L | total and dissolved |
| Tin | EPA 200.8 | 0.0004 mg/L | 0.002 mg/L | total and dissolved |
| Titanium | EPA 200.7 | 0.005 mg/L | 0.025 mg/L | total and dissolved |

| | | | | |
|---|---|---|---|---|
| Vanadium | EPA 200.8 | 0.0002 mg/L | 0.001 mg/L | total and dissolved |
| Nitrate (as N) | EPA 353.2 | 0.02 mg/L | 0.1 mg/L | total |
| Ammonia Direct (as N) | EPA 350.1 | 0.05 mg/L | 0.5 mg/L | total |
| Nitrite (as N) | EPA 353.2 | 0.01 mg/L | 0.05 mg/L | total |
| Alkalinity | SM 2320B | 2 mg/L | 20 mg/L | total |
| Bicarbonate | SM 2320 | 2 mg/L | 20 mg/L | total |
| Carbonate | SM 2320 | 2 mg/L | 20 mg/L | total |
| Chloride, Cl | EPA 300.0 | 0.5 mg/L | 2.5 mg/L | total |
| Conductivity | SM 2510B | 1 umhos/cm | 10 umhos/cm | total |
| Cyanide, Total | EPA 335.4 | 0.003 mg/L | 0.01 mg/L | total |
| Cyanide, Weak Acid Digestion | SM 4500 | 0.003 mg/L | 0.01 mg/L | total |
| Fluoride, F | EPA 300.0 | 0.1 mg/L | 0.5 mg/L | total |
| Hardness | SM 2340 B | calc | calc | total |
| pH | SM 4500-H B | 0.1 C | 0.1 C | total |
| Sulfate, SO4 | EPA 300.0 | 0.5 mg/L | 2.5 mg/L | total |
| Total Dissolved Solids | SM 2540C | 10 mg/L | 20 mg/L | total |
| Total Suspended Solids | SM 2540D | 5 mg/L | 20 mg/L | total |
| Total Phosphorus | EPA 365.1 | 0.01 mg/L | 0.05 mg/L | total |

Table 12. List of Water Quality Analytes, Hold Times, and Preservatives

| Parameter | Laboratory Method of Analyses | Hold Time | Preservative | Bottle Type |
|---|---|---|---|---|
| Aluminum, Al | EPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Total Arsenic | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Inorganic Arsenic | HPLC ICP/MS | 28 Days | EDTA-HAc | 125 mL amber HDPE |
| Barium, Ba | EPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Cadmium Low | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Calcium, Ca | EPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Chromium Low | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Copper Low | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Iron, Fe | EPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Lead Low | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Magnesium, Mg | EPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Manganese Low | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Mercury, Hg (Low Level) | 1631E | 90 Days | 5mL HCl | 250 mL borosilicate glass |
| Nickel Low | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Potassium, K | EPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Selenium Low | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Silver Low | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Sodium, Na | EPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Zinc, Zn | EPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Antimony | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Beryllium | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Bismuth | EPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Boron | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Cobalt | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Gallium | EPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Lithium | EPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Molybdenum | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Scandium | EPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Strontium | EPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Thallium | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Tin | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Titanium | EPA 200.7 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |

| | | | | |
|---|---|---|---|---|
| Vanadium | EPA 200.8 | 6 Months | 2mL 50% HNO3 | 250 mL HDPE |
| Nitrate (as N) | EPA 353.2 | 48 Hours | None | 250 mL HDPE |
| Ammonia Direct (as N) | EPA 350.1 | 28 Days | None | 250 mL HDPE |
| Nitrite (as N) | EPA 353.2 | 48 Hours | None | 250 mL HDPE |
| Alkalinity | SM 2320B | 14 Days | None | 500 mL HDPE |
| Bicarbonate | SM 2320 | 14 Days | None | 500 mL HDPE |
| Carbonate | SM 2320 | 14 Days | None | 500 mL HDPE |
| Chloride, Cl | EPA 300.0 | 28 Days | None | 250 mL HDPE |
| Conductivity | SM 2510B | 28 Days | None | 500 mL HDPE |
| Cyanide, Total | EPA 335.4 | 14 Days | 5 mL 10N NaOH | 500 mL HDPE |
| Cyanide, WAD | SM 4500 | 14 Days | 5 mL 10N NaOH | 500 mL HDPE |
| Fluoride, F | EPA 300.0 | 28 Days | None | 250 mL HDPE |
| Hardness | SM 2340 B | NA | NA | NA |
| pH | SM 4500-H B | * | None | 500 mL HDPE |
| Sulfate, SO4 | EPA 300.0 | 28 Days | None | 250 mL HDPE |
| Total Dissolved Solids | SM 2540C | 7 Days | None | 500 mL HDPE |
| Total Suspended Solids | SM 2540D | 7 Days | None | 500 mL HDPE |
| Total Phosphorus | EPA 365.1 | 28 Days | 2mL 25% H2SO4 | 250 mL HDPE |

*Perform in field within 15 minutes of sample collection. Laboratory analyses of pH are considered estimated.

Water quality samples will be collected using permanent dedicated pumps installed in each monitoring well. The pump will be installed on drop pipe below the cast iron well seal, and a stainless steel tee will be installed above the well seal with a threaded connection to the drop pipe as described in Section 7.5. On the horizontal leg of the tee, a stainless steel ball valve and barbed fitting will be installed in each well. A piece of disposable Tygon tubing will be connected to the barbed fitting for collecting water quality samples. This tubing will only be used once and then discarded.

For collection of samples to be analyzed for dissolved metals, samples will be filtered in the field using a disposable high-capacity field filter with 0.45 μm membrane (Geotech dispos-a-filter with Versapor membrane) connected directly to the disposable Tygon tubing. Pressure to the filter will be maintained below the filter maximum pressure rating of 23 psi. The filter and tubing will be discarded after use at a single monitoring well.

Collection of samples from continuously flowing artesian wells will be conducted in the same manner as spring water samples (described below).

The laboratory that will be used for water quality sample analysis is ACZ Laboratories in Colorado. This laboratory is accredited by NELAP (National Environmental Laboratory Accreditation Program) for water analysis. The proposed analytical methods are appropriate to meet Oregon DEQ reporting and detection limits.

Samples will be collected in bottles supplied by the laboratory. The laboratory will prepare the bottles with the appropriate preservative as required by the testing method. Preservatives are listed in Table 12. Samples will be taken by field personnel wearing latex gloves discarded after each use. Following collection, sample bottles will be properly labeled with the Calico well name,

OWRD well tag number, date, time, and other pertinent information. The sample bottles will be immediately packed in a cooler with ice packs. Samples will be mailed to the laboratory within specified hold times with proper chain of custody documentation.

### 7.8.3. Quality Assurance / Quality Control

Prior to installation of the permanent pumps, an equipment blank will be collected from one of the pumping systems (pump, piece of drop pipe, tee, valve, tubing, and filter) by pumping deionized water through the system, as described in Section 7.5.2. All equipment will be decontaminated using deionized water prior to collection of the equipment blank. The equipment blank will be used to evaluate the effectiveness of the decontamination procedure and to assess any potential contamination resulting directly from the pump and associated equipment. This equipment blank is considered to be representative of all the pumping equipment installed in the wells. If this blank indicates adequate decontamination procedures, then no additional equipment blanks will be collected from the monitoring wells.

Field duplicate samples will be collected at a 10% sampling frequency for quality assurance purposes and is used to measure precision between samples. A total of twelve (12) wells will be sampled, so one (1) field duplicate will be collected from a monitoring well selected at random. This duplicate sample will be identified as such and analyzed for all the analytes listed in Table 11. The laboratory's duplicate precision control limit will be used to evaluate field duplicate samples. The primary sample and duplicate samples will be compared based on the precision control limits, and any discrepancies noted. Results of the duplicate sample analyses will be presented in the sampling event monitoring report and any questionable sample results will be flagged.

In addition to field QA/QC, the laboratory will complete blank, spike, and duplicate sample tests in accordance with ISO 17025 and ISO 9001 standards. Results will be presented in the sampling event monitoring report.

The EPA Method 1669 is the recommended procedure for collecting water quality samples for trace metals at EPA Water Quality Criteria Levels. This method is performance based, and alternative procedures may be used provided that the collection and analysis of blank samples is used to verify the accuracy of sampling procedures. Method 1669 does not specifically address groundwater sampling using dedicated submersible pumps. Collection of the pumping system equipment blank and field duplicate blank and following the field sampling procedures described in the Oregon DEQ Water Monitoring and Assessment Mode of Operations Manual (Oregon DEQ 2009) will be used to verify the accuracy of the sampling procedures.

## 7.9. Spring Water Quality Data Collection

### 7.9.1. Field Water Quality Parameters

Only springs with a minimum flow of ¼ liter per minute will be sampled, any flow less than that is considered unsuitable for collecting samples. For those springs that flow continuously, conditions will be considered steady state and only one set of field parameters (pH, electrical conductivity, specific conductance, dissolved oxygen) will be collected. For those springs that are normally valved off, the isolation valve will be opened and the spring will be allowed to flow for a minimum of 15 minutes prior to field water quality measurements.

Spring flow will be collected in a 5-gallon plastic bucket (or smaller plastic container for low-flow rate springs), pre-rinsed with water from that spring. Flow measurements will be accomplished without altering the spring or disturbing the area around the spring. The sensors for the pH meter, conductivity meter, and dissolved oxygen meter will be rinsed with spring water and placed in the sample bucket. Readings will be recorded once the measurements have stabilized. The same meters will be used as for ground water sampling.

### 7.9.2. Water Quality Sample Collection

Water quality samples from springs will be analyzed for the same constituents as for samples collected from monitoring wells. Table 11 lists the constituents that will be sampled from each spring for analysis at the laboratory, including the proposed laboratory testing method. For metals, samples for both total and dissolved metals will be collected. These are identified in Table 11. For the other parameters, only total samples will be collected. Water quality samples will be collected without altering the spring or disturbing the area around the spring.

For non-filtered samples (non-metals), water quality samples will be collected for analysis at the laboratory directly from each spring by placing sample bottles directly under the spring discharge pipe. Only springs with a minimum flow of approximately ¼ liter per minute will be sampled, any flow less than that is considered unsuitable for collecting samples. For those springs that flow continuously, conditions will be considered steady state and samples will be collected immediately following field water quality measurements. For those springs that are normally valved off, the isolation valve will be opened and the spring will be allowed to flow for a minimum of 15 minutes prior to sample collection.

A Site Specific Testing Plan for each spring is included in Section 8.

For filtered samples (metals), a water sample will be collected from the spring in a clean container. All of the filtered samples at a site will be collected in the same container. A peristaltic pump (Geotech Geopump with easy-load pump

head) and associated Tygon tubing will be used to transfer the water sample from the container, through a disposable high-capacity field filter with 0.45 μm membrane, and into the appropriate sample bottle obtained from the laboratory. The procedure will follow the "in-line peristaltic pump filtration from a container" method described in the Oregon DEQ Water Monitoring and Assessment Mode of Operations Manual (Oregon DEQ 2009). Filtration equipment, including tubing and filter, will only be used at a single site and then discarded.

The laboratory that will be used for water quality sample analysis is ACZ Laboratories in Colorado. This laboratory accredited by NELAP (National Environmental Laboratory Accreditation Program) for water analysis. The proposed analytical methods are appropriate to meet Oregon DEQ reporting and detection limits.

Samples will be collected in bottles supplied by the laboratory. The laboratory will prepare the bottles with the appropriate preservative as required by the testing method. Preservatives are listed in Table 12. Samples will be taken by field personnel wearing latex gloves discarded after each use. Care will be taken to prevent the sample bottles and other sampling equipment from contacting the sampling source (i.e. supply pipe), ground, or other potential sources of contamination.

Following collection, sample bottles will be properly labeled with the spring name, date, time, and other pertinent information. The sample bottles will be immediately packed in a cooler with ice packs. Samples will be mailed to the laboratory within specified hold times with proper chain of custody documentation.

The EPA Method 1669 is the recommended procedure for collecting water quality samples for trace metals at EPA Water Quality Criteria Levels. The sample collection procedures described above and in the Oregon DEQ Water Monitoring and Assessment Mode of Operations Manual (Oregon DEQ 2009) will be followed. These procedures may differ from the exact requirements of EPA Method 1669, but the collection and analysis of blank samples as described in Section 7.9.3 will be used to verify the accuracy of sampling procedures.

### 7.9.3. Quality Assurance / Quality Control

Equipment blanks will be collected from the peristaltic pumping apparatus at a 10% sampling frequency. A total of between seven (7) and eleven (11) springs will be sampled, depending upon whether flow is observed at the spring, and the artesian well Prod-1 will be sampled using the peristaltic pump. Therefore, one (1) equipment blank will be collected from the pumping apparatus. Collection of the equipment blank will follow this procedure: (1) a clean container will be filled with deionized water, (2) a new piece of Tygon tubing will be installed in the

peristaltic pump head, (3) the inlet end of the tubing will be placed into the container, (4) a new 0.45 μm filter will be installed on the other end of the tubing, and (5) the pump will be started and equipment blank samples will be collected in sample bottles. The equipment blank will be analyzed for all the analytes listed in Table 11.

The results of the equipment blank analyses will be compared with laboratory quality control limits. If the blank fails the quality control limits, then target limits will be estimated for the sampling event. Results of the equipment blank sample analyses will be presented in the sampling event monitoring report and any questionable sample results will be flagged. Corrective actions will be identified and implemented prior to the next sampling event.

Water quality samples for non-filtered samples will be collected directly from each spring by placing sample bottles directly under the spring discharge pipe. Therefore collection of transfer blanks at a 10% sampling frequency is appropriate. One (1) transfer blank will be collected at a randomly selected spring. Collection of the transfer blank will involve pouring a sample of deionized water from its original transport container directly to sample bottles. The transfer blank will be analyzed for all the analytes listed in Table 11.

The transfer blank analytical results will be compared with laboratory quality control limits. If the transfer blank fails the quality control limits, then target limits will be estimated for the sampling event. Results will be presented in the sampling event monitoring report and any questionable sample results will be flagged. Corrective actions will be identified and implemented prior to the next sampling event.

Field duplicate samples will be collected at a 10% sampling frequency for quality assurance purposes. One (1) field duplicate will be collected from a randomly selected spring. This duplicate sample will be identified as such and analyzed for all the analytes listed in Table 11. The laboratory's duplicate precision control limit will be used to evaluate field duplicate samples. The primary sample and duplicate samples will be compared based on the precision control limits, and any discrepancies noted. Results of the duplicate sample analyses will be presented in the sampling event monitoring report and any questionable sample results will be flagged.

In addition to field QA/QC, the laboratory will complete blank, spike, and duplicate sample tests that meet ISO 17025 and ISO 9001 standards. The laboratory QA/QC results will be presented in the sampling event monitoring report.

## 7.10. Surface Water Quality Data Collection

### 7.10.1. Field Water Quality Parameters

Only surface water stations with flowing water will be sampled. Surface water conditions will be considered steady state and only one set of field parameters (pH, electrical conductivity, specific conductance, dissolved oxygen) will be collected.

The sensors for the pH meter, conductivity meter, and dissolved oxygen meter will be placed directly in the surface water for data collection. Readings will be recorded once the measurements have stabilized. The same meters will be used as for ground water and spring sampling.

### 7.10.2. Water Quality Sample Collection

Water quality samples collected from surface water will be analyzed for the same constituents as for samples collected from monitoring wells and springs. Table 11 lists the constituents that will be sampled from each surface water site for analysis at the laboratory, including the proposed laboratory testing method. For metals, samples for both total and dissolved metals will be collected. These are identified in Table 11. For the other parameters, only total samples will be collected.

For non-filtered samples (non-metals), water quality samples will be collected for analysis at the laboratory directly from each surface water site by the hand grab method as described in the Oregon DEQ Water Monitoring and Assessment Mode of Operations Manual (Oregon DEQ 2009). Only surface water stations with flowing water will be sampled. Surface water conditions will be considered steady state and samples will be collected immediately following field water quality measurements.

For filtered samples (metals), a water sample will be collected from the surface water in a clean container. All of the filtered samples at a site will be collected in the same container. A peristaltic pump (Geotech Geopump with easy-load pump head) and associated tubing will be used to transfer the water sample from the container, through a disposable high-capacity field filter with 0.45 μm membrane, and into the appropriate sample bottle obtained from the laboratory. The procedure will generally follow the "in-line peristaltic pump filtration from a container" method described in the Oregon DEQ Water Monitoring and Assessment Mode of Operations Manual (Oregon DEQ 2009). Filtration equipment, including tubing, collection container, and filter, will only be used at a single site and then discarded.

The laboratory that will be used for water quality sample analysis is ACZ Laboratories in Colorado. This laboratory is accredited by NELAP (National

Environmental Laboratory Accreditation Program) for water analysis. The proposed analytical methods are appropriate to meet Oregon DEQ reporting and detection limits.

Samples will be collected in bottles supplied by the laboratory. The laboratory will prepare the bottles with the appropriate preservative as required by the testing method. Preservatives are listed in Table 12. Samples will be taken by field personnel wearing latex gloves discarded after each use. Care will be taken to prevent the sample bottles and other sampling equipment from contacting the ground or other potential sources of contamination.

Following collection, sample bottles will be properly labeled with the name of the surface water location, date, time, and other pertinent information. The sample bottles will be immediately packed in a cooler with ice packs. Samples will be mailed to the laboratory within specified hold times with proper chain of custody documentation.

#### 7.10.3. Quality Assurance / Quality Control

No blanks specifically associated with surface water quality sampling are anticipated. The equipment blank and transfer blank that will be collected at one of the spring sites meets the requirement of collecting these blanks at a 10% sampling frequency, assuming that not more than ten (10) spring/surface water samples are collected. If more than ten (10) samples are collected, then an additional equipment and transfer blank will be collected as described in Section 7.9.3.

# 8. SPRING SITE SPECIFIC TESTING PLAN

A site specific testing plan for each of the seven (7) springs proposed for sampling for the Winter 2013 sampling event is included below. Up to four (4) more springs may be sampled if flow is observed.

## 8.1. Government Corral Spring

Background:

Government Corral Spring was visited and sampled on May 31, 2012. The spring feeds stock tanks. Upon arrival at the Government Corral Spring (Figure 2), there was no flow to the stock tanks. A valve was opened and allowed to flow to the tank for approximately 10 minutes prior to measuring field parameters and collecting water samples. Flow was initially very turbid, but gradually cleared. Flow rate declined over time, and was determined at the time of sampling by measuring the time required to fill a 1-liter bottle. Flow was measured to be 1.3 gpm. The valve was shut following sample collection.

Figure 2. Photographs of Government Corral Spring

Test Plan:

The procedure described in Section 7.9 will be followed for sample collection. Government Corral Spring is normally valved off, so the isolation valve will be opened and the spring will be allowed to flow for a minimum of 15 minutes prior to field water quality measurements and sample collection. Samples will be collected directly from the discharge pipe above the stock tank.

## 8.2. Sagebrush Spring

Background:

Sagebrush Spring was visited and sampled on May 31, 2012. Sagebrush Spring consists of surface flow through a vegetated channel to a reservoir created by an earthen embankment, both located north of the access road. In addition, there are stock tanks located north of the road. After initially examining discharge to Sagebrush pond (low pond inflow rate, stagnant pond conditions), continuous spring discharge to the stock tanks (Figure 3) was identified approximately 500 feet south of Sagebrush pond. Since steady state flowing conditions were present, field parameters were immediately measured and samples collected. Flow rate was determined by measuring the time required to fill a 1-liter bottle. Flow was measured to be 1.9 gpm.

Figure 3. Photographs of Sagebrush Spring

Test Plan:

The procedure described in Section 7.9 will be followed for sample collection. Because Sagebrush Spring is continuously flowing, field water quality measurements and sample collection will occur upon arrival at the site. Samples will be collected directly from the discharge pipe above the stock tank.

## 8.3. Grassy Springs Stock Tank

Background:

The Grassy Spring Stock Tank was visited and sampled on June 7, 2012. The spring continuously feeds a large round sheet metal watering tank. At the time of the visit, borderline low-flow conditions were observed (Figure 4). Since steady state flowing conditions were present, field parameters were immediately measured and samples collected. Flow rate was determined by measuring the time required to fill a 1-liter bottle. Flow was measured to be 0.2 gpm.

Figure 4. Photographs of Grassy Spring Stock Tank

Test Plan:

The procedure described in Section 7.9 will be followed for sample collection. Because Grassy Spring is continuously flowing, field water quality measurements and sample collection will occur upon arrival at the site. Samples will be collected directly from the discharge pipe above the watering tank.

## 8.4. Twin Spring North

Background:

Twin Spring North was visited and sampled on June 7, 2012. The spring continuously feeds a stock tank (Figure 5). Since steady-state flowing conditions were present, field parameters were immediately measured and samples collected. Flow rate was determined by measuring the time required to fill a 1-liter bottle. Flow was measured to be 1.7 gpm.

Figure 5. Photograph of Twin Spring North Stock Tank

Test Plan:

The procedure described in Section 7.9 will be followed for sample collection. Because Twin Spring North is continuously flowing, field water quality measurements and sample collection will occur upon arrival at the site. Samples will be collected directly from the discharge pipe located above the stock tank.

## 8.5. Twin Spring South

Background:

Twin Spring South was visited and sampled on June 7, 2012. The spring continuously feeds a stock tank (Figure 6). Since steady state flowing conditions were present, field parameters were immediately measured and samples collected. Flow rate was determined by measuring the time required to fill a 1-liter bottle. Flow was measured to be 9.4 gpm.

Figure 6. Photograph of Twin Spring South Stock Tank

Test Plan:

The procedure described in Section 7.9 will be followed for sample collection. Because Twin Spring South is continuously flowing, field water quality measurements and sample collection will occur upon arrival at the site. Samples will be collected directly from the discharge pipe located above the stock tank.

## 8.6. Sourdough Spring Upper

Background:

Sourdough Spring Upper was visited and sampled on June 7, 2012. The spring continuously feeds a stock tank (Figure 7). Since steady state flowing conditions were present, field parameters were immediately measured and samples collected. Flow rate was determined by measuring the time required to fill a 1-liter bottle. Flow was measured to be 0.4 gpm.

Figure 7. Sourdough Spring Upper Stock Tank

Test Plan:

The procedure described in Section 7.9 will be followed for sample collection. Because Sourdough Spring Upper is continuously flowing, field water quality measurements and sample collection will occur upon arrival at the site. Samples will be collected directly from the discharge pipe located above the stock tank.

## 8.7. Whiskey Spring

Background:

Whiskey Spring was visited and sampled on June 7, 2012. The spring continuously feeds a large circular stock tank (Figure 8). Since steady state flowing conditions were present, field parameters were immediately measured and samples collected. Flow rate was determined by measuring the time required to fill a 1-liter bottle. Flow was measured to be 0.9 gpm.

Figure 8. Photograph of Whiskey Spring Stock Tank

Test Plan:

The procedure described in Section 7.9 will be followed for sample collection. Because Whiskey Spring is continuously flowing, field water quality measurements and sample collection will occur upon arrival at the site. Samples will be collected directly from the discharge pipe located above the stock tank.

# 9. REFERENCES


ABC, Inc., Water Resources Technical Memorandum for Atlas Precious Metals Inc. Grassy Mountain Project Environmental Impact Statement, Volume I-III, June 1992.

Hydro-Geo Consultants, Inc., Progress Report for the Grassy Mountain Hydrology Project, October 1993.

J.M. Montgomery Consulting Engineers, Inc., Phase I Hydrogeologic Report on the Grassy Mountain Mine Project, Malheur County, OR, 1991.

Oregon Department of Environmental Quality, Water Monitoring and Assessment Mode of Operations Manual, March 2009.

Oregon Department of Environmental Quality, Field Sampling Reference Guide, January 2010.

Oregon Department of Environmental Quality, Quality Manual, May 2011.

RMEC and SRK, Calico-Grassy Mountain Project, 2011 Hydrologic Testing Program (DRAFT), January 2012.

RTR Resource Management, Inc. and HDR Engineering, Inc., Draft Environmental Baseline Study Work Plans, Grassy Mountain Project, September 2012.

SPF Water Engineering, LLC, Draft Grassy Mountain Gold Project Ground Water Monitoring Report, May 2012 Sample Period, July 2012.


# 10. ATTACHMENTS

Attachment A: Grassy Mountain Site Map

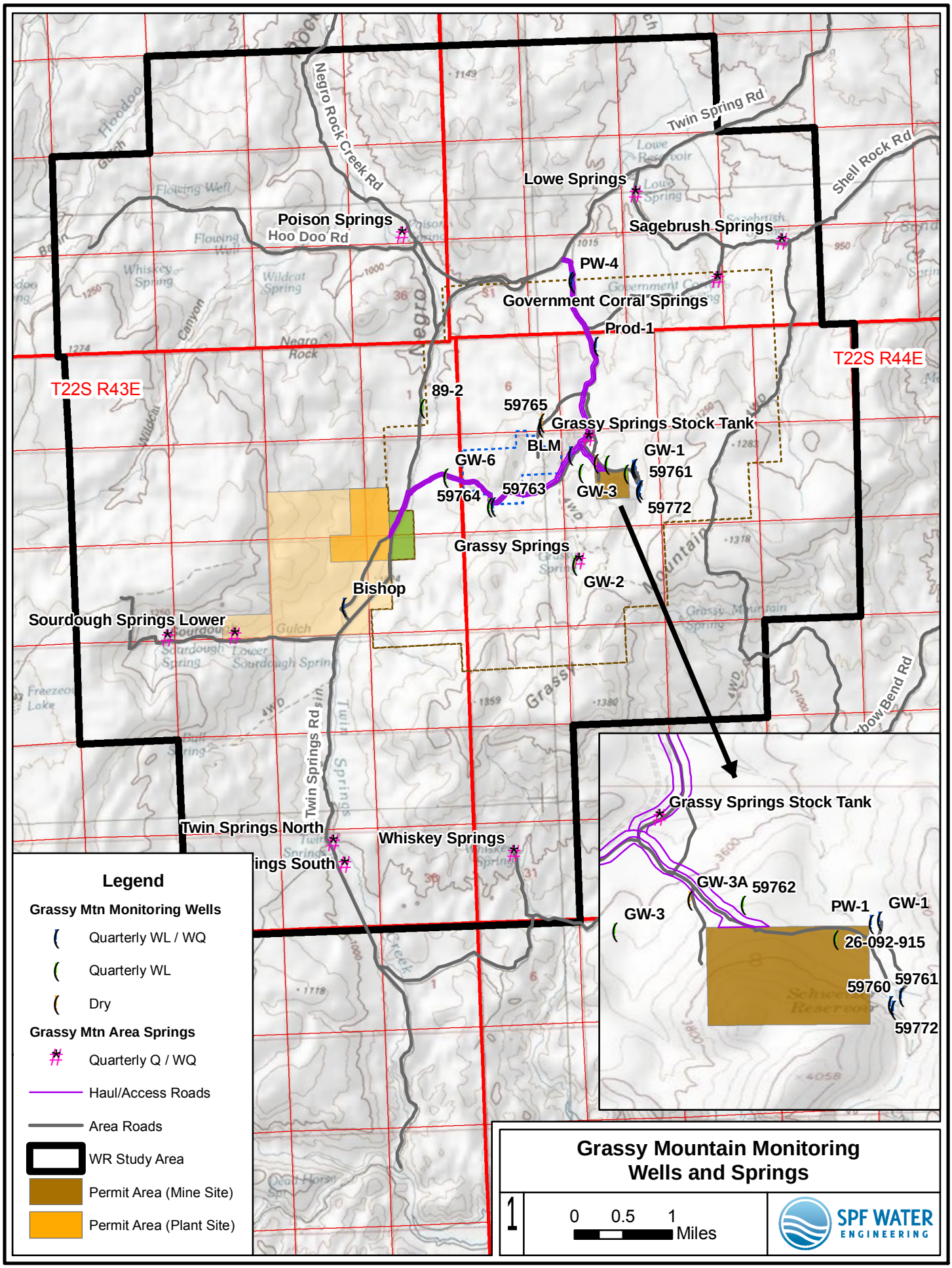
Attachment B: Field Work Documentation

Attachment C: Monitoring Well Purge Calculations

Attachment D: Well Driller's Reports

Attachment E: Field Equipment Calibration Record

# Attachment A: Grassy Mountain Site Map


Negro Rock Creek Rd
Twin Spring Rd
Shell Rock Rd
Lowe Springs
Poison Springs
Hoo Doo Rd
Sagebrush Springs
PW-4
Government Corral Springs
Prod-1
T22S R43E
T22S R44E
89-2
59765
Grassy Springs Stock Tank
BLM
GW-1
GW-6
59761
59764
59763
GW-3
59772
Grassy Springs
GW-2
Bishop
Sourdough Springs Lower
Twin Springs Rd
Twin Springs North
Whiskey Springs
ings South
Grassy Springs Stock Tank
GW-3A
59762
PW-1
GW-1
26-092-915
59760
59761
59772
Legend
Grassy Mtn Monitoring Wells
Quarterly WL / WQ
Quarterly WL
Dry
Grassy Mtn Area Springs
Quarterly Q / WQ
Haul/Access Roads
Area Roads
WR Study Area
Permit Area (Mine Site)
Permit Area (Plant Site)
Grassy Mountain Monitoring Wells and Springs
1
0 0.5 1 Miles
SPF WATER ENGINEERING

# Attachment B: Field Work Documentation

# Grassy Mountain Ground Water Monitoring Sampling Form

Well No.: _____

Personnel: _____

Date: _____

SPF Sounder #: _____

Sounder Correction: _____

Weather: _____

Wat Lev Transducer Download? Y _____ N _____

**Well Description**

Surface Casing Diam (in): _____

Well Casing Diam (in): _____

Surface Casing Height AGL (ft): _____

WL Meas Point Desc: _____

Const Depth [ft, BMP]: _____

Locked? Y _____ N _____

Well Condition: _____

**Casing Purge**

3x Casing Volume (gal): _____

Flow Rate (gpm): _____

Required Purge Time (min): _____

Page No.: _____ of _____

Photos (#,Name): _____

**GPS Coord. (UTM 11N, NAD83)**

Northing: _____

Easting: _____

**Pump Description**

Permanent: _____ Temporary: _____

Type: _____ HP: _____

Setting Depth (ft): _____

Drop Pipe Diam (in): _____

Notes: _____

**Water Quality**

Sample Time: _____

Field Filtered? Y _____ N _____

Samples Filtered: _____

Equip Blank Collected? Y _____ N _____

Transfer Blank Collected? Y _____ N _____

Duplicate Set Collected? Y _____ N _____

**Sampler Signature:** _____

| **Time** | **DTW** [ft] | **Flow Rate** [gpm] | **pH** [S.U.] | **EC** [µS/cm] | **SC** [µS/cm @ 25°C] | **Temp** [°C] | **DO** [mg/L] / [% Sat] | **Notes** (Visual Appearance) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

| **Time** | **DTW** [ft] | **Flow Rate** [gpm] | **pH** [S.U.] | **EC** [µS/cm] | **SC** [µS/cm @ 25°C] | **Temp** [°C] | **DO** [mg/L] / [% Sat] | **Notes** (Visual Appearance) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

# Grassy Mountain Spring Monitoring Sampling Form

Spring Name: _____ Page No.: _____ of _____

Personnel: _____

Date: _____ Photos (#,Name): _____

Weather: _____

**GPS Coord. (UTM 11N, NAD83)**

Northing: _____ Easting: _____

**Spring Source Description** _____

_____

_____

**Spring Sampling Point Description** _____

_____

_____

**Spring Flow Rate (gpm) _____** (Volume:_____ Time:_____ )

**Water Quality**

Sample Time: _____

Field Filtered? Y _____ N _____

Samples Filtered: _____

Equip Blank Set Collected? Y _____ N _____

Transfer Blank Set Collected? Y _____ N _____

Duplicate Set Collected? Y _____ N _____

**Sampler Signature:** _____

| **Time** | **Flow Rate** [gpm] | **pH** [S.U.] | **EC** [µS/cm] | **SC** [µS/cm @ 25°C] | **Temp** [°C] | **DO** [mg/L] | **DO** [% Sat] | **Notes** (Visual Appearance) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

# Grassy Mountain Surface Water Monitoring Sampling Form

Surface Water Name: _____ Page No.: _____ of _____

Sampling Location Name: _____

Personnel: _____

Date: _____ Photos (#,Name): _____

Weather: _____

**GPS Coord. (UTM 11N, NAD83)**

Northing: _____ Easting: _____

**Notes** _____

_____

_____

_____

_____

_____

_____

**Flow Rate:** _____ **Flow Rate Measurement Desc:** _____

**Flow Units:** _____ _____

**Water Quality**

Sample Time: _____ Equip Blank Set Collected? Y _____ N _____

Field Filtered? Y _____ N _____ Transfer Blank Set Collected? Y _____ N _____

Samples Filtered: _____ Duplicate Set Collected? Y _____ N _____

**Sampler Signature:** _____

| **Time** | **pH** [S.U.] | **EC** [µS/cm] | **SC** [µS/cm @ 25°C] | **Temp** [°C] | **DO** [mg/L] | **DO** [% Sat] | **Notes** (Visual Appearance) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

# Attachment C: Monitoring Well Purge Calculations

Calico-Grassy Mountain
Field Reference Sheet
Winter 2013

| Well No. | GW-1 | GW-4 | Prod 1 | PW-1 | PW-4 | BLM | 59760 | 59761 | 59763 | 59766 | 59772 | Bishop Well |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OWRD Tag # | 107469 | 107460 | 107457 | 109353 | 109351 | 109398 | 107462 | 109400 | 109356 | 107468 | 109352 | NA |
| Other Well Name (if any) | 47-1 | --- | Artesian | Drilling Supply Well | --- | Owyhee Ridge Well | TW-1, Middle Schweizer | MW-2, Lower Schweizer | TW-4 | MWS-8 | MW-13, Upper Schweizer | Rye Field Well |
| Northing (UTM 11N, NAD83) | 4835644 | 4838740 | 4837684 | 4835627 | 4838778 | 4835898 | 4835250 | 4835286 | 4835105 | 4836380 | 4835229 | 4833564 |
| Easting (UTM 11N, NAD 83) | 471460 | 470557 | 470904 | 471431 | 470535 | 470406 | 471497 | 471532 | 469094 | 469927 | 471504 | 466562 |
| Measurement Point (MP) Description | top of 4" PVC Coupler | top of surf casing | --- | top of casing | top of 6" | top of casing | top of casing | top of casing (steel) | top of surf casing | top casing | top of casing | top of steel 6" coupler |
| MP (ft agl) | 3.5 | 2.52 | --- | 3.3 | 3 | 0.85 | 3.1 | 3 | 2.92 | 2.8 | 2.9 | 2.5 |
| Constructed Well Depth (ft) | 156 | 370 | 425 | 550 | 375 | 175 | 203 | 118 | 323 | 45 | 207 | 482 |
| Well Casing Diameter (in) | 4 | 4 | 4 | 6 | 6 | 6 | 6 | 4 | 6 | 4 | 4 | 12 |
| Static Water Level (ft, BMP) | 55.48 | 83.45 | flowing | 55.26 | 80.27 | 157.15 | 89.21 | 89.45 | 280.55 | 26.86 | 95.43 | 107.93 |
| Static Water Level (ft, BGL) | 51.98 | 80.93 | flowing | 51.96 | 77.27 | 156.3 | 86.11 | 86.45 | 277.63 | 24.06 | 92.53 | 105.43 |
| 3x Casing Volume (gal) | 204 | 566 | See Note 1 | 2,193 | 1,311 | 82 | 515 | 62 | 200 | 41 | 224 | 6,633 |
| Design Flow Rate $(gpm)^2$ | 20 | 30 | See Note 1 | 30 | 30 | 5 | 9 | 10 | 3 | 3 | 26 | 15 |
| Purge Time (min) | 10 | 19 | See Note 1 | 73 | 44 | 16 | 57 | 6 | 67 | 14 | 9 | 442 |

Note 1: Prod-1 has artesian flow so this well will not be purged, samples will be collected from the artesian flow
Note 2: For the wells with pumps already installed, the flow rate is assumed to be similar to that observed in May/June 2012

# Attachment D: Well Driller's Reports

| Grassy Mountain Gold Project Ground Water Monitoring Program Wells | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Well Name | Alternative Name | OWRD Well Tag Number | Township | Range | Section | 1/4-1/4 | Report ID No. | Permit No. | Drilled Depth | Purpose | Owner | Static Water Level | Completion Date | Recorded with OWRD? | Remarks |
| PW-4 | | 109351 | 21S | 44E | 32 | SENW | Malh 2206 | W-14815 | 375 | Industrial | Atlas PM | 81 | 11/20/1989 | Y | |
| Prod 1 | | 107457 | 22S | 44E | 5 | NWNE | Malh 2275 | 9256 | 425 | Industrial | Atlas PM | 0 | 12/10/1988 | Y | Original log |
| | | | | | | | Malh 2511 | | | Domestic | Atlas PM | 40 | 3/31/1989 | N | Recondition log |
| 59761 | Lower Sweizer, MW-2 | 109400 | 22S | 44E | 8 | NENE | Malh 2993 | 59761 | 120 | Monitoring | Newmont Gold | 88 | 10/4/1993 | N | Wrong legal, should be NESE |
| PW-1 | | 109353 | 22S | 44E | 8 | SENE | Malh 2276 | 14816 | 555 | Industrial | Atlas PM | 52 | 12/1/1989 | Y | |
| BLM | Owyhee Ridge | 109398 | 22S | 44E | 8 | NWNW | Malh 2277 | u/k | 175 | Stockwater | BLM | 154 | 8/16/1972 | Y | Original log |
| | | | | | | | Malh 2280 | | 220 | Testing | | 140 | 10/20/1970 | Y | Testing log |
| 59760 | Middle Sweizer, TW-1 | 107462 | 22S | 44E | 8 | NWSE | Malh 2974 | 59760 | 205 | Monitoring | Newmont Gold | 88 | 10/11/1993 | N | Malh 2991 duplicate of Malh 2974 |
| 59772 | Upper Sweizer, MWS-13 | 109352 | 22S | 44E | 8 | SESE | Malh 2984 | 59772 | 207 | Monitoring | Newmont Gold | 95 | 10/19/1993 | N | Malh 2987 duplicate of Malh 2984 |
| GW-1 | 47-1 | 107469 | 22S | 44E | 17 | NWNW | Malh 2281 | 9258 | 160 | Monitoring | Atlas PM | 140 | 1/18/1989 | Y | Wrong legal, should be SENE S8? |
| 59763 | TW-4 | 109356 | 22S | 44E | 7 | SWNE | | 59763 | 324 | Monitoring | Newmont Gold | 280 | 10/15/1993 | ? | |
| 59766 | MWS-8 | 107468 | 22S | 44E | 6 | SESE | | 59766 | 76.5 | Monitoring | Newmont Gold | 45.5 | 10/2/1993 | ? | |
| Bishop | Rye Field | ? | u/k | u/k | u/k | u/k | | 13 | 482 | Monitoring | John Bishop | 95 | 6/18/1963 | N | No legal description |

SPF1

JAN 02 1990

# STATE OF OREGON
# WATER WELL REPORT
(as required by ORS 537.765)

WATER RESOURCES DEPT
SALEM, OREGON

Malh 2206

215/44E/32bd
W-14815

(START CARD) # W-14814

## (1) OWNER:
Well Number: PW-4
Name: ATLAS PRECIOUS METALS
Address: 318 A STREET WEST
City: VALE State: OR Zip: 97918

## (2) TYPE OF WORK:
☒ New Well ☐ Deepen ☐ Recondition ☐ Abandon

## (3) DRILL METHOD
☒ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Other

## (4) PROPOSED USE:
☐ Domestic ☐ Community ☒ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

## (5) BORE HOLE CONSTRUCTION:
Special Construction approval: Yes ☒ No ☐ Depth of Completed Well 375 ft.
Explosives used: Yes ☐ No ☒ Type ____ Amount ____

| HOLE Diameter | From | To | SEAL Material | From | To | Amount sacks or pounds |
|---|---|---|---|---|---|---|
| 14 3/4 | 0 | 40 | PORTLAND CEMENT | 0 | 40 | 19 |
| 9 7/8 | 40 | 375 | VOLCLAY | 5 | 275 | 40 |
| | | | CEMENT | 0 | 5 | |

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E
☐ Other
Backfill placed from 315 ft. to 370 ft. Material 10-20 MESH
Gravel placed from 370 ft. to 275 ft. Size of gravel 10-20 MESH

## (6) CASING/LINER:

| | Diameter | From | To | Gauge | Steel | Plastic | Welded | Threaded |
|---|---|---|---|---|---|---|---|---|
| Casing: | 10" | 0 | 40 | .250 | ☒ | ☐ | ☐ | ☐ |
| | | | | | ☐ | ☐ | ☐ | ☐ |
| | | | | | ☐ | ☐ | ☐ | ☐ |
| | | | | | ☐ | ☐ | ☐ | ☐ |
| Liner: | 6 5/8" | 0 | 280 | .250 | ☐ | ☐ | ☐ | ☐ |
| | 6 5/8" | 300 | 340 | .250 | ☒ | ☐ | ☐ | ☐ |

Final location of shoe(s)

## (7) PERFORATIONS/SCREENS:
☐ Perforations Method
☒ Screens Type WIRE WOUND Material Low Carbon Steel

| From | To | Slot size | Number | Diameter | Tele/pipe size | Casing | Liner |
|---|---|---|---|---|---|---|---|
| 280 | 300 | .030 | | 6" | | ☐ | ☑ |
| 340 | 360 | .030 | | 6" | | ☐ | ☑ |
| | | | | | | ☐ | ☐ |
| | | | | | | ☐ | ☐ |
| | | | | | | ☐ | ☐ |
| | | | | | | ☐ | ☐ |

## (8) WELL TESTS: Minimum testing time is 1 hour
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

| Yield gal/min | Drawdown | Drill stem at | Time |
|---|---|---|---|
| 100 | | 350 | 1 hr. |
| | | | |
| | | | |

Temperature of water 62°F Depth Artesian Flow Found —
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☒ Odor ☐ Colored ☐ Other
Depth of strata: 280 STILL USABLE

## (9) LOCATION OF WELL by legal description:
County MALHEUR Latitude ____ Longitude ____
Township 21S N or S, Range 44E E or W, WM.
Section 32 SE ¼ NW ¼
Tax Lot ____ Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address)

## (10) STATIC WATER LEVEL:
81 ft. below land surface. Date 11/11/89
Artesian pressure ____ lb. per square inch. Date ____

## (11) WATER BEARING ZONES:
Depth at which water was first found 280'

| From | To | Estimated Flow Rate | SWL |
|---|---|---|---|
| 280 | 360 | 100 gpm | 81 |
| | | | |
| | | | |
| | | | |

## (12) WELL LOG:
Ground elevation ≅ 3350

| Material | From | To | SWL |
|---|---|---|---|
| Alluvium | 0 | 25' | |
| Clay | 25 | 150' | |
| Sandy clay | 150 | 175 | |
| Sandstone | 175 | 215 | |
| Clay | 215 | 275 | |
| Sandstone | 275 | 305 | |
| Clay | 305 | 325 | |
| Sandstone and Conglomerate | 325 | 365 | |
| Clay. | 365 | 375 | |

Date started 11/16/89 Completed 11/20/89

**(unbonded) Water Well Constructor Certification:**
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.
Signed [signature] WWC Number ____ Date 11/20/89

**(bonded) Water Well Constructor Certification:**
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. all work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.
Signed Larry Bund WWC Number 544 Date 11-20-89

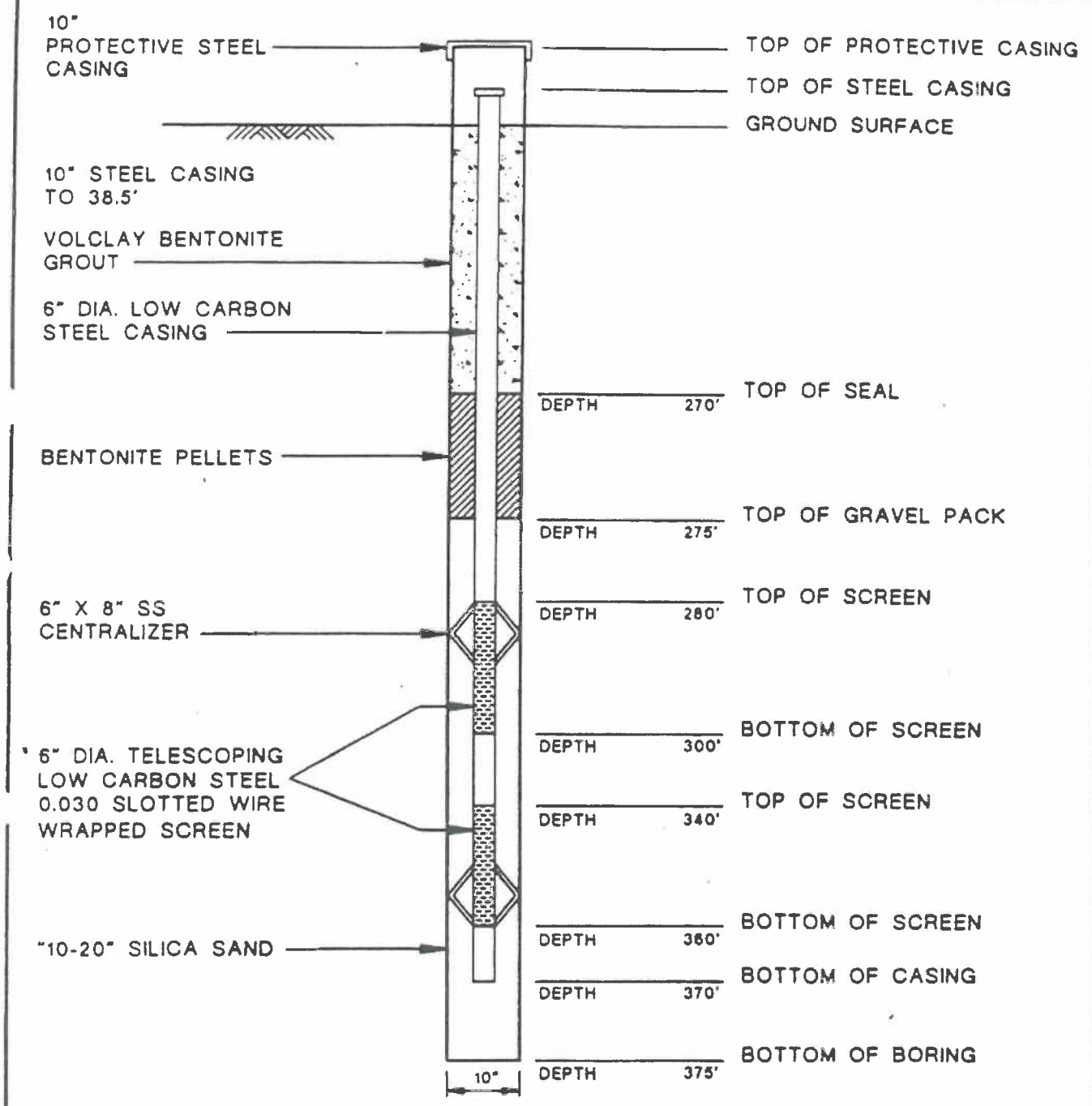
ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER 9809C 8/87

STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

CLIENT ATLAS PRECIOUS METALS
PROJECT GRASSY MTN.
PROJECT NO. 24101
DATE 11/89

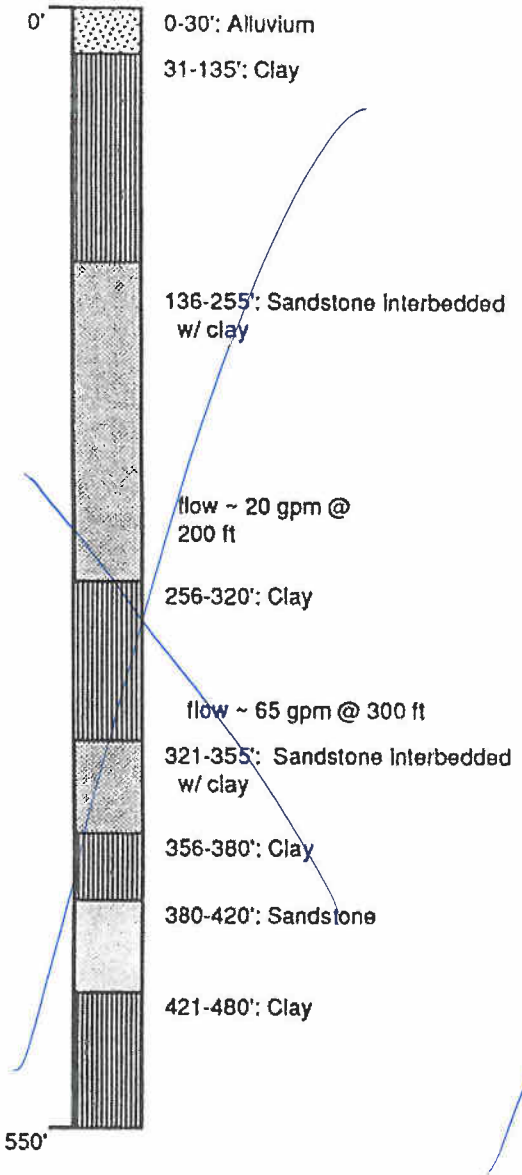
WELL NO. PW-4
BY E. DILLE



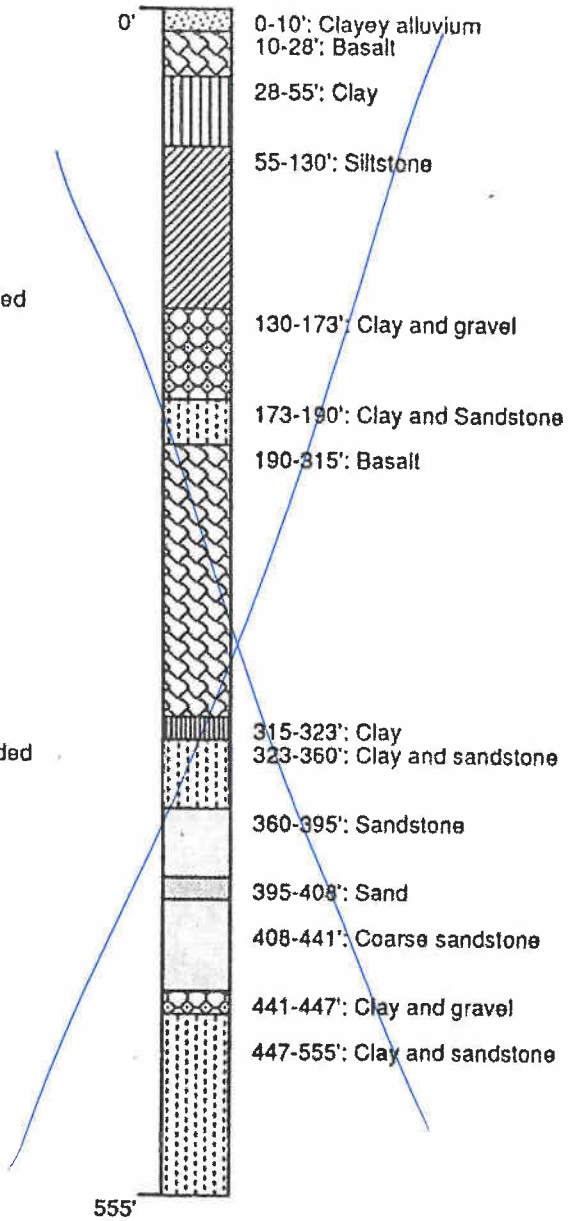

NOTES:
1. NOT DRAWN TO SCALE

## PRODUCTION WELL LITHOLOGIC SUMMARIES

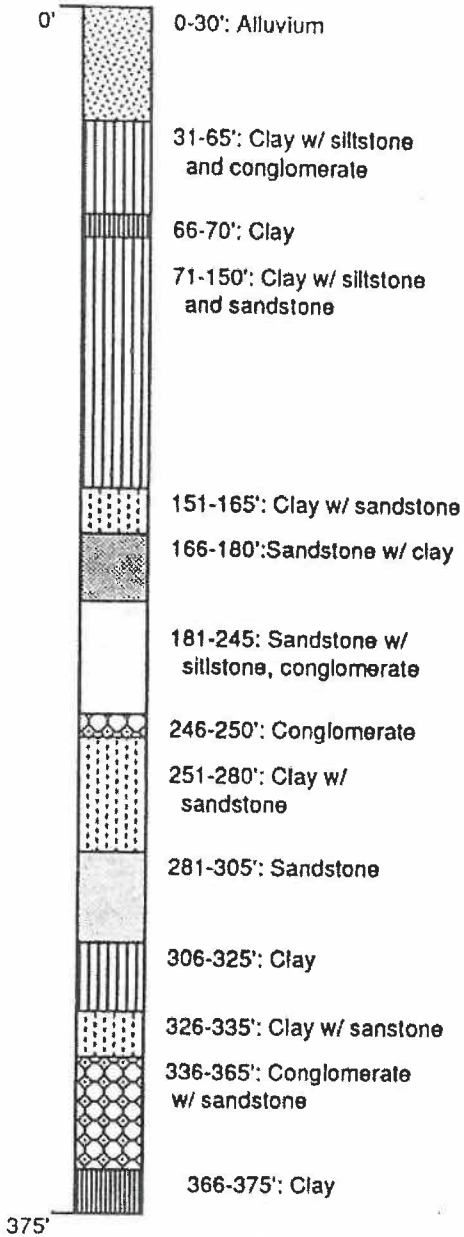
NOT TO SCALE




**Prod-1**




**PW-1** (from driller's log)




**PW-4**

SPF4-1

STATE OF OREGON
**WATER WELL REPORT**
(as required by ORS 537.765)

RECEIVED
JAN 4 1989
WATER RESOURCES DEPT.
SALEM, OREGON

March 2275

22S/44E/5d6

(START CARD) # 9256

Well Number: Flat 6

**(1) OWNER:**
Name Atlas Precious Metals Inc.
Address 743 Horizon Court Suite 202
City Grand Junction State Colorado Zip 81506

**(2) TYPE OF WORK:**
☒ New Well ☐ Deepen ☐ Recondition ☐ Abandon

**(3) DRILL METHOD**
☒ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Other

**(4) PROPOSED USE:**
☐ Domestic ☐ Community ☒ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

**(5) BORE HOLE CONSTRUCTION:**
Special Construction approval Yes ☐ No ☒ Depth of Completed Well 425 ft.
Explosives used Yes ☐ No ☒ Type ____ Amount ____

| HOLE Diameter | From | To | SEAL Material | From | To | Amount sacks or pounds |
|---|---|---|---|---|---|---|
| 14 3/4 | 0 | 18 | Bent. Cement Mixed 48 Bent & Cement (Portland) to 100# to 5.5 gal of water | 18' | 0' | 25 SACKS |

How was seal placed: Method ☐ A ☐ B ☒ C ☐ D ☐ E
☐ Other
Backfill placed from ____ ft. to ____ ft. Material ____
Gravel placed from 425 ft. to 100 ft. Size of gravel Col. Silica #8

**(6) CASING/LINER:**

| | Diameter | From | To | Gauge | Steel | Plastic | Welded | Threaded |
|---|---|---|---|---|---|---|---|---|
| Casing: | 10" | +2 | 99 | .250 | ☒ | ☐ | ☒ | ☐ |
| | | | | | ☐ | ☐ | ☐ | ☐ |
| | | | | | ☐ | ☐ | ☐ | ☐ |
| | | | | | ☐ | ☐ | ☐ | ☐ |
| Liner: | 6" | ~~+2~~ | | | ☐ | ☐ | ☐ | ☐ |
| | | +2 | 425 | Sch 80 | ☐ | ☒ | ☐ | ☒ |

Final location of shoe(s) ____

**(7) PERFORATIONS/SCREENS:**
☐ Perforations ~~Method~~ 7120 Type 1 Astm 1785
☒ Screens Type ____ Material PVC Sch 80

| From | To | Slot size | Number | Diameter | Tele/pipe size | Casing | Liner |
|---|---|---|---|---|---|---|---|
| 140 | 255 | .020 | | 6" | | ☐ | ☒ |
| 325 | 355 | .020 | | 6" | | ☐ | ☒ |
| 380 | 420 | .020 | | 6" | | ☐ | ☒ |
| | | | | | | ☐ | ☐ |
| | | | | | | ☐ | ☐ |
| | | | | | | ☐ | ☐ |

**(8) WELL TESTS: Minimum testing time is 1 hour**
☒ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

| Yield gal/min | Drawdown | Drill stem at | Time |
|---|---|---|---|
| 150 | — | 405 | 1 hr. |
| 60 | 40 | Set At 120 | 3 hr. |

Pump

Temperature of water ____ Depth Artesian Flow Found See #1
Was a water analysis done? No ☐ Yes By whom ____
Did any strata contain water not suitable for intended use? ☒ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other ____
Depth of strata: 145-255, 325-355,

**(9) LOCATION OF WELL by legal description:**
County Malheur Latitude ____ Longitude ____
Township 22S N or S, Range 44E E or W, WM.
Section 5 NW ¼ NE ¼
Tax Lot ____ Lot ____ Block ____ Subdivision ____
Street Address of Well (or nearest address) ____

**(10) STATIC WATER LEVEL:**
0 ft. below land surface. Date 12-17-88
Artesian pressure ____ lb. per square inch. Date ____

**(11) WATER BEARING ZONES:**
Depth at which water was first found 145-255

| From | To | Estimated Flow Rate | SWL |
|---|---|---|---|
| 145 | 255 | 20 gpm | 40 |
| 325 | 355 | 60 gpm | 40 |
| 380 | 420 | 150 gpm | 40 |
| | | | |

**(12) WELL LOG:** Ground elevation 3520

| Material | From | To | SWL |
|---|---|---|---|
| Overburden w/ Boulders | 0 | 17 | 0 |
| Clay (Brown) | 17 | 140 | 0 |
| Sand Stone w/ Blue Clay | 140 | 255 | 40 |
| Blue Clay | 255 | 320 | 40 |
| Sandstone w/ Blue Clay | 320 | 355 | 40 |
| Blue Clay | 355 | 380 | 40 |
| Frac. (Hard) Sandstone | 380 | 415 | 40 |
| Blue Clay | 415 | 425 | 40 |
| After setting 1 week water will come up to GR. level | | | |
| Between 6" & 10" from 100' to Mr. Level Annular space is filled with Volcay Bent. pellets | | | |

Date started 12/5/88 Completed 12/10/88

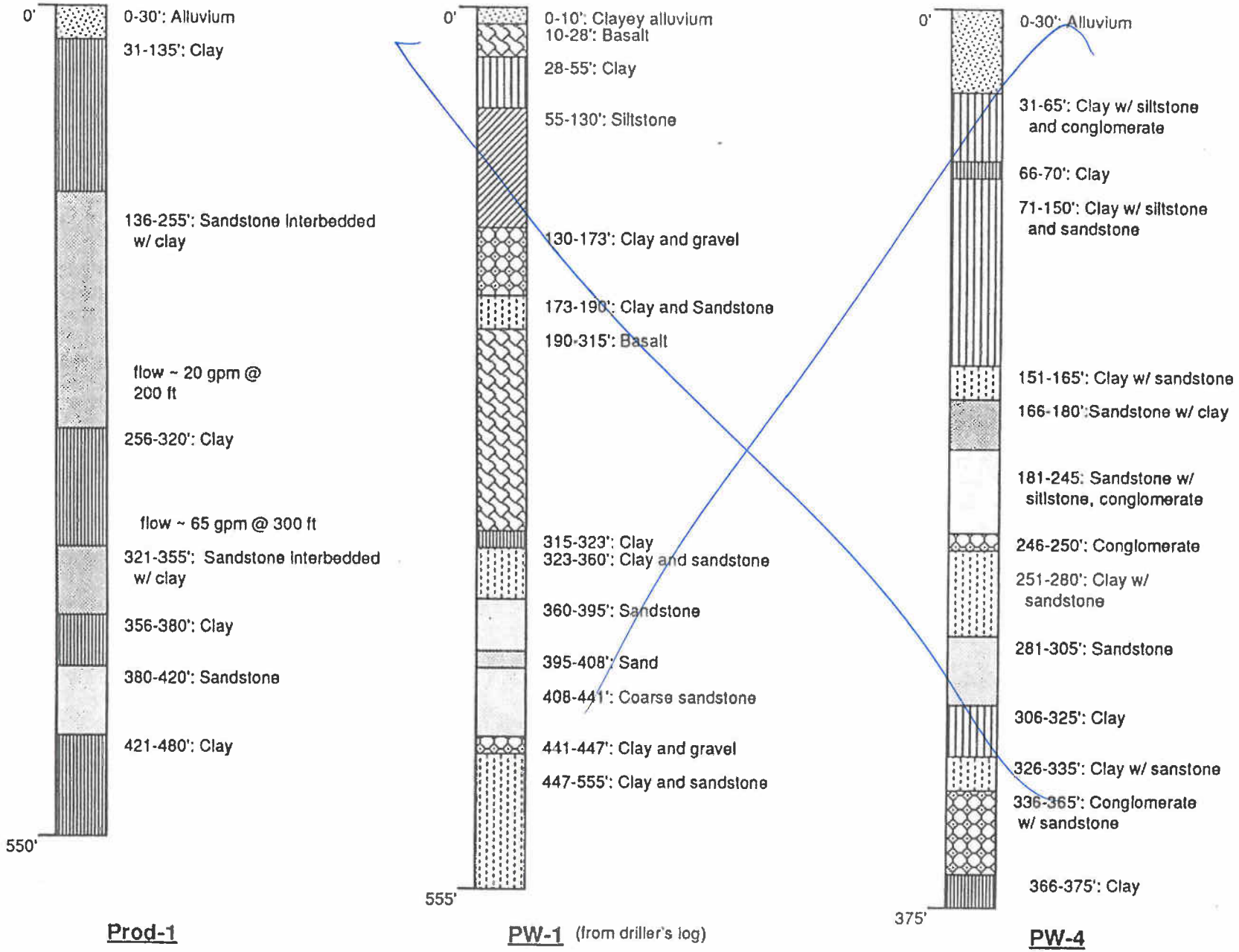
**(unbonded) Water Well Constructor Certification:**
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.
Signed Robert Alex Doty WWC Number 620
Date 12/28/88

**(bonded) Water Well Constructor Certification:**
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. all work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 326
Signed Robert Alex Doty for William E. Doty Date 12/28/88

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER 9809C 3/88

# PRODUCTION WELL LITHOLOGIC SUMMARIES

NOT TO SCALE



(SPF 4-2)

RECEIVED

MAY 1 1989

WATER RESOURCES DEPT. SALEM, OREGON

MAH 2511

22S/44E/5ab

(START CARD) # 9256

STATE OF OREGON

# WATER WELL REPORT

(as required by ORS 537.765)

## (1) OWNER:

Well Number:

Name Atlas Precious Metals

Address 743 Horizin Ct. Suite 202

City Grand Junction State Co Zip 81506

## (2) TYPE OF WORK:

☒ New Well ☐ Deepen ☒ Recondition ☐ Abandon

## (3) DRILL METHOD

☒ Rotary Air ☐ Rotary Mud ☐ Cable

☒ Other Auger

## (4) PROPOSED USE:

☒ Domestic ☐ Community ☐ Industrial ☐ Irrigation

☐ Thermal ☐ Injection ☐ Other

## (5) BORE HOLE CONSTRUCTION:

Special Construction approval Yes ☐ No ☐ Depth of Completed Well ft.

Explosives used Yes ☐ No ☒ Type Amount

| HOLE Diameter | From | To | SEAL Material | From | To | Amount sacks or pounds |
|---|---|---|---|---|---|---|
| 12" | 0 | 18 | | | | |
| 10 | 18 | 425 | | | | |
| | | | Cement grout | 0 | 26 | 19 |

How was seal placed: Method ☐ A ☐ B ☒ C ☐ D ☐ E

☐ Other

Backfill placed from ft. to ft. Material Cement Grout

Gravel placed from 100 ft. to 245 ft. Size of gravel No. 8

## (6) CASING/LINER:

| | Diameter | From | To | Gauge | Steel | Plastic | Welded | Threaded |
|---|---|---|---|---|---|---|---|---|
| Casing: | 10" | +2 | 99 | .250 | ☒ | ☐ | ☒ | ☐ |
| | 6" | +2 | 245 | Sch 80 | ☐ | ☒ | ☐ | ☐ |
| | | | | | ☐ | ☐ | ☐ | ☐ |
| | | | | | ☐ | ☐ | ☐ | ☐ |
| Liner: | | | | | ☐ | ☐ | ☐ | ☐ |
| | | | | | ☐ | ☐ | ☐ | ☐ |

Final location of shoe(s)

## (7) PERFORATIONS/SCREENS:

☐ Perforations Method

☒ Screens Type Aaroark Material PVC Sch 80

| From | To | Slot size | Number | Diameter | Tele/pipe size | Casing | Liner |
|---|---|---|---|---|---|---|---|
| 380 | 420 | .020 | | 6" | | ☐ | ☐ |
| 145 | 255 | 325-355 | | | | ☐ | ☐ |
| | | | | | | ☐ | ☐ |
| | | | | | | ☐ | ☐ |
| | | | | | | ☐ | ☐ |
| | | | | | | ☐ | ☐ |

## (8) WELL TESTS: Minimum testing time is 1 hour

☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

| Yield gal/min | Drawdown | Drill stem at | Time |
|---|---|---|---|
| 100 | 40' | 300 | 1 hr. |
| | | | |
| | | | |

Temperature of water Depth Artesian Flow Found

Was a water analysis done? ☐ Yes By whom

Did any strata contain water not suitable for intended use? ☐ Too little

☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other

Depth of strata:

## (9) LOCATION OF WELL by legal description:

County Malheur Latitude ' " Longitude ' "

Township 22S N or S, Range 44E E or W, WM.

Section 5 NW ¼ NE ¼

Tax Lot Lot Block Subdivision

Street Address of Well (or nearest address)

## (10) STATIC WATER LEVEL:

40' ft. below land surface. Date 12-8-88

Artesian pressure lb. per square inch. Date

## (11) WATER BEARING ZONES:

Depth at which water was first found 40'

| From | To | Estimated Flow Rate | SWL |
|---|---|---|---|
| 140-~~255~~ | 255 | 30 gpm | |
| 320 | 355 | 50 gpm | |
| 380 | 415 | 150 gpm | |
| | | | |

## (12) WELL LOG:

Ground elevation

| Material | From | To | SWL |
|---|---|---|---|
| Overburden w/ boulders | 0 | 17 | 0 |
| Clay brown | 17 | 140 | 0 |
| Sandstone w/ blue clay | 140 | 255 | 40 |
| blue clay | 255 | 320 | 40 |
| Sandstone w/ blue clay | 320 | 355 | 40 |
| Blue clay | 355 | 380 | 40 |
| Fruited hard sandstone | 380 | 415 | 40 |
| Blue clay | 415 | 425 | 40 |
| = | | | |
| 12-5-88 - 12-10-88 | | | |
| + | | | |
| | | | |
| Redone surface seal to 26 feet using method 2 referring to letter sent January 9, 1989 | | | |
| Drilled around 10" casing to the depth of 26' using method C pumped 19 sacks of cement down hole | | | |
| 3-30-89 - 3-31-89 | | | |
| = | | | |
| Incorporated to singel log per state request | | | |

Date started 12-5-88 Completed 3-31-89

**(unbonded) Water Well Constructor Certification:**

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.

Signed Bob Doty WWC Number 1202

Date 4-15-89

**(bonded) Water Well Constructor Certification:**

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. all work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief. WWC Number 323

Signed Bob Doty for Bill Doty Date 4/15/89

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER 9809C 3/88

SPF6'

# STATE OF OREGON
# MONITORING WELL REPORT
(as required by ORS 537.765 & OAR 690-240-0055)

JAN 26 1994
WATER RESOURCES DEPT.
SALEM, OREGON

Malh 2993

22S/44E/8aa

9

Start Card # 59761

## (1) OWNER/PROJECT:

WELL NO. MW-2

Name: Newmont Gold
Address: 318 A Street
City: West Vale State: OR Zip: 97918

## (2) TYPE OF WORK:

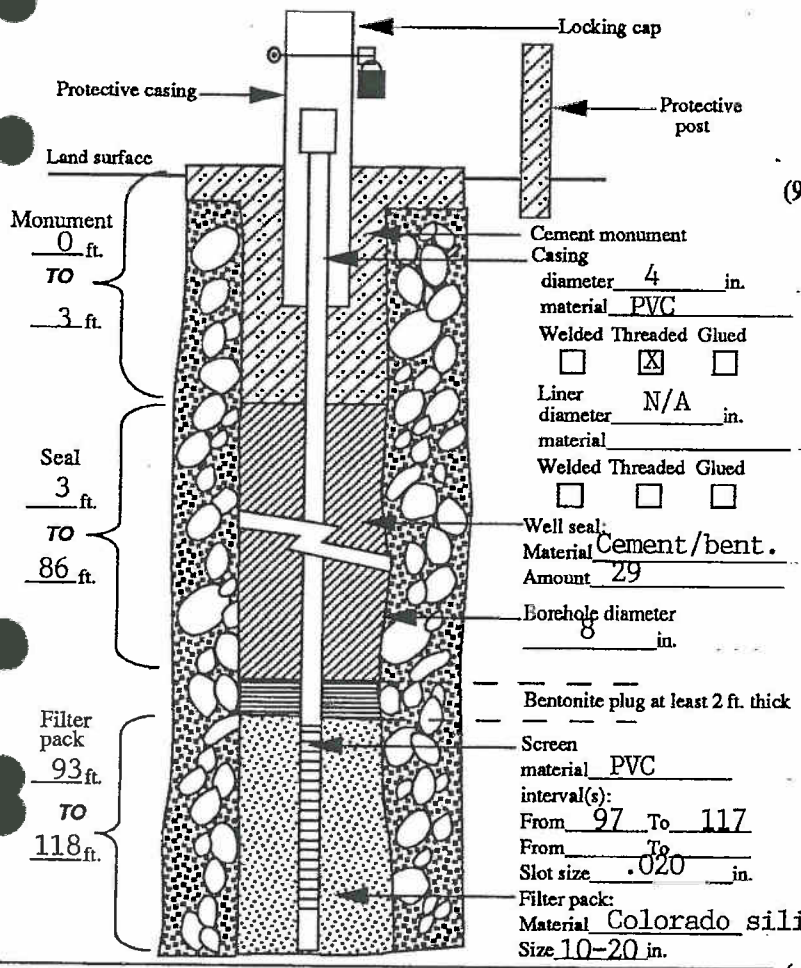
[X] New construction [ ] Repair [ ] Recondition
[ ] Conversion [ ] Deepening [ ] Abandonment

## (3) DRILLING METHOD

[X] Rotary Air [ ] Rotary Mud [ ] Cable
[ ] Hollow Stem Auger [ ] Other

## (4) BORE HOLE CONSTRUCTION

Special Standards: Yes [ ] No [X] Depth of completed well 118 ft.




Cement monument
Casing diameter 4 in. material PVC
Welded [X] Threaded [ ] Glued [ ]
Liner diameter N/A in. material
Welded [ ] Threaded [ ] Glued [ ]
Well seal: Material Cement/bent. Amount 29
Borehole diameter 8 in.
Bentonite plug at least 2 ft. thick
Screen material PVC
interval(s): From 97 To 117
From To
Slot size .020 in.
Filter pack: Material Colorado silica Size 10-20 in.

## (5) WELL TEST:

[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian
Permeability — Yield — GPM
Conductivity — PH —
Temperature of water 56 °F/C Depth artesian flow found — ft.
Was water analysis done? [ ] Yes [ ] No
By whom? —
Depth of strata to be analyzed. From — ft. to — ft.
Remarks: —

Name of supervising Geologist/Engineer Mike Pappalardo

## (6) LOCATION OF WELL By legal description

Well Location: County Malheur
Township 22 (N or S) Range 44E (E or W) Section 8
1. NE 1/4 of NE 1/4 of above section.
2. Street address of well location Grassy Mountain, Vale
3. Tax lot number of well location Unknown
4. ATTACH MAP WITH LOCATION IDENTIFIED.

## (7) STATIC WATER LEVEL:

88 Ft. below land surface. Date 10/04/93
Artesian Pressure — lb/sq. in. Date —

## (8) WATER BEARING ZONES:

Depth at which water was first found 100

| From | To | Est. Flow Rate | SWL |
|---|---|---|---|
| 100 | 120 | 60 | 88 |
| | | | |
| | | | |
| | | | |

## (9) WELL LOG:

Ground elevation —

| Material | From | To | SWL |
|---|---|---|---|
| Aluvian silt & cobbles | 0 | 13 | |
| Clayey siltstone brn | 13 | 15 | |
| Siltstone brown | 15 | 36 | |
| Clayey siltstone brn | 36 | 65 | |
| Siltstone with basalt | 65 | 70 | |
| Basalt with some | 70 | | |
| siltstone | | 72.5 | |
| Basalt | 72.5 | 80 | |
| Basalt with some | 80 | | |
| calcite filling | | | |
| vesicles | | 92 | |
| Basalt with fractures | 92 | 105 | |
| Basalt with clay seams | 105 | 120 | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Date started 10/02/93 Completed 10/04/93

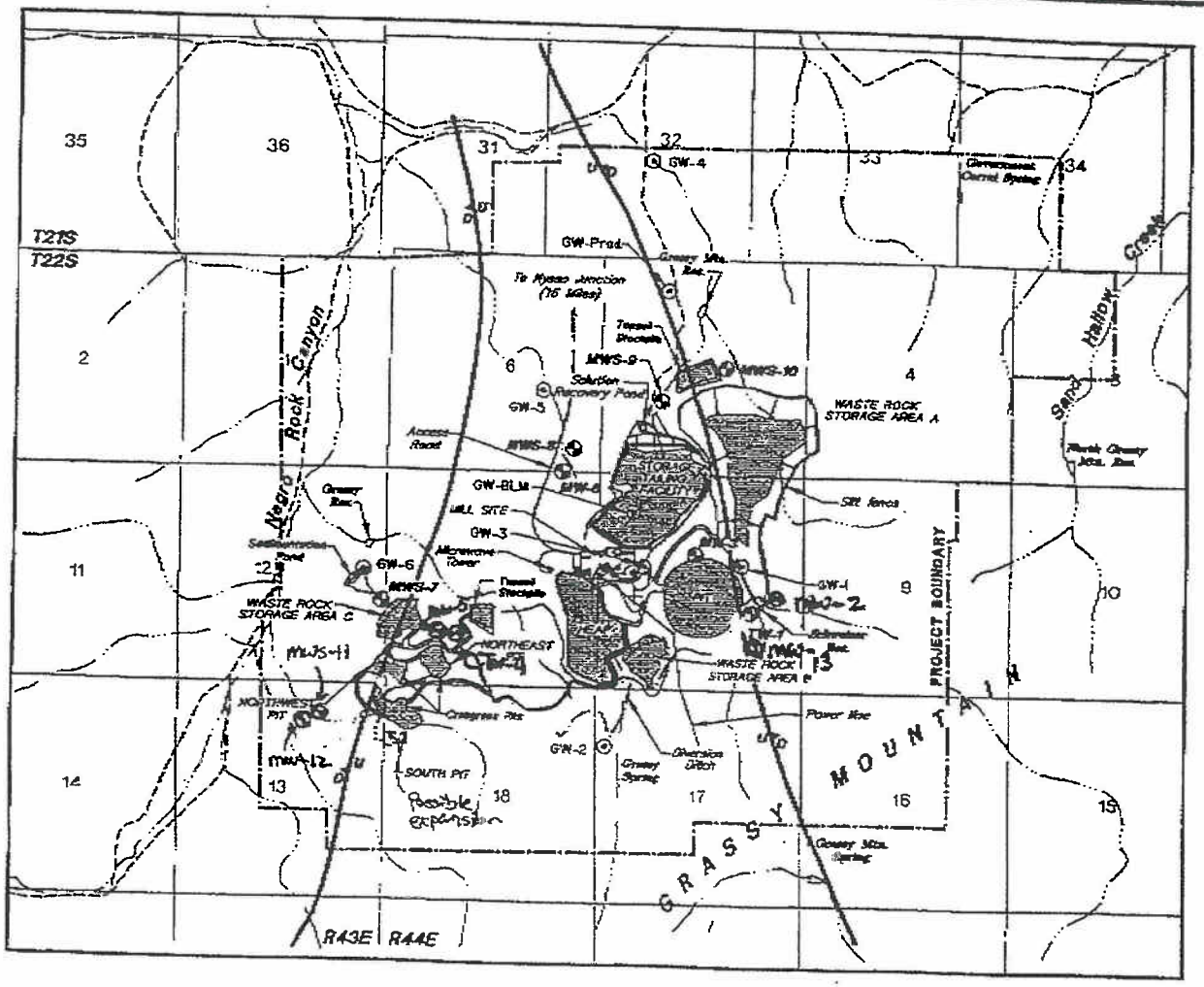
(unbonded) Monitor Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to the best knowledge and belief.

Signed [signature] MWC Number 1008 Date 1/12/94

(bonded) Monitor Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

Signed [signature] MWC Number 1009 Date 1/12/94

RECEIVED
JAN 26 1994
WATER RESOURCES DEPT.
SALEM, OREGON




**LEGEND**

- CREEKS
- ROADS
- EXISTING WELL
- PROPOSED WELL
- DIVERSION DITCH
- APPROXIMATE NORMAL FAULT

NOTE: ACZ PROPOSES TO SAMPLE THE PROPOSED WELLS FOR A PERIOD OF ABOUT SIX MONTHS. EXISTING WELLS WILL BE RESAMPLED FOR ONE OR TWO MONTHS.

FACILITY LOCATIONS ARE BASED ON MOST RECENT (1993) KNIGHT-PIESOLD LAYOUT.

| | | |
|---|---|---|
| Project No.: 639-1000 | Design By: RICH BURTELL | Scale: SEE BAR SCALE |
| File: GMTNOSS.DWG | Drawn By: KAREN COMRATH | Date: MAY 1993 |
| ACZ inc ENVIRONMENTAL AND ENGINEERING SERVICES | FIGURE | |

NEWMONT GRASSY MOUNTAIN CORPORATION
GRASSY MOUNTAIN GOLD PROJECT

LOCATION OF GROUND WATER STATIONS

3039853433 HYDRO-GEO 010 P04 OCT 12 '93 18:09

SPF 8

JAN 02 1990

STATE OF OREGON
**WATER WELL REPORT**
(as required by ORS 537.765)

WATER RESOURCES DEPT
SALEM, OREGON

Malk 2276

22s/44E/8ad

(START CARD) # W-14816

**(1) OWNER:** Well Number:
Name Atlas Precious Metals Inc
Address 318 A St.
City Vale, State OR Zip 97918

**(2) TYPE OF WORK:**
☑ New Well ☐ Deepen ☐ Recondition ☐ Abandon

**(3) DRILL METHOD**
☑ Rotary Air ☐ Rotary Mud ☐ Cable
☐ Other

**(4) PROPOSED USE:**
☐ Domestic ☐ Community ☑ Industrial ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

**(5) BORE HOLE CONSTRUCTION:**
Special Construction approval Yes ☐ No ☑ Depth of Completed Well 420 ft.
Explosives used Yes ☐ No ☑ Type Amount

| HOLE Diameter | From | To | SEAL Material | From | To | Amount sacks or pounds |
|---|---|---|---|---|---|---|
| 14 3/4 | 0 | 28 | PT CEMENT | 0 | 28 | 19 |
| | | | VOLCLAY | 300 | SURFACE | 40 Sacks |
| | | | BENT PELLETS | 295 | 300 | 3 BUCKETS |

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E
☐ Other TREMIE
Backfill placed from ft. to ft. Material
Gravel placed from 555 ft. to 295 ft. Size of gravel .030

**(6) CASING/LINER:**

| | Diameter | From | To | Gauge | Steel | Plastic | Welded | Threaded |
|---|---|---|---|---|---|---|---|---|
| Casing: | 6" | +2 | 320 | .250 | ☑ | ☐ | ☑ | ☐ |
| | 6" | 340 | 400 | " | ☑ | ☐ | ☑ | ☐ |
| | | | | | ☐ | ☐ | ☐ | ☐ |
| | | | | | ☐ | ☐ | ☐ | ☐ |
| Liner: | | | | | ☐ | ☐ | ☐ | ☐ |
| | | | | | ☐ | ☐ | ☐ | ☐ |

Final location of shoe(s)

**(7) PERFORATIONS/SCREENS:**
☐ Perforations Method
☑ Screens Type WIRE WOUND Material LOW CARBON

| From | To | Slot size | Number | Diameter | Tele/pipe size | Casing | Liner |
|---|---|---|---|---|---|---|---|
| 320 | 340 | .030 | | | 6" | ☐ | ☑ |
| 400 | 420 | .030 | | | 6" | ☐ | ☑ |
| | | | | | | ☐ | ☐ |
| | | | | | | ☐ | ☐ |
| | | | | | | ☐ | ☐ |

**(8) WELL TESTS: Minimum testing time is 1 hour**
☐ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

| Yield gal/min | Drawdown | Drill stem at | Time |
|---|---|---|---|
| 35 | | 294 | 1 hr. |
| | | | |
| | | | |

Temperature of water 64° F Depth Artesian Flow Found
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

**(9) LOCATION OF WELL by legal description:**
County Malheur Latitude ' " Longitude ' "
Township 22 S N or S, Range 44E E or W, WM.
Section 8 SE ¼ NE ¼
Tax Lot Lot Block Subdivision
Street Address of Well (or nearest address)

**(10) STATIC WATER LEVEL:**
52 ft. below land surface. Date 12-6-89
Artesian pressure lb. per square inch. Date

**(11) WATER BEARING ZONES:**
Depth at which water was first found

| From | To | Estimated Flow Rate | SWL |
|---|---|---|---|
| 320 | 340 | 20 | |
| 400 | 420 | 20 | |
| | | 40 | |

**(12) WELL LOG:** Ground elevation

| Material | From | To | SWL |
|---|---|---|---|
| SOIL | 0 | 2 | |
| CLAY | 2 | 10 | |
| BASALT | 10 | 28 | |
| BROWN CLAY | 28 | 55 | |
| SILTSTONE | 55 | 130 | |
| CLAY & GRAVEL | 130 | 173 | |
| CLAY & SAND | 173 | 190 | |
| BASALT | 190 | 315 | |
| BROWN CLAY | 315 | 323 | |
| BROWN CLAY & SAND | 323 | 360 | |
| BROWN SANDSTONE | 360 | 395 | |
| BLACK & RED SAND | 395 | 408 | |
| SANDSTONE COARSE | 408 | 441 | |
| CLAY & GRAVEL | 441 | 447 | |
| CLAY & SAND | 447 | 555 | |

Date started 11/27/89 Completed 12-1-89

**(unbonded) Water Well Constructor Certification:**
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.
WWC Number
Signed Date

**(bonded) Water Well Constructor Certification:**
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. all work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 544
Signed Larry Bird Date 12/1/89

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER 9809C 3/88

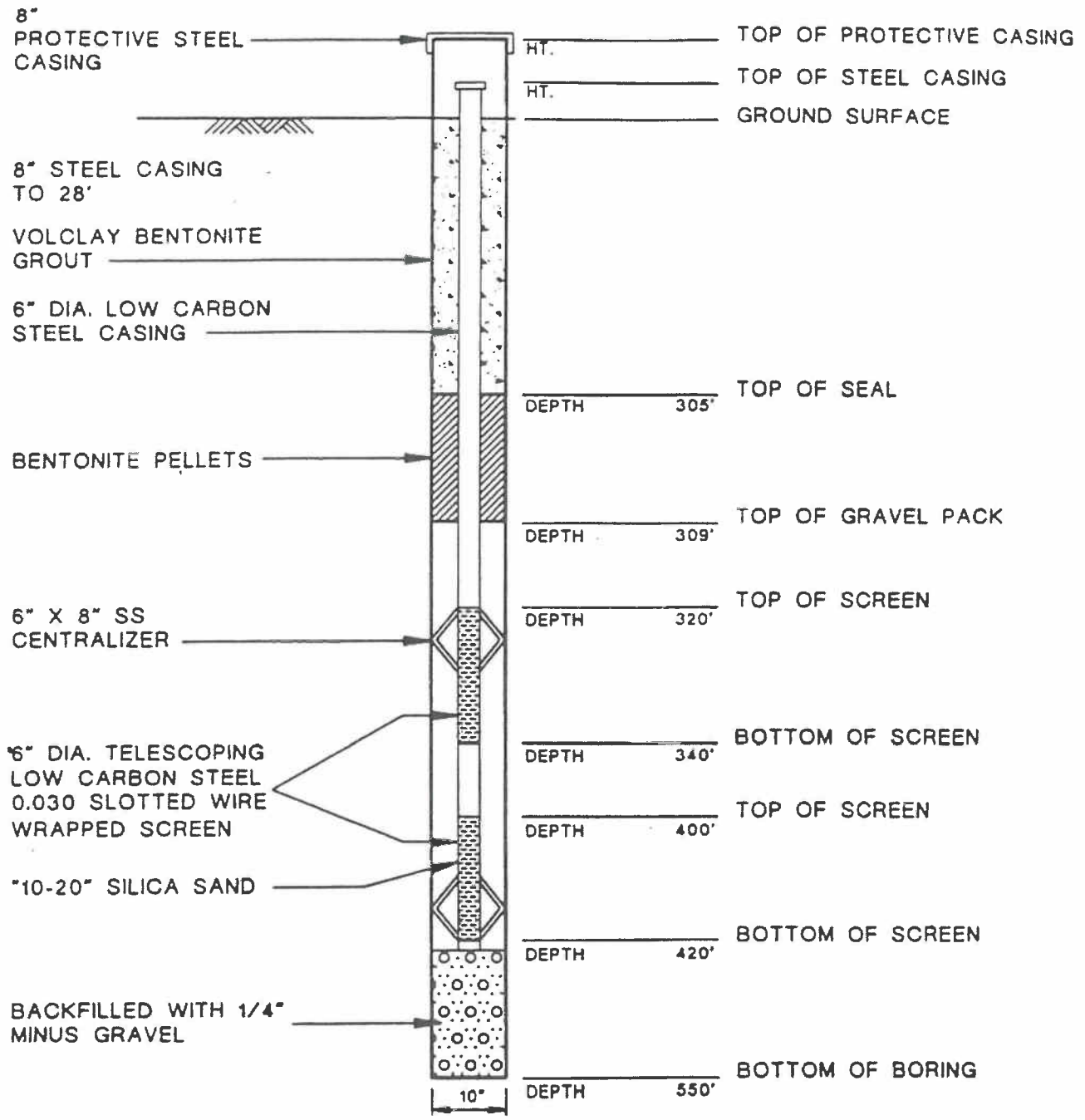
STEFFEN ROBERTSON & KIRSTEN (U.S.)

Consulting Engineers & Scientists

| | |
|---|---|
| CLIENT | ATLAS PRECIOUS METALS |
| PROJECT | GRASSY MTN. |
| PROJECT NO. | 24101 |
| DATE | 4/90 |

WELL NO. PW-1

BY E. DILLE

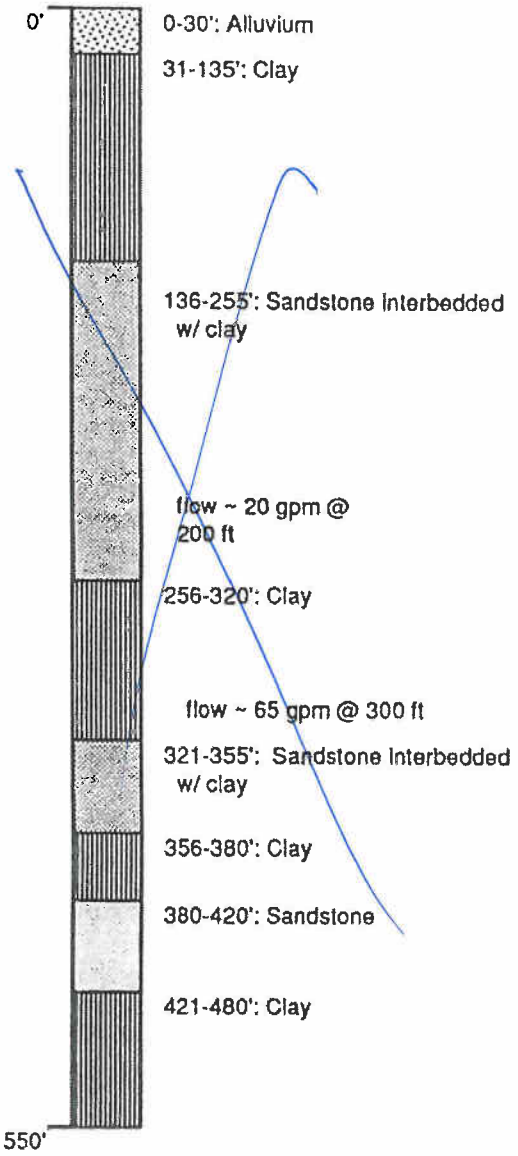



NOTES:

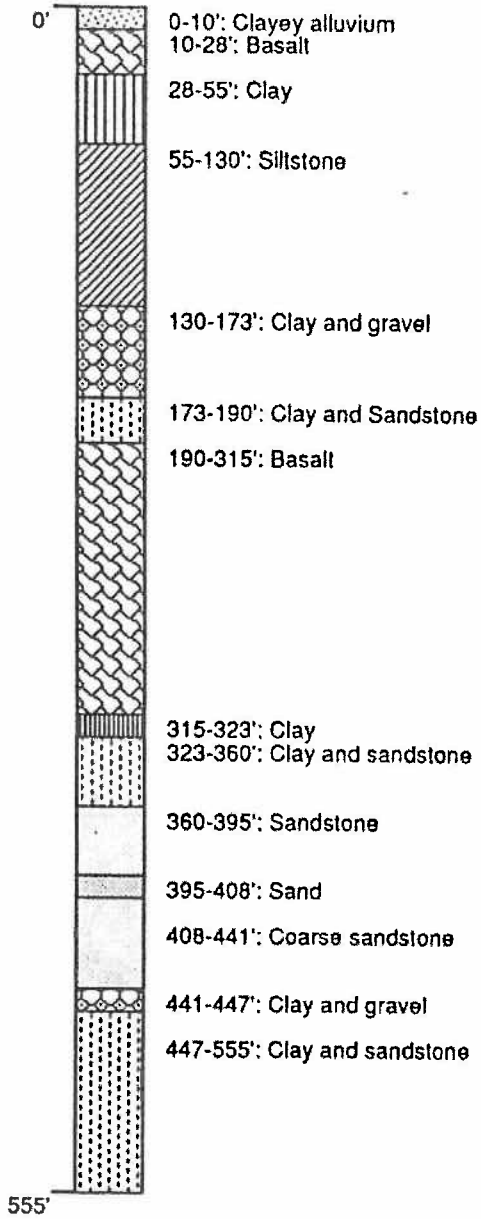
1. NOT DRAWN TO SCALE

## PRODUCTION WELL LITHOLOGIC SUMMARIES

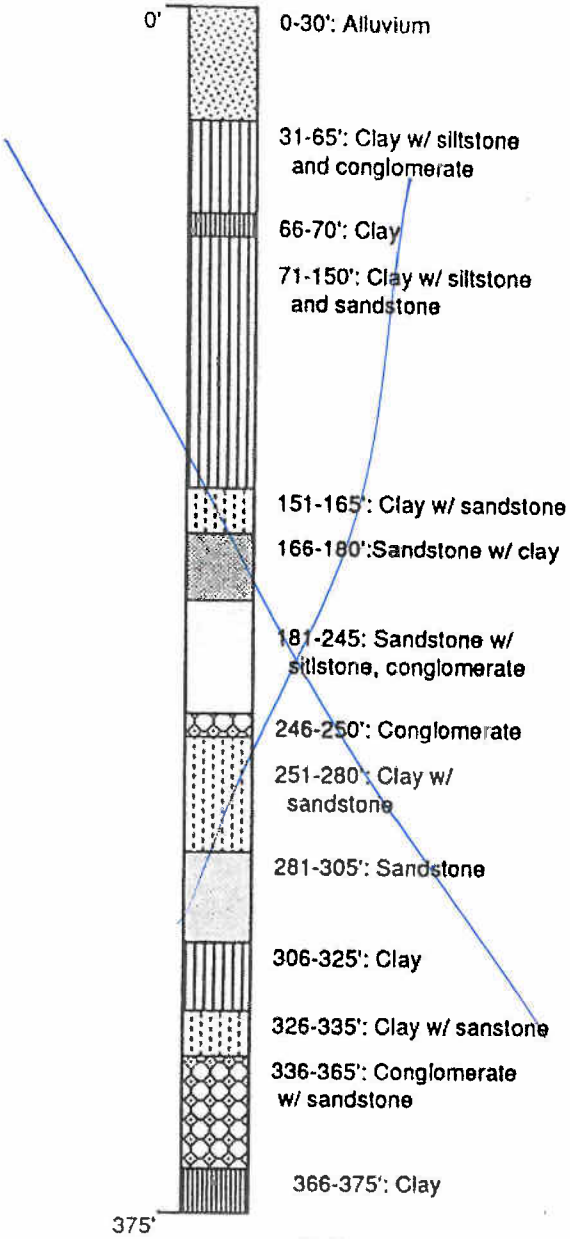
NOT TO SCALE




**Prod-1**




**PW-1** (from driller's log)




**PW-4**

SPF 9-1

BLM WELL

Copy of Well Log

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

# WATER WELL REPORT
STATE OF OREGON
(Please type or print)
(Do not write above this line)

APPROX ELEV. 3590

State Well No. _____

State Permit No. _____

CRYSTAL RIDGE WELL JOB # 4702

(1) OWNER: Bureau of Land Management
Name Box 700 , Vale Oregon
Address

(2) TYPE OF WORK (check):
New Well ☐ Deepening ☒ Reconditioning ☒ Abandon ☐
If abandonment, describe material and procedure in item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other Stock

(5) CASING INSTALLED: Threaded ☐ Welded ☒
6 " Diam. from 0 ft. to 147 ft. Gage .280
_____ " Diam. from _____ ft. to _____ ft. Gage _____
_____ " Diam. from _____ ft. to _____ ft. Gage _____

(6) PERFORATIONS: Perforated? ☐ Yes ☒ No.
Type of perforator used
Size of perforations _____ in. by _____ in.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

SCREENS: Well screen installed? ☒ Yes ☐ No
Manufacturer's Name VOP Johnson
Type Stainless Steel Model No. _____
Diam. 6 Slot size 10 Set from 159 ft. to 166 ft.
Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.

(8) WATER LEVEL: Completed well.
Static level _____ ft. below land surface Date
Artesian pressure _____ lbs. per square inch Date

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
_____ " _____ " _____ " _____ "
_____ " _____ " _____ " _____ "
Baller test 12 gal./min. with no ft. drawdown after 4 hrs.
Artesian flow _____ g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(10) CONSTRUCTION:
Was a seal—Material used One Sack Cement
Depth of seal 18 ft.
Diameter of well bore to bottom of seal 8 in. Below Seal
Were any loose strata cemented off? ☐ Yes ☐ No Depth _____
Was drive shoe used? ☐ Yes ☒ No
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off

(11) LOCATION OF WELL:
County Malheur Driller's well number
_____ ¼ _____ ¼ Section 8 T. 22 R. 44 W.M.
Bearing and distance from section or subdivision corner

Depth at which water was first found

(12) WELL LOG: Diameter of well below casing _____
Depth drilled 175 ft. Depth of completed well 175 ft.
Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level as drilling proceeds. Note drilling rates.

| MATERIAL | From | To | SWL |
|---|---|---|---|
| Yellow Clay | 0 | 60 | |
| Blue Clay | 60 | 75 | |
| Brown Clay | 75 | 95 | |
| Blue Clay | 95 | 105 | |
| Brown Clay | 105 | 170 | |
| White Sand | 170 | 175 | 154 |
| | | | |
| | | | |
| | | | |
| ORIGINAL 1972 | | | |
| STATIC LEVEL | 126' | | |
| PUMP LEVEL | 147' | | |
| | | | |
| 6 2" PIPE | | | |
| 6 2" CYLINDER | | | |
| | | | |
| | | | |
| STATIC LEVEL AS OF | 8/3/88 | | |
| x 150' | | | |
| | | | |
| | | | |
| | | | |

Work started 8-15 1972 Completed 8-16 1972
Date well drilling machine moved off of well 8-16 1972

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
(Signed) /S/ Winfield Page Date _____ 1972
(Drilling Machine Operator)
Drilling Machine Operator's License No. 65

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME Page Brothers Drilling
(Person, firm or corporation) (Type or print)
Address Rt. 2 Box 371 , Vale Oregon
/S/ Winfield Page

SPF 9-2

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the STATE ENGINEER, SALEM 10, OREGON within 30 days from the date of well completion.

# WATER WELL REPORT
STATE OF OREGON
(Please type or print)

Copy of well log

OWYHEE RIDGE WELL (Testing) Job # 3655

State Well No. 22/44-8 bb

State Permit No. .....

## OWNER:
Bureau of Land Management
Address Vale Oregon

## (2) LOCATION OF WELL:
County Malheur Driller's well number
NW ¼ NW ¼ Section 8 T. 22S R. 44E W.M.
Bearing and distance from section or subdivision corner

## (3) TYPE OF WORK (check): Testing existing Well
New Well ☐ Deepening ☐ Reconditioning ☒ Abandon ☐
If abandonment, describe material and procedure in Item 12.

## (4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☒

## (5) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

## (6) CASING INSTALLED:
Threaded ☐ Welded ☐
6 5/8" Diam. from 0 ft. to 22 ft. Gage .280
..... " Diam. from ..... ft. to ..... ft. Gage .....
..... " Diam. from ..... ft. to ..... ft. Gage .....

## PERFORATIONS:
Perforated? ☐ Yes ☒ No
Type of perforator used
Size of perforations in. by in.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.
..... perforations from ..... ft. to ..... ft.

## (8) SCREENS:
Well screen installed ☐ Yes ☒ No
Manufacturer's Name .....
Type ..... Model No. .....
Diam. ..... Slot size ..... Set from ..... ft. to ..... ft.
Diam. ..... Slot size ..... Set from ..... ft. to ..... ft.

## (9) CONSTRUCTION:
Well seal—Material used in seal Cement
Depth of seal to 18' ft. Was a packer used? .....
Diameter of well bore to bottom of seal 9 in.
Were any loose strata cemented off? ☐ Yes ☐ No Depth .....
Was a drive shoe used? ☐ Yes ☒ No
Was well gravel packed? ☐ Yes ☒ No Size of gravel: .....
Gravel placed from ..... ft., to ..... ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? ..... Depth of strata .....
Method of sealing strata off

## WATER LEVELS:
Static level 140 ft. below land surface Date 9-20-70
Artesian pressure lbs. per square inch Date

## (11) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☐ No If yes, by whom?
Yield: ..... gal./min. with ..... ft. drawdown after .....
" " "
" " "
Bailer test 6 gal./min. with 5 ft. drawdown after 4 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☐

## (12) WELL LOG:
Diameter of well below casing 5
Depth drilled ft. Depth of completed well 180
Formation: Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.

| MATERIAL | FROM | TO |
|---|---|---|
| Clay and med gravel | 0 | 22 |

RECEIVED
MAR 3 - 1972
STATE ENGINEER
SALEM OREGON

Work started 9-1 19 70 Completed 10-20 19
Date well drilling machine moved off of well 10-21 19

## (13) PUMP:
Manufacturer's Name .....
Type: ..... H.P. .....

## Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
NAME /s/ W.L. Page 11-23-70
(Person, firm or corporation) (Type or print)
Address Vale Oregon
Drilling Machine Operator's License No. 65
[Signed] /s/ Glen Hysell
(Water Well Contractor)
Contractor's License No. 396 Date 11-23, 19 70

(USE ADDITIONAL SHEETS IF NECESSARY)

SPF 12-1

MALH 2974

RECEIVED JAN 18 1994 WATER RESOURCES DEPT. SALEM, OREGON

22S/44E/8dd

# STATE OF OREGON MONITORING WELL REPORT

(as required by ORS 537.765 & OAR 690-240-095)

Start Card # 59760

## (1) OWNER/PROJECT:

WELL NO. TW-1

Name Newmont Gold

Address 318 A. Street

City West Vale State OR Zip 97018

## (2) TYPE OF WORK:

[X] New Construction [ ] Repair [ ] Recondition

[ ] Conversion [ ] Deepening [ ] Abandonment

## (3) DRILLING METHOD

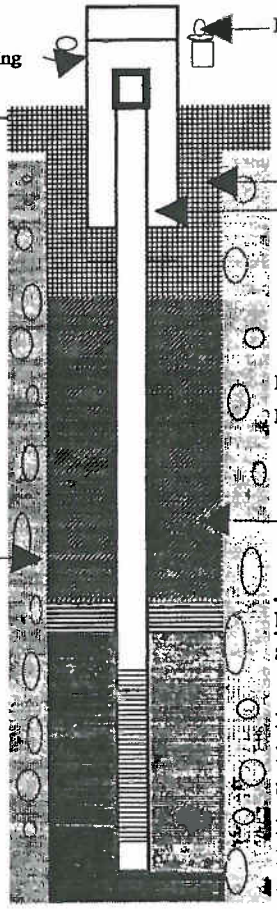
[X] Rotary Air [ ] Rotary Mud [ ] Cable

[ ] Hollow Stem Aug. [ ] Other

## (4) BORE HOLE CONSTRUCTION

Special Standards Yes [ ] No [X]

Depth completed well 203 ft.




Casing diameter 6 in.

material PVC

Welded [ ] Threaded [X] Glued [ ]

Liner Diamter ____ in.

Liner material ____

Welded [ ] Threaded [ ] Glued [ ]

Well Seal

Material cement/bent

Amount 29 sacks

Bentonite plug >2 ft. thick

Screen Material PVC

interval(s):

From: 163 To: 203

From: ____ To: ____

Slot Size 0.020 in.

Filter Pack:

Material Colorado silica sand

Size 10-20 in.

## (5) WELL TEST:

[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Permeability ____ Yield 45 GPM

Conductivity ____ pH ____

Temperature of water 56 F/C Depth artesian flow found ____ ft.

Was water analysis done? [ ] Yes [X] No

By whom? ____

Depth of strata to be analyzed. From ____ To ____ ft.

Remarks: ____

Name of supervising Geologist/Engineer M. Pappalardo

## (6) LOCATION OF WELL By legal description

Well Location: County MALHEUR

Township 22S (N/S) Range 44E (W/E) Section 8

1. NW 1/4 of SE 1/4 of above section.

2. Street address of well location GRASSY MOUNTAIN, VALE, OR

3. Tax lot number of well location UNKNOWN

4. ATTACH MAP WITH LOCATION IDENTIFIED.

## (7) STATIC WATER LEVEL:

88 Feet below land surface. Date October 11, 1993

Artesian Pressure ____ lb/sq.in. Date ____

## (8) WATER BEARING ZONES:

RECEIVED FEB 4 1994 WATER RESOURCES DEPT. SALEM, OREGON

Depth at which was first found

| From | To | Estimated Flow Rate | SWL |
|---|---|---|---|
| 160 | 205 | 45-50 | 88 |
| | | | |
| | | | |
| | | | |

## (9) WELL LOG:

Ground elevation ____

| Material | From | To | SWL |
|---|---|---|---|
| Alluvial silt with basalt float | 0 | 11 | |
| Siltstone, brown, with basalt pebbles | 11 | 15 | |
| Siltstone, Brown | 15 | 40 | |
| Siltstone, Brown, with basalt cobbles | 40 | 65 | |
| Siltstone, brown w/ increasing basalt | 65 | 90 | |
| Basalt, Red with 40% brown siltstone | 90 | 109 | |
| Basalt, Red and Black, vesicular, fine grained | 109 | 160 | |
| Basalt, vesicular w/clay in vesicles | 160 | 185 | |
| Basalt w/increased oxidation | 185 | 200 | |
| Basalt w/20% clays | 200 | 205 | |

Date Started October 4, 1993 Completed October 11, 1993

(unbonded) Monitor Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oergon well construction standards. Materials used and information reported above are true to the best knowledge and belief.

MWC Number 10098

Signed [signature] Date 1/12/94

(bonded) Monitor Well Constructor Certification:

I accept responsibility for the construction , alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

MWC Number 10096

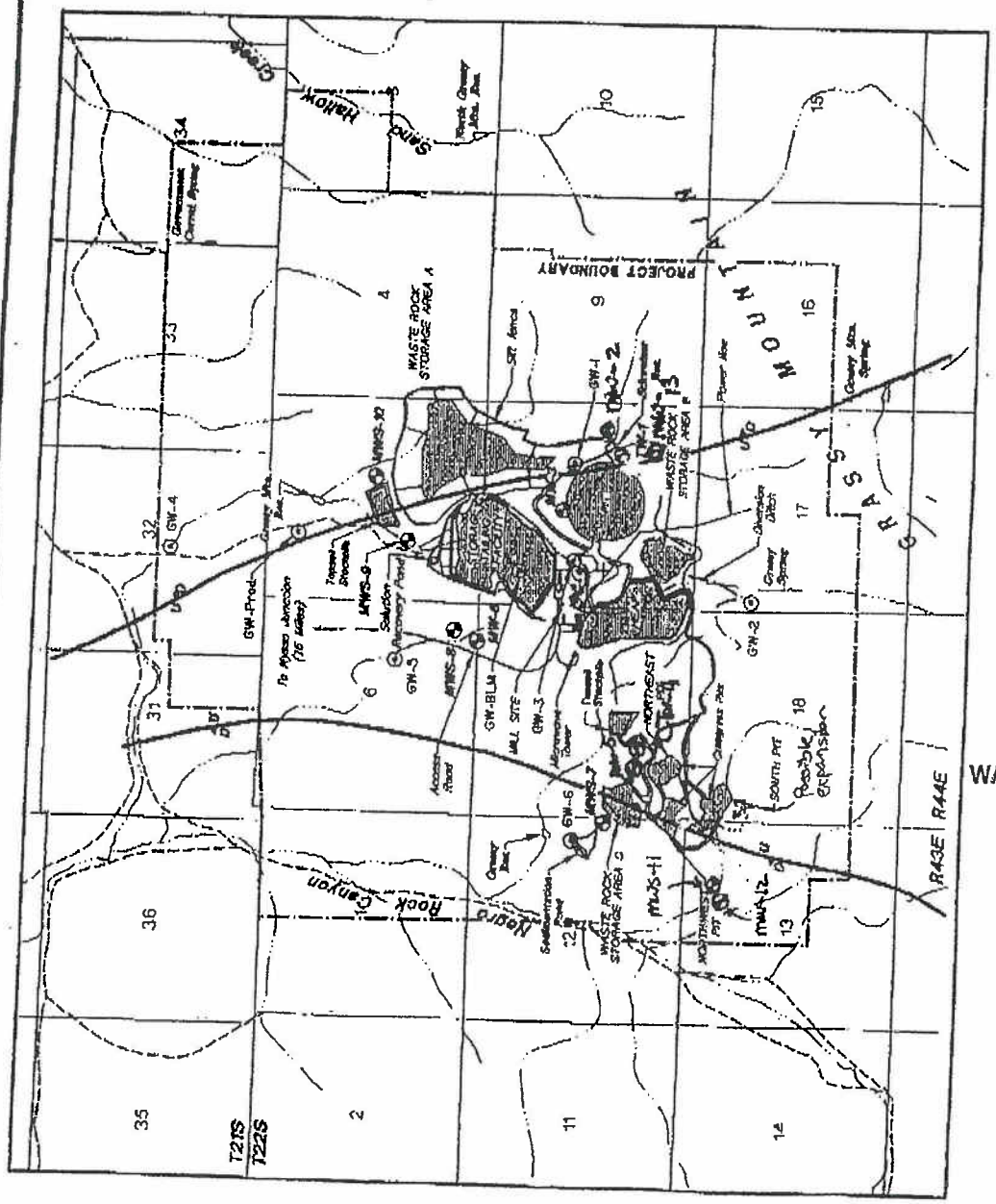
Signed [signature] Date 1-12-94

RECEIVED
JAN 18 1994
WATER RESOURCES DEPT.
SALEM, OREGON

NEWMONT GRASSY MOUNTAIN CORPORATION
GRASSY MOUNTAIN GOLD PROJECT

LOCATION OF GROUND WATER STATIONS

FIGURE




RECEIVED
FEB 4 1994
WATER RESOURCES DEPT.
SALEM, OREGON

SPF13-1

MAIH 2984

RECEIVED
JAN 18 1994
WATER RESOURCES DEPT.
SALEM, OREGON

22S / 44E / 8dd

59772

# STATE OF OREGON
# MONITORING WELL REPORT

(as required by ORS 537.765 & OAR 690-240-085) Start Card #

## (1) OWNER/PROJECT:

WELL NO. MWS-13

Name Newmont Gold

Address 318 A. Street

City West Vale State OR Zip 97018

## (2) TYPE OF WORK:

[X] New Construction [ ] Repair [ ] Recondition
[ ] Conversion [ ] Deepening [ ] Abandonment

## (3) DRILLING METHOD

[X] Rotary Air [ ] Rotary Mud [ ] Cable
[ ] Hollow Stem Aug. [ ] Other

## (4) BORE HOLE CONSTRUCTION

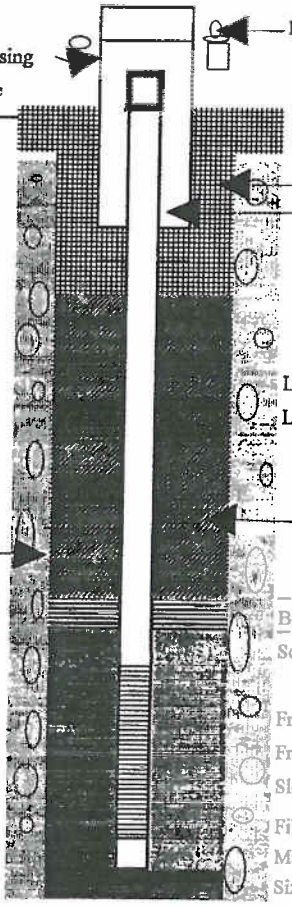
Special Standards Yes [ ] No [X] Depth completed well 207 ft.

Protective casing
Land Surface
Monument
0 ft
TO
3 ft

Seal
3 ft
TO
142 ft

Borehole
Diameter
8 in.

Filter
Pack
144 ft.
TO
207 ft.



Locking Cap
Protective post
Cement Monument
Casing
diameter 4 in.
material PVC
Welded [ ] Threaded [X] Glued [ ]
Liner Diamter in.
Liner material
Welded [ ] Threaded [ ] Glued [ ]
Well Seal
Material Cement-bent
Amount 35
Bentonite plug >2 ft. thick
Screen Material PVC
interval(s):
From: 146 To: 206
From: To:
Slot Size .020 in.
Filter Pack:
Material: Colorado Silica
Size 10-20 in.

## (5) WELL TEST:

[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian
Permeability Yield GPM
Conductivity pH
Temperature of water 51 F/C Depth artesian flow found ft.
Was water analysis done? [ ] Yes [X] No
By whom?
Depth of strata to be analyzed. From To ft.
Remarks:
Name of supervising Geologist/Engineer M. Pappolardo

## (6) LOCATION OF WELL By legal description

Well Location: County MALHEUR
Township 22S (N/S) Range 44E (W/E) Section 8
1. SE 1/4 of SE 1/4 of above section.
2. Street address of well location GRASSY MOUNTAIN
VALE, OREGON
3. Tax lot number of well location N/A
4. ATTACH MAP WITH LOCATION IDENTIFIED.

RECEIVED
FEB 4 1994
WATER RESOURCES DEPT.
SALEM, OREGON

## (7) STATIC WATER LEVEL:

95 Feet below land surface. Date OCTOBER 19, 1993
Artesian Pressure lb/sq.in. Date

## (8) WATER BEARING ZONES:

Depth at which was first found

| From | To | Estimated Flow Rate | SWL |
|---|---|---|---|
| 125 | 207 | 35 | 95' |
| | | | |
| | | | |
| | | | |

## (9) WELL LOG:

Ground elevation

| Material | From | To | SWL |
|---|---|---|---|
| Brown silt and clayey silt | 0 | 9 | |
| with cobbles | | | |
| Brown siltstone with basalt | 9 | 27 | |
| pebbles | | | |
| Brown siltstone with some | 27 | 137 | |
| some claystone | | | |
| Basalt weathered and | 137 | 156 | |
| fractured | | | |
| Basalt, very weathered | 156 | 165 | |
| Basalt | 165 | 207 | |

Date Started 10-18-93 Completed 10-19-93

(unbonded) Monitor Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to the best knowledge and belief. MWC Number 10098
Signed Date 1/12/94

(bonded) Monitor Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief. MWC Number 10096
Signed Date 1-12-94

WATER RESOURCES DEPT.
SALEM, OREGON

RECEIVED
FEB 4 1994
WATER RESOURCES DEPT.
SALEM, OREGON

LEGEND

EXISTING WELL
PROPOSED WELL
DIVERSION DITCH
APPROXIMATE NORMAL FAULT

NOTE: AGZ PROPOSES TO SAMPLE THE PROPOSED WELLS FOR A PERIOD OF ABOUT SIX MONTHS. EXISTING WELLS WILL BE RESAMPLED FOR ONE OR TWO MONTHS.

FACILITY LOCATIONS ARE BASED ON MOST RECENT 1993# KNIGHT-RESOLD LAYOUT.




| | |
|---|---|
| NEWMONT GRASSY MOUNTAIN CORPORATION<br>GRASSY MOUNTAIN GOLD PROJECT | |
| LOCATION OF GROUND WATER STATIONS | FIGURE |
| Project No.: 639-1000 | Design By: RICH BARTELL |
| File: CATMOSSLOWG | Drawn By: KAREN COMRATH |
| AGZ Inc. | Scale: SEE BAR SCALE<br>Date: MAY 1993 |

SPF 14

STATE OF OREGON

# WATER WELL REPORT

(as required by ORS 537.765)

RECEIVED

FEB 16 1989

WATER RESOURCES DEPT

228/44E/17bb

(START CARD) # 9258

## (1) OWNER:

Well Number: 47-1

Name: Atlas Precious Metals

Address: 2025 Century Way

City: Boise, State: Id Zip: 83709

## (2) TYPE OF WORK:

☒ New Well ☐ Deepen ☐ Recondition ☐ Abandon

## (3) DRILL METHOD

☒ Rotary Air ☐ Rotary Mud ☐ Cable

☐ Other

## (4) PROPOSED USE:

☐ Domestic ☐ Community ☐ Industrial ☐ Irrigation

☐ Thermal ☐ Injection ☒ Other Monitoring

## (5) BORE HOLE CONSTRUCTION:

Special Construction approval ☐ Yes ☒ No Depth of Completed Well 155.5 ft.

Explosives used ☐ Yes ☒ No Type ____ Amount ____

| HOLE Diameter | From | To | SEAL Material | From | To | Amount sacks or pounds |
|---|---|---|---|---|---|---|
| 12¼ | 160 | 122 | Colo. Sand | 160 | 122 | 9 sacks |
| 12¼ | 122 | 115 | Enviro Plug | 122 | 115 | 2 sacks |
| 12¼ | 115 | +1 | cement grout | 115 | +1 | 432 sacks |

How was seal placed: Method ☐ A ☐ B ☒ C ☐ D ☐ E

☐ Other

Backfill placed from ____ ft. to ____ ft. Material see above

Gravel placed from ____ ft. to ____ ft. Size of gravel 8-12 sand

## (6) CASING/LINER:

| | Diameter | From | To | Gauge | Steel | Plastic | Welded | Threaded |
|---|---|---|---|---|---|---|---|---|
| Casing: | 12" | +2 | 8 | 250 | ☒ | ☐ | ☐ | ☐ |
| | | | | | ☐ | ☐ | ☐ | ☐ |
| | 4 | +2 | 155.5 | sch80 | ☐ | ☒ | ☐ | ☐ |
| | | | | | ☐ | ☐ | ☐ | ☐ |
| Liner: | | | | | ☐ | ☐ | ☐ | ☐ |
| | | | | | ☐ | ☐ | ☐ | ☐ |

Final location of shoe(s) no shoe screw on plug

## (7) PERFORATIONS/SCREENS:

☐ Perforations Method ____

☒ Screens Type Aardvark Material PVC

| From | To | Slot size | Number | Diameter | Tele/pipe size | Casing | Liner |
|---|---|---|---|---|---|---|---|
| 135.5 | 155.5 | .020 | | 4" | | ☒ | ☐ |
| 135.5 | +2 | | | 4" PVC | | ☒ | ☐ |
| | | | | | | ☐ | ☐ |
| | | | | | | ☐ | ☐ |
| | | | | | | ☐ | ☐ |

## (8) WELL TESTS: Minimum testing time is 1 hour

☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

| Yield gal/min | Drawdown | Drill stem at | Time |
|---|---|---|---|
| | NA | | 1 hr. |
| 60 | | 160 | |
| | | | |

Temperature of water NA Depth Artesian Flow Found 140

Was a water analysis done? ☐ Yes By whom ____

Did any strata contain water not suitable for intended use? ☐ Too little

☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other ____

Depth of strata: ____

## (9) LOCATION OF WELL by legal description:

EM, C Malheur

County ____ Latitude ____ Longitude ____

Township 22S N or S, Range 44E E or W, WM.

Section 17 NW ¼ NW ¼

Tax Lot ____ Lot ____ Block ____ Subdivision ____

Street Address of Well (or nearest address) NA

## (10) STATIC WATER LEVEL:

49 ft. below land surface. Date 1/21/89

Artesian pressure na lb. per square inch. Date ____

## (11) WATER BEARING ZONES:

Depth at which water was first found 140- 160

| From | To | Estimated Flow Rate | SWL |
|---|---|---|---|
| 140 | 160 | 60 | 49 |
| | | | |
| | | | |

## (12) WELL LOG:

Ground elevation 3698

| Material | From | To | SWL |
|---|---|---|---|
| Brown Clay | 0 | 35 | 0 |
| Brown clay w/gravely sand | 35 | 56 | 0 |
| Blue Clay | 56 | 122 | 0 |
| Blue Clay & Gravel | 122 | 140 | ? |
| Gravel | 140 | 160 | 49 |

Date started 12/14/89 Completed 1/18/89

**(unbonded) Water Well Constructor Certification:**

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to my best knowledge and belief.

Signed Robert W. Doty WWC Number 1202 Date 2-13-89

**(bonded) Water Well Constructor Certification:**

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. all work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

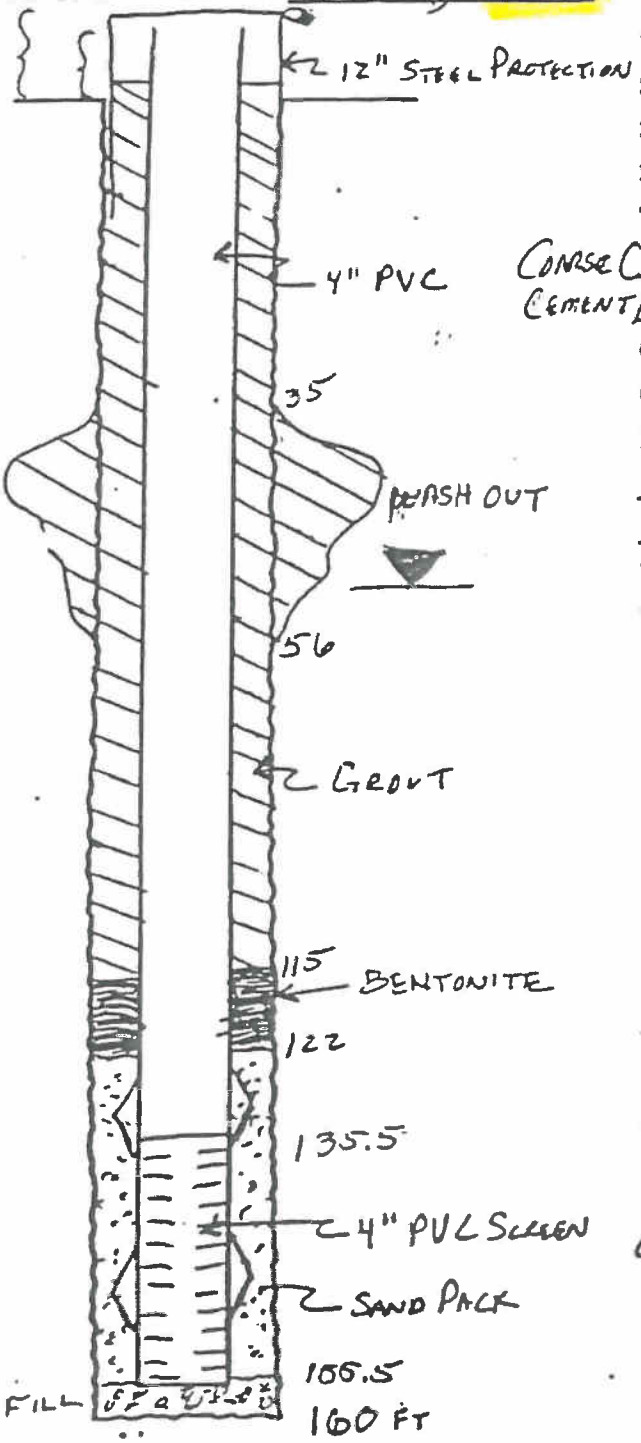
Signed Robert W. Doty for William E. Doty WWC Number 325 Date 2-13-89

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT SECOND COPY - CONSTRUCTOR THIRD COPY - CUSTOMER 9809C 3/88

# PIEZOMETER COMPLETION DIAGRAM

DATE COMPLETED: 12-14 to 1-18-89
WEATHER: VARIED FROM BLIZZARD 4 0° TO CLEAR AND 35°
PROJECT NAME/LOCATION: ATLAS GRASSY MTN - VALE OREGON
PROJECT # 219-8J-008
WELL LOCATION: EAST SIDE OF ORE BODY @ 26-61
PIEZOMETER NUMBER: 47-1 GU1-1

PERMIT # _____
PROPERTY OWNER: BLM - ATLAS
GEOLOGIST: K. BEISER - WTI (DENVER)
DRILLER: BILL DOTY DRILLING CO / DAVID KNARR
RIG TYPE & MODEL: SPEEDSTAR TTH 15 AIR-ROTARY
AQUIFER: UPPERMOST BEDROCK - MIOCENE GRASSY MT.




## COMPLETION SUMMARY

Total Well Depth 155.5 FROM GROUND
Stickup _____
Screen Type 4" ID SCHED 80 PVC .020" SLOTTED FLUSH-TH
Screen 135.5 to 155.5
Top Seal:
COARSE CHUNK ENVIROPLUG from 115.5 to 122
CEMENT/BENTONITE from +1 to 115.5
Gravel Pack from 122 to 155.5
Gravel Pack Material 8-12 COLO. SILICA
Bottom Seal:
NONE from _____ to _____
_____ from _____ to _____
Well Casing Diameter USED TEMP 8"/12" STEEL W/PVC
Well Casing Depth 12" to 6 FT AND 4" PVC to 135.5
Bit Diameter 0-140 IS 12" 140 TO 160 IS 8"
Drilled Depth 160 FT
Centralizers S.S @ 122' AND 142'
Protective Casing 12" STEEL
Logged - Y _____ N X
Type - SP _____ Res _____ Gamma _____
CAL _____ Por _____ Neutron _____
Remarks: WATER DURING DRILLING AT 135 TO 160 FT (60 gpm AIR LIFT). DRILLED USING FOAM. SAND PACKED AS 8" TEMP. STEEL CASING WAS PULLED. VOID FROM 35' to 56'. TOTAL OF 116 YARDS OR 432 SACKS OF GROUT. GROUTED USING METHOD C: STATE OF OREGON CHAPTER 690 (TREMIE PIPE)

ELEV = 3698
SWL = 49.0 BELOW GROUND 1-21-89
KEY NUMBER _____

SPF 15-A

# STATE OF OREGON
# MONITORING WELL REPORT
(as required by ORS 537.765 & OAR 690-240-095)

Start Card # 59763

## (1) OWNER/PROJECT:

WELL NO. TW-4

Name Newmont Gold

Address 316 A Street

City West Vale State OR Zip 97918

## (2) TYPE OF WORK:

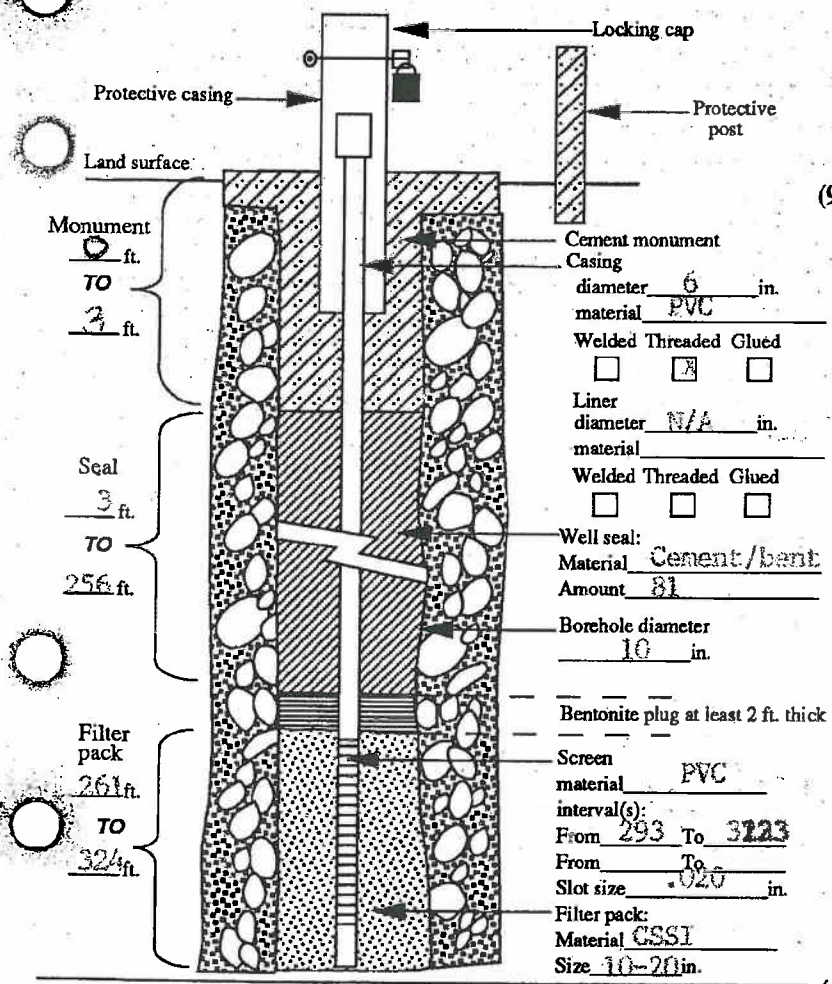
[X] New construction [ ] Repair [ ] Recondition
[ ] Conversion [ ] Deepening [ ] Abandonment

## (3) DRILLING METHOD

[X] Rotary Air [ ] Rotary Mud [ ] Cable
[ ] Hollow Stem Auger [ ] Other

## (4) BORE HOLE CONSTRUCTION

Special Standards Yes [ ] No [X] Depth of completed well 324 ft.




## (5) WELL TEST: N/A

[ ] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian

Permeability — Yield — GPM

Conductivity — PH —

Temperature of water 51.0 °F/C Depth artesian flow found ft.

Was water analysis done? [ ] Yes [ ] No

By whom? —

Depth of strata to be analyzed. From — ft. to — ft.

Remarks: —

Name of supervising Geologist/Engineer Mike Pappalardo

## (6) LOCATION OF WELL By legal description

Well Location: County Malheur

Township 22S (N or S) Range 44E (E or W) Section 7

1. SW 1/4 of NE 1/4 of above section.

2. Street address of well location Grassy Mountain, Vale

3. Tax lot number of well location Unknown

4. ATTACH MAP WITH LOCATION IDENTIFIED.

## (7) STATIC WATER LEVEL:

280 Ft. below land surface. Date 10/15/93

Artesian Pressure lb/sq. in. Date

## (8) WATER BEARING ZONES:

Depth at which water was first found —

| From | To | Est. Flow Rate | SWL |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

## (9) WELL LOG:

Ground elevation —

| Material | From | To | SWL |
|---|---|---|---|
| Alluvium | 0 | 3 | |
| Light brown tuff | 3 | 18 | |
| Clayey siltstone tuff | 18 | 43 | |
| Tuff and Rhyolite | 43 | 163 | |
| Gray tuff | 163 | 215 | |
| Gray tuff and Rhyolite | 215 | 305 | 277 |
| Rhyolite | 305 | 324 | |

Date started 10/11/93 Completed 10/15/93

(unbonded) Monitor Well Constructor Certification:

I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon well construction standards. Materials used and information reported above are true to the best knowledge and belief.

Signed [signature] MWC Number 1009B Date 1/12/94

(bonded) Monitor Well Constructor Certification:

I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.

Signed [signature] MWC Number 1006 Date 1-12-94

SPF 16-B

# STATE OF OREGON
# MONITORING WELL REPORT

(as required by ORS 537.765 & OAR 690-240-095)

Start Card # 59766

## (1) OWNER/PROJECT:

WELL NO. MWS-8

Name Newmont Gold

Address 318 A. Street

City West Vale State OR Zip 97018

## (2) TYPE OF WORK:

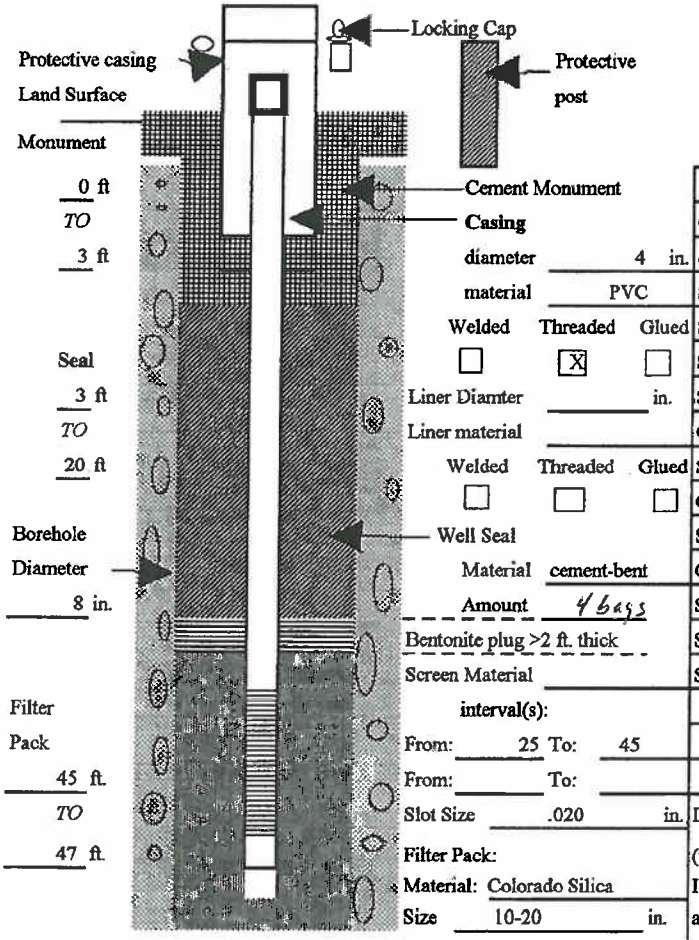
[X] New Construction [ ] Repair [ ] Recondition
[ ] Conversion [ ] Deepening [ ] Abandonment

## (3) DRILLING METHOD

[X] Rotary Air [ ] Rotary Mud [ ] Cable
[ ] Hollow Stem Aug. [ ] Other

## (4) BORE HOLE CONSTRUCTION

Special Standards Yes [ ] No [X] Depth completed well 45 ft.




## (5) WELL TEST:

[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian
Permeability Yield N/A GPM
Conductivity pH
Temperature of water F/C Depth artesian flow found ft.
Was water analysis done? [ ] Yes [X] No
By whom?
Depth of strata to be analyzed. From To ft.
Remarks: bottom hole backfilled w/pellets&sand 47-76.5'
Name of supervising Geologist/Engineer M. Pappolardo

## (6) LOCATION OF WELL By legal description

Well Location: County MALHEUR
Township 22S (N/S) Range 44E (W/E) Section 6
1. SE 1/4 of SE 1/4 of above section.
2. Street address of well location GRASSY MOUNTAIN
VALE, OREGON
3. Tax lot number of well location N/A
4. ATTACH MAP WITH LOCATION IDENTIFIED.

## (7) STATIC WATER LEVEL:

Dry to 45.5 Feet below land surface. Date: October 2, 1993
Artesian Pressure lb/sq.in. Date

## (8) WATER BEARING ZONES:

Depth at which was first found

| From | To | Estimated Flow Rate | SWL |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

## (9) WELL LOG:

Ground elevation

| Material | From | To | SWL |
|---|---|---|---|
| Gravely sandy loam, med. gray brown | 0 | 10 | |
| dry. | | | |
| Siltstone tan-gray | 10 | 29 | |
| Sandstone-yellow-tan | 29 | 32.5 | |
| Sandstone - orange | 32.5 | 33.5 | |
| Sandstone, yellow-tan | 33.5 | 46.5 | |
| Clayey siltstone, gray and tan with sand | 46.5 | 48 | |
| Sandstone, tan-brown | 48 | 59 | |
| Clayey siltstone w/sand, tan-gray | 59 | 62 | |
| Sandstone, yellow-tan | 62 | 64 | |
| Carbonaceous shale | 64 | 68 | |
| Siltstone, med. gray-brown | | | |
| Sandstone, tan-orange | 68 | 71 | |
| Sandstone, light tan | 71 | 76.5 | |
| | | | |
| | | | |
| | | | |

Date Started 10-1-93 Completed 10-2-93

(unbonded) Monitor Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oergon well construction standards. Materials used and information reported above are true to the best knowledge and belief. MWC Number 10098
Signed [signature] Date 1/12/94

(bonded) Monitor Well Constructor Certification:
I accept responsibility for the construction , alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon well construction standards. This report is true to the best of my knowledge and belief.
Signed [signature] MWC Number 10096
Date 1-12-94

SPF 17

... BY: ERO TELECOPIER 7010 ; 3-22-91 1:53PM ; ...OMITT 63- 2083455897;#

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
STATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

# WATER WELL REPORT
## STATE OF OREGON
(Please type or print)
(Do not write above this line)

State Well No. #13
State Permit No. _____

## (1) OWNER:
Name John Bishop
Address Vale, Oregon

## (2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

## (3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
Dug ☐ Bored ☐

## (4) PROPOSED USE (check):
Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

## (5) CASING INSTALLED:
Stock Threaded ☐ Welded ☒
12 Diam. from 1 ft. to 150 ft. Gage .250
_____ Diam. from _____ ft. to _____ ft. Gage _____
_____ Diam. from _____ ft. to _____ ft. Gage _____

## (6) PERFORATIONS:
Perforated? ☒ Yes ☐ No.
Type of perforator used Torch
Size of perforations in. by in.
101 perforations from 135 ft. to 145 ft.
_____ perforations from _____ ft. to _____ ft.
_____ perforations from _____ ft. to _____ ft.

## SCREENS:
Well screen installed? ☐ Yes ☒ No
Manufacturer's Name _____
Type _____ Model No. _____
Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.
Diam. _____ Slot size _____ Set from _____ ft. to _____ ft.

## (8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☐ No If yes, by whom?
Yield: _____ gal./min. with _____ ft. drawdown after _____ hrs.
" " " "
" " " "
Bailer test _____ gal./min. with _____ ft. drawdown after _____ hrs.
Artesian flow _____ g.p.m.
Temperature of water _____ Depth artesian flow encountered _____ ft.

## (9) CONSTRUCTION:
Well seal—Material used _____
Well sealed from land surface to _____ ft.
Diameter of well bore to bottom of seal _____ in.
Diameter of well bore below seal _____ in.
Number of sacks of cement used in well seal _____ sacks
Number of sacks of bentonite used in well seal _____ sacks
Brand name of bentonite _____
Number of pounds of bentonite per 100 gallons of water _____ lbs./100 gals.
Drive shoe used ☒ Yes ☐ No Plugs _____ Size: location _____ ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? _____ depth of strata _____
Method of sealing strata off _____
Was well gravel packed? ☐ Yes ☒ No Size of gravel: _____

## (10) LOCATION OF WELL:
County Malheur Driller's well number _____
¼ ¼ Section T. R. W.M.
Bearing and distance from section or subdivision corner _____

## (11) WATER LEVEL: Completed well.
Depth at which water was first found _____ ft.
Static level 95 ft. below land surface. Date 6/19/63
Artesian pressure _____ lbs. per square inch. Date _____

## (12) WELL LOG:
Diameter of well below casing 12"
Depth drilled 492 ft. Depth of completed well 432 ft.

Formation: Describe color, texture, grain size and structure of materials and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

| MATERIAL | From | To | SWL |
|---|---|---|---|
| Yellow Clay | 0 | 15 | |
| Fine Sand & Gravel | 15 | 22 | |
| Yellow Clay & Boulders | 22 | 57 | |
| Cemented Sand | 57 | 75 | |
| Cemented Sand & Gravel | 75 | 106 | |
| Coarse Gravel | 106 | 112 | water |
| Yellow Clay & Sm. Boulders | 112 | 129 | |
| Soft Sandstone | 129 | 133 | |
| Coarse Gravel | 133 | 142 | |
| Fine Sandstone | 142 | 170 | |
| Hard Gray Stonestone | 170 | 239 | |
| Soft Gray Sandstone | 239 | 450 | |
| Soft Sandy Blue Shale | 450 | 462 | |
| Fine Sand | 462 | 481 | |
| Sandstone | 481 | 492 | |
| Mud Sand In Bottom | | | |

Work started 5/7/63 19 Completed 6/19/63 19
Date well drilling machine moved off of well 19

**Drilling Machine Operator's Certification:**
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] _____ (Drilling Machine Operator) Date _____, 19____
Drilling Machine Operator's License No. _____

**Water Well Contractor's Certification:**
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name HYSELLS DRILLING (Person, firm or corporation) (Type or print)
Address _____
[Signed] _____ (Water Well Contractor)

# Attachment E: Field Equipment Calibration Record

# Field Equipment Calibration Record

Instrument: pH Meter
Manufacturer / Model: YSI Ecosense pH100
Date / Time of Calibration: _____
Calibration Method: 2 - point
Buffers Used: _____
Slope Deviation: _____
Electrode Efficiency: _____
Successful Calibration? _____ Yes _____ No
If No, List Corrective Action: _____
Signature: _____

Instrument: Conductivity Meter
Manufacturer / Model: YSI Ecosense EC300
Date / Time of Calibration: _____
Calibration Method: _____
Cell Constant: _____ Default? _____ Yes _____ No
Temperature Coefficient: _____ Default? _____ Yes _____ No
Temperature Reference: _____ Default? _____ Yes _____ No
Conductivity Standard: _____
Conductivity Standard @ 25C: _____
Successful Calibration? _____ Yes _____ No
If No, List Corrective Action: _____
Signature: _____

Instrument: Dissolved Oxygen Meter
Manufacturer / Model: OxyGuard Handy Polaris 2
Date / Time of Calibration: _____
Calibration Method: _____
Initial DO Saturation Reading: _____ (Should read 100.5%)
Calibration Needed? _____ Yes _____ No
Calibration Precision: _____ Field _____ Normal _____ High
Successful Calibration? _____ Yes _____ No
If No, List Corrective Action: _____
Signature: _____