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### Appendices

- Appendix A: Project Site Layout Map
- Appendix B: Plant Site General Arrangement Plan
- Appendix C: Geotechnical Exploration Location Map
- Appendix D: Bore Logs
- Appendix E: Lithologic Cross-Sections
- Appendix F: Well Driller’s Reports
- Appendix G: Conceptual Well Diagram
1. INTRODUCTION

This report presents a groundwater monitoring proposal for Calico Resources USA Corp’s (Calico’s) Grassy Mountain Project (Project). This report specifically addresses groundwater monitoring for the tailings storage facility (TSF), waste rock storage facility, and the process plant collection pond. This report intends to meet the requirements of Oregon Administrative Rules (OAR) Chapter 340, Division 40, Groundwater Quality Protection.

The purpose of the groundwater monitoring proposal is to detect any groundwater contamination resulting from these facilities occurring in the uppermost aquifer and any other potentially affected aquifers. The “uppermost aquifer” is defined in OAR 340-040 as the geologic formation, group of formations, or part of a formation that contains the uppermost potentiometric surface capable of yielding water to wells or springs, and may include fill material that is saturated.

Both up-gradient and down-gradient monitoring wells will be installed. The up-gradient wells will serve as background monitoring points. The down-gradient monitoring wells will serve as the down-gradient detection monitoring points to determine if the groundwater is being affected by leakage from the TSF, waste rock storage facility, or collection pond. The down-gradient detection monitoring points are expected to serve as the compliance points where groundwater-quality parameters must be at or below the permit-specific concentration limits or the concentration limit variance, unless other compliance points are required by the Oregon Department of Environmental Quality (ODEQ). The concentration limit is the maximum acceptable concentration of a contaminant allowed in groundwater at a compliance point. For new facilities, the permit-specific concentration limits shall be the background water quality for all contaminants.

In addition to the proposed monitoring wells, there are existing wells in the near vicinity of the Project facilities that are proposed be included in the monitoring well network.

This report outlines the purposes of the monitoring proposal, and then describes (1) area and local geological and hydrogeological conditions, (2) proposed monitoring well locations and construction, (3) existing monitoring wells, (4) groundwater monitoring approach and methods, (5) data analysis, and (6) reporting requirements.

2. PROJECT LOCATION

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

The Mine and Process Area 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 Bureau of Land Management (BLM) (Figure 2). All proposed mining would occur on the patented claims, with some mine facilities on unpatented claims. The Mine and Process Area is in all or portions of Sections 5 through 8, Township 22 South, Range 44 East (T22S, R44E) (Willamette Meridian).

The Access Road Area is located on public land administered by the BLM, and private land controlled by others (Figure 2). A portion of the Access Road Area is a Malheur County Road named Twin Springs Road. The Access Road Area extends north from the Mine and Process Area to Russell Road, a paved Malheur County Road. The Access Road Area is in portions of Section 5, T22S, R44E, Sections 3, 10, 11, 14, 15, 21 through 23, 28, 29, and 32, T21S, R44E, Sections 1, 12 through 14, 23, 26, 27, and 34, T20S, R44E, Sections 6 and 7, T20S, R45E, and Sections 22, 23, 26, 35, and 36, T19S, R44E (Willamette Meridian). The width of the Access Road Area is 300 feet (150 feet on either side of the access road centerline) to accommodate possible minor widening or re-routing and a potential powerline adjacent to the access road. There are several areas shown that are significantly wider than 300 feet on the Permit Area Map (Figure 2), which are areas where the final alignment has not yet been determined. The final engineering of the road will be consistent throughout, and within the Permit Area. The Access Road Area also includes a buffer on either side of the proposed road width for the collection of environmental baseline data. The road corridor will be 30 feet wide, which includes a 20-foot wide road travel width (10 feet on either side of the road centerline), two-foot wide shoulders on each side of the road, minimum one-foot wide ditches on each side of the road, and appropriate cut and fill. The Access Road Area totals approximately 876 acres.
Figure 1. Location map
Figure 2. Permit area map
3. FACILITIES

3.1. Tailings Storage Facility

The following description of the TSF was obtained from the Geotechnical Data Report, Grassy Mountain Project, Malheur County, Oregon (Golder 2018) and the Preliminary Feasibility and Technical Report for the Grassy Mountain Gold and Silver Project Malheur County, Oregon (Mine Development Associates, 2018).

The proposed TSF will be located in a drainage northwest of the proposed Grassy Mountain mine site and associated process facilities, refer to the Project site layout map included in Appendix A. The bottom elevation of the TSF is at approximately 3,540 feet, along the base of the north embankment.

The TSF will require embankments on the north, west, and southwest sides of the drainage. The main embankment will be located at the north end. The north embankment will extend east-west across the drainage and will have an approximate maximum height of about 80 feet. The west and southwest embankments will range in height from about 10 feet to about 44 feet. The proposed TSF will cover approximately 110 acres.

The embankments will be constructed in stages with soil and/or rock materials obtained from on-site borrow sources. The TSF impoundment will include a composite lining system, including (from bottom to top): a prepared subgrade, an enhanced geosynthetic clay liner, HDPE geomembrane liner, a drainage layer, and a filter layer. An underdrain collection system consisting of perforated piping will be located within the impoundment drainage layer. The upstream slope of the embankments will utilize the same composite lining system, but without the underdrain collection system, drainage and filter layers.

A reclaim pond will capture all process solution collected in the TSF underdrain collection system. The reclaim pond is proposed north of the TSF. The reclaim pond will be lined, the lining system will consist of (from bottom to top): a prepared subgrade, an HDPE secondary geomembrane liner, an HDPE geonet, and an HDPE geomembrane primary liner. The geonet will serve as the leakage collection and recovery system.

Water collected from the reclaim pond and from the supernatant pool will be returned to the mill for use in the process circuit using independent return-water systems.

The TSF has been designed as a zero-discharge facility, capable of storing the 500-year, 24-hour storm event. Permanent and temporary stormwater diversions will collect and divert a majority of the stormwater runoff around the facility to a natural drainage located on the north side of the TSF.

3.2. Waste Rock Storage Facility

Waste rock from mining will ultimately be used as cemented rock fill (CRF) material. During operation, a stockpile of waste rock will be managed on the surface to be used
as CRF as needed. The waste rock storage facility will be located south and immediately adjacent to the TSF, refer to the Project site layout map included in Appendix A.

The waste rock storage facility will be a lined facility due to the potential sulfides in the waste rock material. The composite lining system will consist of (from bottom to top): prepared subgrade, an enhanced geosynthetic clay liner, an HDPE geomembrane liner, and a drainage layer. A collection system consisting of perforated piping will be installed within the drainage layer to collect any water coming in contact with the waste rock. The collection system will drain by gravity to the TSF reclaim pond.

3.3. Process Plant Collection Pond

The mine process facilities will be situated on a saddle between the proposed mine site and a knoll about 600 feet north of the mine portal. Diversion ditches will be constructed along the perimeter of the process facilities to prevent runoff from entering the facilities. The process facilities pad will include a system of ditches and culverts that will collect any precipitation that falls directly on the pad. Water collected will be directed by gravity towards a collection pond.

The collection pond is proposed northeast of the main process facilities, refer to the plant site general arrangement plan included in Appendix B. The pond volume will be approximately 110,000 ft$^3$ (823,000 gallons). The pond volume has been designed to accommodate the 100-year, 24-hour storm event while also accounting for sediment accumulation and freeboard. The pond will be double-lined with a fluid evacuation zone between the two liners. The bottom elevation of the pond is 3,675 feet.

4. GEOLOGY

4.1. Area Geology

The Grassy Mountain Geology and Soils Baseline Report (Abrams 2018) describes the surficial geology in the vicinity of the Project. The Mine and Process Area Geology map from the Geology and Soils Baseline Report is shown on Figure 3, along with the TSF and process plant.

The eastern portion of the TSF is underlain by geologic unit Qal, identified as Pleistocene and Holocene alluvium, and described as *unconsolidated and generally poorly sorted deposits or gravel, sand and silt accumulated along modern streams, drainages and floodplains* (Abrams 2018).

The western portion of the TSF and the process plant is underlain by geologic units Tgs and Tgsc, identified as Grassy Mountain Formation - undifferentiated and Grassy Mountain Formation - conglomerate. The Grassy Mountain Formation sedimentary units in the area of the process plant and proposed mine are silicified and strongly indurated (Abrams 2018).
Figure 3. Surficial geology map

Geologic unit *Tgs* (Grassy Mountain Formation – undifferentiated) is described in the Geology and Soils Baseline Report as: *Arkosic sandstones and channel-fill granite clast conglomerates. Mainly white to tan arkosic sandstones. Includes Tgsc, channel fill conglomerates with abundant granite and rhyolite clasts in the upper part of the unit. Uppermost conglomerates locally contain rounded obsidian clasts and rare black chert clasts. Unit Tgs generally becomes finer grained upward and includes white bentonitic clays near the top of the section which, where overlain by unit Tgb often generated large landslide masses. Hot spring activity contemporaneous with the deposition of the arkoses is indicated by sinter beds Tgsn, and sinter boulders containing silicified reeds and wood near the Grassy mountain gold deposit. Unit Tgs is the host for both the Grassy Mountain and Crabgrass gold deposits.*

Geologic unit *Tgsc* (Grassy Mountain Formation – conglomerate) is described as conglomerates found in the upper part of geologic unit *Tgs* (Abrams 2018).

A representative stratigraphic column of the geology near the Mine and Process Area from Abrams 2018 is provided as Figure 4. The Quaternary-age alluvium overlies the Grassy Mountain Formation in the lower elevation drainages, with the Grassy Mountain Formation siltstone, sandstone, and conglomerate exposed at the higher elevations in the Mine and Process Area. The Tuff of Kern Basin underlies the Grassy Mountain Formation.
Figure 4. Representative stratigraphic column
4.2. Area Hydrogeology

4.2.1. Aquifer System

Groundwater in the general vicinity of the proposed mine site is found primarily within unconsolidated and semi-consolidated sandstone and conglomerate units of the Grassy Mountain Formation. The Grassy Mountain Formation generally strikes from east to west and dips towards the north. Discontinuous lenses of higher permeability sandstone and conglomerate form localized and compartmentalized water-bearing units that are interbedded with thick layers of low-permeability clay and clayey siltstone that impede groundwater flow. These sedimentary rocks are locally capped by basalt, alluvium and colluvium. The Grassy Mountain Formation is underlain by fine-grained lithic tuff, the Tuff of Kern Basin. The Grassy Mountain Formation is the host unit for the Grassy Mountain gold and silver deposit. A more detailed description of principal hydrogeological units can be found in the Grassy Mountain Gold Project Groundwater Characterization Report (SPF 2019b).

The aquifer system in the near vicinity of the proposed mine is typically found in silicified sediments or clay with very low hydraulic conductivity and high hydraulic gradients. Production and monitoring wells near the deposit completed in unconsolidated sediments and fractured basalt typically have short-term yields of less than 50 gpm. Long-term aquifer sustainability appears to be limited by negative hydraulic boundaries such as water-bearing zones of limited spatial extent, faulting, and/or silicification. Wells near the deposit completed in clay or silicified sediments have very low yields, generally less than 5 gpm.

The aquifer hydraulic conductivity increases down-gradient of the proposed mine where the sediments are not silicified. However, aquifer sustainability appears to be still affected by faulting and lithologic variability, with limited data suggesting that the Grassy Mountain Formation thins out moving north from the deposit. The Grassy Mountain fault zone also extends north of the deposit (RQV 2015). This fault zone acts as a barrier to groundwater flow based on testing of nearby wells; the most productive wells in the area are presumably located on the east side of the Grassy Mountain fault zone.

4.2.2. Groundwater Flow

Potentiometric surface maps are two-dimensional depictions of groundwater flow. In reality, groundwater flow occurs in three-dimensions. These maps, however, are useful for providing an indication of the overall, general groundwater flow direction and hydraulic gradient. Water-level data collected from the monitoring well network support the development of shallow and deep potentiometric surface maps (SPF 2019b).

The shallow surface can be considered representative of the regional aquifer system. The deep potentiometric surface is based on water-level data from deep wells only located near the deposit, and appears to be a function of high vertical gradient related to silicification, faulting, and steeply dipping beds. The groundwater conceptual model
is based on a single aquifer system that is supported by geology, water quality, potentiometric surface, and water-level data (SPF 2019b).

4.2.2.1. Shallow Potentiometric Surface

A groundwater elevation (potentiometric surface) contour map has been developed using the 2017 average water-level data from the shallow monitoring wells. This map is included as Figure 5. This map is considered representative of groundwater flow in the Project area. Potentiometric surface maps created using water-level data from 2013 through 2016 are included in the Grassy Mountain Gold Project Groundwater Resources Baseline Data Report (SPF 2019a).

Review of the shallow groundwater potentiometric surface maps suggests the following:

- The shallow potentiometric surface has remained relatively constant over the period of monitoring, generally without apparent seasonal influences. The consistent potentiometric surface reflects stable groundwater-level trends measured in individual wells over time.

- Groundwater flow generally occurs from the southeast to the northwest in the vicinity of the Project, from higher elevations along the base of Grassy Mountain (~4,000 feet amsl) to lower elevations along Negro Rock Canyon (~3,200 feet amsl). The groundwater elevations range from approximately 3,700 feet amsl (at well 57-1 southwest of the deposit) to approximately 3,220 feet (at well GW-5 northwest of the deposit).

- Local variations are apparent in the potentiometric surface, attributed to structural and/or spatial contrasts in aquifer permeability and vertical gradients possibly due to silicification. For example, steeper horizontal hydraulic gradients are apparent between wells 57-1 (completed from 108 to 138 feet) and GW-3 (completed from 320 to 350 feet) and between wells 59766 (completed from 25 to 45 feet) and GW-5 (completed from 204 to 224 feet) compared to other areas, likely due to differences in completion depth and resultant vertical gradient.

- Despite the local variations, the shallow well potentiometric surface suggests a single aquifer system. Despite differences in aquifer formation materials and well depths, the groundwater flow to the northwest towards lower elevation follows a relatively consistent pattern.
Figure 5. Shallow potentiometric surface
4.2.2.2. Deep Potentiometric Surface

A deep potentiometric surface was developed from water levels measured from two deep well completions (59762 and GMW17-32) and the average\(^1\) of six vibrating wire piezometers (VWPs) installed at deep and intermediate depths (refer to the Grassy Mountain Gold Project Groundwater Resources Baseline Data Report for additional information). This potentiometric surface suggests the direction of groundwater flow in deeper water-bearing intervals is also toward the northwest in the vicinity of the deposit, from higher elevations along the base of Grassy Mountain to lower elevations along Negro Rock Canyon (Figure 6). These groundwater elevations range from approximately 3,150 feet amsl at the deposit to approximately 3,100 feet at the two monitoring wells just northwest of the deposit.

\[\text{Figure 6. Deep potentiometric surface}\]

\(^1\) Although not a direct measurement of groundwater-level elevation, the average water level from the VWPs is considered to be the best approximation of deep groundwater elevation in the ore body vicinity due to local controls on potentiometric surface.
4.3. Local TSF Geology

4.3.1. Geotechnical Boreholes

A geotechnical field exploration program was conducted between November 30 and December 8, 2017, to support pre-feasibility design of the TSF and mine process facilities (Golder 2018). The program included drilling 12 borings to depths ranging from approximately 40 to 100 ft below the ground surface (bgs) at the TSF. An additional 6 borings were drilled at the TSF between March 20 and 26, 2017. These ranged in depth from 50.4 to 121.4 feet bgs. A map showing the borehole locations is included in Appendix C.

Soils were classified in accordance with the Unified Soil Classification System (UCSC) by Golder geologists. The following description of the subsurface conditions is taken from Golder 2018:

- **Topsoil**: Topsoil was estimated to have an average thickness of ½ foot across a majority of the site. Topsoil was generally comprised of dark brown, silty- to clayey-sands with non-plastic to low plastic fines.
- **Quaternary deposits**: These deposits include unconsolidated sediments deposited by water (alluvium) and accumulated material on exposed slopes (colluvium). These units are estimated to be Quaternary-age deposits based on Ferns et al, 1993. These materials were encountered across the site and consisted of sands, gravels, clays, and silts with thicknesses ranging from about 2 to 25 feet bgs. Generally, the upper portion of the deposit was classified as fine-grained soils described as lean and fat clay with varying amounts of sand and gravel and were underlain by coarse-grained soils described as clayey- to silty-sand, clayey- to silty-gravel, and poorly- to well-graded sand and gravel.
- **Lacustrine deposits**: Lacustrine deposits were encountered across a majority of the site and are primarily classified as lean to high plasticity clay with varying sand content. These deposits were not identified by Ferns et al, 1993. However, based on similar units in the region, these units are estimated to be Miocene-age deposits.
- **Alluvium and beach deposits**: Discontinuous alluvium and beach deposits were observed within the lacustrine clay deposits generally consisting of poorly-graded sand and silty sand. Due to the location of these deposits within the lacustrine clays, these deposits were estimated to be Miocene-age deposits.
- **Arkosic sandstone**: Part of the Grassy Mountain Formation generally consisting of fine- to coarse grained sands and are mapped as mid-Miocene in age (Ferns et al, 1993).
- **Basalt**: Upper Miocene olivine basalt flows observed in the hills east of the project area (Ferns et al, 1993).

Water was not noted in any of the boreholes. The soils were generally described as being moist, suggesting potential saturation.
4.3.2. Cross-Sections

Using the bore logs and UCSC classification developed by Golder, lithologic cross-sections were created through the TSF to describe subsurface stratigraphy. The bore logs used to create the lithologic cross-sections are included in Appendix D. The cross-sections are included in Appendix E. The cross-sections are labelled with the UCSC classification by Golder, while the color scheme reflects a more generalized classification as clay, gravel, sand, or silt (as interpreted by SPF Water Engineering). A map showing the location of the cross-sections in included as Figure 7.

The cross-sections generally show interbedded layers of clay and sand. At the north end of the TSF near the reclaim pond, there appears to be a clay layer 10 to 20 feet thick at the surface (below a thin layer of topsoil). Below this is a relatively thin layer of clayey sand (approximately 5 to 10 feet thick), underlain by a relatively thick clay zone at least 40 feet thick. Below this clay layer is another clayey sand zone that appears to be about 30 feet thick, underlain by a thin clay zone and then another layer of silty sand.

Moving southeast from the reclaim pond, the upper clay and sand zones appear to thicken, and may dip upwards with topography. South of the reclaim pond, a sand zone caps the upper clay layer observed near the reclaim pond. Through the center of the TSF, there is a surface layer of clayey to silty sand, 10 to 25 feet thick, underlain by a clay zone 25 to 40 feet thick. On the northwest side of the TSF, this clay zone is on the thinner end of that thickness range, and a sand zone is apparent below the clay. These layers appear to generally follow surface topography.
Figure 7. Lithologic cross-section map
4.3.3. Field Permeability

Field permeability (falling head) tests were also performed at six boreholes to estimate the hydraulic conductivity of subsurface soils (Golder 2018). Results are summarized on Table 1. The hydraulic conductivity values of the shallow alluvial sands are on the low end for sands, representative of silt and silty sand (Freeze and Cherry 1979).

Table 1. Estimated hydraulic conductivity (Golder 2018)

<table>
<thead>
<tr>
<th>Borehole ID</th>
<th>Test Interval (feet bgs)</th>
<th>Material Description (UCSC Classification)</th>
<th>Estimated Hydraulic Conductivity (cm/s)</th>
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<tr>
<td>BH-2</td>
<td>20 to 25</td>
<td>Poorly Graded Sand (Beach Deposits)</td>
<td>$1.1 \times 10^{-6}$</td>
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<tr>
<td>BH-3</td>
<td>2 to 4</td>
<td>Poorly Graded Sand (Overburden)</td>
<td>$8.1 \times 10^{-6}$</td>
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<td>BH-5</td>
<td>10 to 15</td>
<td>Poorly Graded Sand (Overburden)</td>
<td>$4.6 \times 10^{-6}$</td>
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<td>BH-6</td>
<td>22.8 to 24.8</td>
<td>Fat Clay (Lacustrine)</td>
<td>$1.2 \times 10^{-7}$</td>
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<td>BH-7</td>
<td>14.45 to 19.45</td>
<td>Poorly Graded Sand with Clay and Gravel (Overburden)</td>
<td>$3.5 \times 10^{-6}$</td>
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<tr>
<td>BH-9</td>
<td>3.6 to 8.6</td>
<td>Poorly Graded Sand (Overburden)</td>
<td>$5.4 \times 10^{-5}$</td>
</tr>
</tbody>
</table>

4.3.4. Monitoring Wells

In addition to the geotechnical boreholes, there are existing monitoring wells located in the near vicinity of the TSF that provide information on local hydrogeology. These monitoring wells are shown on Figure 8. Driller’s reports are included in Appendix F.

The BLM well is located within the footprint of the TSF. The well is located at an elevation of approximately 3,580 feet. This well was constructed to a total depth of 175 feet. The well log describes clay to a depth of 170 feet and white sand between a depth of 170 and 175 feet. Groundwater was encountered at a depth of 165 feet. The well is reportedly screened from a depth of 159 to 166 feet. This log suggests that the lacustrine deposits encountered in the geotechnical bores extend to a depth of at least 170 feet in his area. The static water level in the well has varied between approximately 156 and 157 feet bgs during the baseline monitoring period (March 2013 through September 2018). This is equivalent to a water surface elevation of approximately 3423 to 3424 feet, refer to Figure 9.
Figure 8. Existing monitoring wells map
Well GW-3 is located southeast (up-gradient) of the TSF, at an elevation of approximately 3,630 feet. The driller’s log describes clay to the total depth of 400 feet. These clay deposits are likely part of the same lacustrine deposits encountered in the geotechnical bores. Groundwater was not encountered during drilling. The well is reportedly screened from a depth of 320 to 350 feet. Groundwater was not observed during drilling of the well in 1989. However, groundwater has since entered the well. Between March 2013 and September 2017, the static water level measured in the well varied between approximately 223 and 224 feet bgs, equivalent to a water surface elevation ranging from 3406 to 3407 feet. Between September 2017 and September 2018, the static water level varied between approximately 224 and 228 feet bgs, equivalent to a water surface elevation ranging from about 3402 to 3406 feet. Figure 10 is a plot of groundwater elevation.

Well GW-3A is also located southeast (up-gradient) of the TSF and northeast of GW-3, at an elevation of approximately 3,640 feet. GW-3A was constructed to a total depth of 420 feet, encountering clay with silt and tuff to a depth of 300 feet and clay with silt and sandstone to total depth. The well is reportedly screened from a depth of 360 to 400 feet. Groundwater was not encountered during drilling nor following construction.
Well 59766 is located northwest (down-gradient) of the TSF, at an elevation of approximately 3,457 feet. This well was constructed to a total depth of 76.5 feet. The well log describes layers of siltstone and sandstone to total depth, presumably sediments of the Grassy Mountain Formation. The alluvial and lacustrine deposits identified in the TSF geotechnical bores were not encountered. The well is reportedly screened from a depth of 25 to 45 feet. Groundwater was not observed during drilling of the well in 1993. However, groundwater has since entered the well. Between March 2013 and September 2018, the static water level measured in the well varied between approximately 27 and 30 feet bgs, equivalent to a water surface elevation ranging from 3427 to 3430 feet. Figure 11 is a plot of groundwater elevation.
Well 59765 is also located northwest (down-gradient) of the TSF, about at an elevation of approximately 3,445 feet. This well was constructed to a total depth of 37 feet, with layers of siltstone and sandstone (Grassy Mountain Formation) to total depth. The alluvial and lacustrine deposits identified in the TSF geotechnical bores were not encountered. The well is reportedly screened from a depth of 28 to 36 feet. Groundwater was not observed during drilling of the well in 1993 nor following construction.

4.3.5. Conclusions

The geology near the TSF can be described as shallow alluvial deposits of sand and clay, underlain by lacustrine clay deposits with interbedded alluvial sand zones. The dip of the sediments generally appears to follow surface topography. The shallow sands do not appear to be water-bearing, but may be saturated to some degree. The alluvial sands have a relatively low hydraulic conductivity, on the order of $10^{-6}$ cm/s. Drilling of the BLM well, located in the TSF footprint, indicates that a sand zone at a depth of 170 feet is water-bearing. The BLM well has a static water level of approximately 154 and 155 feet bgs, or a water surface elevation of approximately 3423 to 3424 feet. This water surface elevation is over 100 feet lower in elevation than the bottom of the TSF.
4.4. Local Geology at Collection Pond

4.4.1. Geotechnical Boreholes

The geotechnical field exploration program described in Section 4.3.1 included drilling three (3) borings to depths ranging from 20 to 40 ft bgs at the mine process facilities, including the collection pond. A map from Golder (2018) showing the borehole locations is included in Appendix C. Soils were classified in accordance with the Unified Soil Classification System (UCSC) by Golder geologists.

4.4.2. Cross-Sections

One lithologic cross-section was developed through the process plant and collection pond (Cross Section F in Appendix E and on Figure 7). This section shows a clay layer at the surface, nearly 10 feet thick southwest of the pond, and about 30 feet thick just west of the pond. Below the clay layer is a sand zone at least 10 feet thick.

4.4.3. Field Permeability

None of the boreholes near the collection pond were field tested for permeability. However, testing of other boreholes indicates that the shallow alluvial sands in the area have a relatively low hydraulic conductivity, on the order of $10^{-6}$ cm/s.

4.4.4. Monitoring Wells

There are two monitoring wells constructed about 600 feet east of the collection pond (see Figure 8). These wells are not up-gradient or down-gradient of the pond but provide information on local hydrogeology. Driller’s reports are included in Appendix F.

Well 59762 is located at an elevation of approximately 3,723 feet. This well was constructed to a total depth of 700 feet. The well log describes surface alluvium and then layers of siltstone and sandstone to a depth of 94 feet and clayey siltstone to total depth. The siltstone is described as silicified from a depth of 180 to 355 feet. These sediments are presumably sediments of the Grassy Mountain Formation. The well is reportedly screened from a depth of 537.5 to 657.5 feet.

Groundwater was not observed during drilling of the well in 1993. However, groundwater has since entered the well. Between March 2013 and September 2018, the static water level measured in the well varied between approximately 617 and 619 feet bgs, equivalent to a water surface elevation ranging from 3103 to 3105 feet. Figure 12 is a plot of groundwater elevation.

Well GMW17-31 is located at an elevation of approximately 3,720 feet. This well was constructed to a total depth of 520 feet in August 2017. The well bore log describes layers of sandstone, arkose, sinter, siltstone, tuff, and clay to the completion depth. Traces of silicified siltstone were observed as shallow as 41 feet and were encountered sporadically throughout the rest of the lithology. No water was encountered during the drilling. The well was screened from a depth of 458 to 498 feet.
A groundwater static water level has been measured in the well since March 2018, at a depth of approximately 497.6 feet bgs, equivalent to a water surface elevation of about 3,222.6 feet.

Figure 12. 59762 groundwater elevation

4.4.5. Conclusions

The geology near the collection pond can be described as shallow Quaternary-age alluvial deposits of sand and clay, underlain by Miocene-age lacustrine clay deposits with interbedded alluvial sand zones. Below the alluvial and lacustrine deposits are layers of siltstone, sandstone, and clayey siltstone of various degrees of silicification, to a depth of at least 700 feet. The Grassy Mountain Formation in this area has limited water-bearing potential, with an estimated hydraulic conductivity of $10^{-6}$ to $10^{-7}$ cm/s (SPF 2019b). The static water level in the near vicinity of the collection pond appears to be 500 to 600 feet bgs, or an elevation of between 3,100 and 3,200 ft asl. The water surface elevation is at least 475 feet below the bottom of the pond, although it is possible that saturated, non-water-bearing materials are present at shallower depths.
5. PROPOSED MONITORING WELLS

5.1. Introduction

New monitoring wells are proposed down-gradient of the TSF to detect contamination of any potentially affected aquifers resulting from this facility. The wells will also serve to detect contamination resulting from the TSF reclaim pond and the waste rock storage facility.

Wells are also proposed down-gradient of the process plant collection pond. The down-gradient well will be used to detect contamination of any potentially affected aquifers resulting from the collection pond.

A new deep up-gradient monitoring well is proposed to serve as a background water-quality monitoring point for the entire Project, including the TSF and the collection pond. This well will target the regional deep aquifer system; existing up-gradient wells will be used to monitor the regional shallow aquifer system up-gradient of the entire Project.

5.2. Location

The locations of the proposed monitoring wells are shown on Figure 13. There are six (6) proposed wells located down-gradient of the TSF. The six wells are proposed in two clusters, with a four-well cluster located down-gradient of the main north embankment and reclaim pond and a two-well cluster located down-gradient of the secondary west embankment. The wells in each cluster will be installed to target different depths to target potentially separate water-bearing zones.

One well is proposed down-gradient of the collection pond as shown on Figure 13. One well is proposed up-gradient of the entire Project, as shown on Figure 13.

5.3. Design Approach

5.3.1. TSF Wells

Available information on subsurface lithology indicates two (2) relatively shallow sand layers in the vicinity of the reclaim pond (refer to Figure 7 and lithologic cross-sections in Appendix E). One monitoring well (GMW19-2) will target a shallow sand zone, 5 to 10 feet thick, expected to occur at a depth of 20 feet bgs. Another monitoring well (GMW19-1) will target the deeper of the shallow sand zones, anticipated to be about 30 feet thick and found at a depth of 70 feet bgs. These sand zones are expected to be saturated, but with a relatively low hydraulic conductivity. Even though these wells are expected to have very low yields and may not produce adequate groundwater for sample collection, these shallow sand zones are considered to be where any leakage from the TSF or reclaim pond would be detected first. Water-level monitoring would detect the leakage, and this water could potentially be sampled.
Figure 13. Monitoring wells map (proposed and existing)
A third well (GMW19-3) will target the regional shallow aquifer system, expected to occur in a sand layer at a depth of approximately 170 feet bgs. A well completed in this aquifer should produce adequate water for groundwater sampling. Given the extensive clay zones and elevation difference of over 100 feet between the bottom the TSF and the aquifer, it is unlikely that this aquifer could become contaminated by leakage from the TSF. However, a down-gradient well that can be sampled is an important component of the monitoring program.

A fourth well (GMW19-4) will be constructed to target the regional deep aquifer system, expected to occur at a depth of approximately 600 feet bgs. This depth is based on an estimated water surface elevation of about 3,000 feet for the deep aquifer system (refer to Figure 6). Monitoring of the deep aquifer is contemplated even though it is very unlikely that this aquifer could become contaminated by leakage from the TSF. There are extensive confining layers and an elevation difference of over 500 feet between the bottom the TSF and the deep aquifer.

Two other monitoring wells are proposed down-gradient of the secondary west embankment. One of these wells (GMW19-5) will target a shallow sand zone expected to occur from near ground surface to a depth of 25 feet bgs. The other well (GMW19-6) will target a deeper sand zone expected to be encountered at a depth of 50 feet bgs, and estimated to be about 20 feet thick.

These sand layers are expected to be saturated, but appear unlikely to yield appreciable groundwater. However, any leakage from the TSF would be expected to flow into one or both of these sand zones, where it could be detected by water-level monitoring and potentially sampled.

5.3.2. Collection Pond Wells

The subsurface lithology near the process plant collection pond appears to consist of a surface layer of clay, about 10 feet thick southwest of the pond and at least 30 feet thick near the pond (refer to Figure 7 and lithologic cross-sections in Appendix E). This clay layer is underlain by a sand zone at least 10 feet thick southwest of the pond and at least 20 feet thick west of the pond. The down-gradient well GMW19-7 will target this sand layer.

This sand zone is expected to be saturated, but is unlikely to yield appreciable groundwater due to a relatively low hydraulic conductivity. However, any leakage from the collection pond would be expected to flow into this sand zone, where it could be detected by water-level monitoring and potentially sampled to assess contamination. The silicified siltstone and sandstone underlying the surface sediments in the area of the collection pond has a very low hydraulic conductivity and is unlikely to yield adequate groundwater for sampling.
5.3.3. **Up-Gradient Wells**

One new up-gradient well is proposed to serve as background water-quality monitoring points for the entire Project, including the TSF and the collection pond. This well will be located where groundwater quality should not be affected by Project facilities (see Figure 13). The proposed well (GMW19-8) will be constructed to target the regional deep aquifer system, expected to occur at a depth of approximately 560 feet bgs. This depth is based on an estimated water surface elevation of about 3,200 feet for the deep aquifer system (refer to Figure 6). Background water-quality monitoring of the deep aquifer is anticipated even though this aquifer is unlikely to be contaminated by leakage from the TSF or collection pond. The presence of extensive confining layers and the elevation difference between the Project facilities and the deep aquifer should prevent any contamination.

Existing monitoring wells are proposed to serve as up-gradient background water-quality monitoring points for the entire Project. Additional information on these wells is provided in Section 6.4.

5.3.4. **Summary**

Monitoring well location, elevation, proposed depth, and proposed screen length are summarized in Table 2.

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Northing (UTM NAD83 Zone 11, Meters)</th>
<th>Easting (UTM NAD83 Zone 11, Meters)</th>
<th>Elevation (ft, amsl)</th>
<th>Proposed Depth (ft)</th>
<th>Proposed Screen Length (ft)</th>
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</thead>
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<td>GMW19-1</td>
<td>down-gradient TSF</td>
<td>4,836,335.9</td>
<td>470,678.6</td>
<td>3,540</td>
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<td>10</td>
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<tr>
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<td>50</td>
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<tr>
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<td>3,756</td>
<td>600</td>
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</table>
5.4. Conceptual Design

The proposed monitoring wells will be constructed with nominal 5-inch diameter PVC casing and screen. The well casing diameter will be adequate to allow for the installation of a 4-inch submersible pump for groundwater sampling.

Monitoring well construction will comply with State of Oregon monitoring well construction standards (Oregon Administrative Rules Chapter 260, Division 240, dated July 1, 2015). The contractor selected to construct the monitoring wells will have an Oregon Monitoring Well Constructor’s License. The contractor shall provide notice to the Oregon Water Resources Department (OWRD) using a start card.

Specific well construction details include:

- Monitoring wells will be constructed with a borehole diameter at least 4 inches larger than the nominal casing and screen diameter.
- Monitoring well casing and screen will be PVC, which is non-reactive with groundwater. PVC casing shall be spline-locking design, conforming to ASTM F-480. The casing shall be Schedule 40 for well depths of less than 100 feet and Schedule 80 for well depths of more than 100 feet.
- Casing diameter will be adequate to accommodate a 4-inch submersible pump for well testing and sampling.
- Screen slot size will be selected to be compatible with the filter pack grain size. Length of screen will depend on water-bearing formations encountered. Based on other monitoring wells in the area, it is anticipated that 0.020-inch slot screen will be used with No. 10-20 Colorado silica sand. Screen and filter pack size will be verified after drilling and examination of the drill cuttings.
- Centralizers will be installed to center well casing and screen in the borehole. Centralizers will be installed at the top and bottom of the screened interval and opposite the well casing every 20 to 50 feet depending upon total well depth.
- Filter pack (Colorado silica sand or equal) will be placed around the PVC screen. The filter pack will be clean, chemically inert, and well-rounded. The filter pack shall extend not more than 3 feet above the top of the screen and 1 foot below the bottom of the screen. Filter pack will be installed with a tremie pipe for uniform placement and to prevent bridging.
- Above the filter pack, at least 2 feet of fine-grained clean sand and/or at least 3 feet of hydrated granular bentonite will be placed to serve as a filter pack seal.
- An annular seal will be placed above the filter pack seal to ground surface, installed from the bottom through a grout (tremie) pipe. The seal material will be cement-bentonite grout, mixed at no more than 3.75 pounds of bentonite per 94-lb sack of cement (up to 5% bentonite by dry weight) with up to 7.8 gallons of water (5.2 gallons of water per 94-lb sack of cement plus 0.7 gallons of water per pound of bentonite). The water and bentonite will be mixed first, then the cement added to the slurry. The cement-bentonite grout will be weighed using ASTM Test Method.
D-4380-84, and this weight must be within 10% of the specified 14.1 pounds per gallon before placing the grout.

- The annular seal will be placed in maximum 200-foot lifts to avoid excessive external pressure on well casing.
- The well seal shall be allowed to cure for 24 hours prior to well development.
- The top of the well casing will extend at least 18 inches above ground surface and be fitted with a vented, removable sanitary well cap.
- A protective steel shelter (12-inch mild steel casing, standard wall thickness) will be installed over the top of the PVC well casing. The steel shelter will include a locking cap or lid. The protective surface casing shall extend 6 inches above the top of the well casing and at least 3 feet into the ground.
- A well identification label with the start card number will be permanently attached to the surface casing in a visible location.
- A reinforced concrete pad (3 feet square, 4 inches thick) will be poured around the well head shelter. Three protective bollards will be placed around the well shelter. Each bollard shall be a metal post with a minimum diameter of 3 inches, set in and filled with concrete, and extending at least 3 feet above and 3 feet below ground surface. The bollards will be arranged in a triangular pattern, at least 2 feet from the surface casing.
- The monitoring well locations and elevations will be professionally surveyed soon after completion.

A conceptual monitoring well diagram is included in Appendix G.

5.5. Drilling Approach and Observations

The monitoring wells will be drilled by the air-rotary method, without temporary casing, if the borehole is stable. If the borehole is unstable then the well could be drilled either by the air-rotary method with temporary casing to maintain hole stability or by the mud-rotary method. If mud-rotary drilling is used, then geophysical logging will be used to identify sand zones.

Drill cuttings will be disposed of on patented land (private property). The expected source of water for drilling will be the existing on-site production wells PW-1, Prod-1, and PW-4.

The deepest well down-gradient of the TSF (GMW19-4) will be drilled first to gather information on subsurface lithology prior to drilling the other down-gradient wells.

During well drilling, a geologist will collect and evaluate drill cuttings for geologic interpretation. Formation samples will be collected at 5-foot intervals and at each significant change in lithology. Well driller observations and an examination of cuttings will be used to characterize the lithology, identify screen size and placement, and select filter pack. If the wells are drilled by mud-rotary, geophysical logging will be used to verify screen placement.
During air-rotary drilling, the presence of water can be detected when groundwater is encountered during drilling. All water-bearing zones encountered by the borehole will be noted by the supervising geologist. A rough estimate of water produced can be made by measuring the discharge of water during drilling.

5.6. Development

Following well completion, each well will initially be developed by air-lifting to remove drill water and fines, stabilize and settle the filter pack, and maximize well efficiency and capacity. Following air-lifting, any well that produces appreciable groundwater will be further developed with a test pump to document well capacity and production. Each well will be developed until the water produced is clear and free from sediment.

5.7. Monitoring Well Driller and Equipment

The selected well driller will have an Oregon Monitoring Well Constructor’s License or work under the supervision of a licensed Monitoring Well Constructor. The selected well driller will have at least 5 years of experience drilling monitoring wells. All wells will be constructed under a bond. The well driller shall notify the Oregon Water Resources Department (OWRD) with a start card prior to starting well construction. The well driller will prepare and sign a monitoring well report for each monitoring well and submit to the OWRD within 30 days of well completion.

6. EXISTING MONITORING WELLS

6.1. Introduction

There are existing wells in the vicinity of the TSF and collection pond (Figure 8). Some of these wells are recommended to be used as additional down-gradient monitoring points to detect groundwater contamination. There are also existing wells located up-gradient of the Project facilities that are proposed to be used for background monitoring of the regional shallow aquifer system. The wells near the proposed facilities are described below, along with a recommendation for future use. The existing wells proposed for future monitoring are shown on Figure 13. Driller's reports are included in Appendix F.

6.2. TSF Wells

6.2.1. BLM Well

There has been baseline groundwater data (seven quarterly events) collected from the BLM well. The BLM well is located in the footprint of the TSF, and will be abandoned in accordance with State standards prior to construction of the TSF. Therefore, while it cannot be used as a future monitoring well, the quarterly data already collected does provide background water quality data in the near vicinity of the TSF.
6.2.2. 59766

Well 59766 is located about 1,800 feet down-gradient of the TSF, at an elevation of approximately 3,457 feet. This well has a total depth of 76.5 feet, and a screened interval of 25 to 45 feet bgs. This well is completed in the Grassy Mountain Formation siltstone and sandstone.

The top and bottom of the screen are at elevations of 3,432 and 3,412 feet amsl, or over 100 feet below the bottom of the TSF. Given the distance and difference in elevation, well 59766 is not considered an ideal down-gradient monitoring location. However, it is still recommended that this well serve as a long-distance monitoring location. This well was included in the groundwater baseline monitoring program, with water-quality data collected during seven (7) different quarters in 2013 and 2014 (SPF 2019a). This well is equipped with a dedicated submersible pump for water-quality sampling.

6.2.3. GW-5

Well GW-5 is located about 3,000 feet down-gradient of the TSF, at an elevation of about 3,411 feet amsl. This well was drilled to a total depth of 265 feet, with tuff and clay reported on the bore log. The well was constructed with 2-inch Schedule 40 and 80 PVC casing and Schedule 80 PVC screen, screened from a depth of 203.5 feet to 223.5 feet (elevation of 3,207.5 feet amsl and 3,187.5 feet amsl respectively). The top of the screened interval is over 300 feet below the bottom of the TSF. The main water-bearing zone is reportedly between a depth of 220 and 265 feet bgs. The bore log and well as-built schematic is included in Appendix F.

A groundwater static water level has been measured in the well since September 2014, at a consistent depth of approximately 190 feet bgs, equivalent to a water surface elevation of about 3,221 feet. This water surface elevation is over 300 feet deeper that the bottom of the TSF.

GW-5 was reportedly sampled for water quality in the early 1990s (JMM 1991), but there is no evidence of more recent sampling. GW-5 was not included in the baseline water-quality monitoring well network.

It is recommended that GW-5 serve as a down-gradient monitoring well because of its location and because it apparently can yield adequate groundwater for sample collection. However, given its distance from the TSF, the difference in elevation, and differences on geology, the currently proposed new wells are also needed to provide better monitoring locations. GW-5 will need to be equipped with a 2-inch dedicated submersible pump for sampling.

6.3. Collection Pond Wells

6.3.1. 59762

Well 59762 is located about 600 feet east of the collection pond. This well was constructed to a total depth of 700 feet, in silicified and non-silicified siltstone and
sandstone. The well is screened from a depth of 537.5 to 657.5 feet. The groundwater elevation in the well has varied from 3,103 to 3,105 feet amsl, over 500 feet below the bottom of the collection pond. Testing of this well in 2017 indicated a well yield of less than 1 gpm (SPF 2019b). Given the difference in elevation between the static water level in this well and the collection pond and the poor well yield, the usefulness of this well for detecting groundwater contamination from the pond is limited. It is recommended that this well not be included in the collection pond monitoring well network.

6.3.2. GMW17-31

Well GMW17-31 is located near 59762, about 600 feet east of the collection pond. This well was constructed to a total depth of 520 feet and screened from a depth of 458 to 498 feet bgs in silicified and non-silicified siltstone and claystone and tuff. No water was encountered during the drilling, but the well has a current groundwater elevation of about 3,222.6 feet amsl. This well does not have enough water to test and therefore should not be included in the collection pond monitoring well network.

6.4. Up-Gradient Wells

6.4.1. 59760

Well 59760 is proposed to serve as an up-gradient background monitoring well (Figure 13). This well is located about 1,000 feet up-gradient of the proposed mine, at an elevation of approximately 3,755 feet. This well has a total depth of 205 feet, and a screened interval of 163 to 203 feet bgs. This well is completed in the regional shallow aquifer system, found locally in the Grassy Mountain Basalt (Abrams 2018). Between March 2013 and September 2018, the static water level measured in the well varied between approximately 85 and 87 feet bgs, equivalent to a water surface elevation ranging from 3,672 to 3,674 feet (see Figure 14).

Well 59760 was included in the groundwater baseline monitoring program, with water-quality data collected during seven (7) different quarters in 2013 and 2014 (SPF 2019a). This well is equipped with a dedicated submersible pump for water-quality sampling.

It is recommended that well 59760 serve as an up-gradient monitoring well because of its location, adequate yield to support groundwater sampling, and sampling history.

6.4.2. 59761

Well 59761 is also located about 1,000 feet up-gradient of the proposed mine, near well 59760 (Figure 13). This well is proposed to serve as another up-gradient background monitoring well. This well has a total depth of 120 feet, and a screened interval of 97 to 117 feet bgs. This well is completed in the regional shallow aquifer system that occurs locally in the Grassy Mountain Basalt. The well’s static water level varied between approximately 85 and 87 feet bgs between March 2013 and September 2018, equivalent to a water surface elevation ranging from 3,672 to 3,674 feet (see Figure 14).
Well 59761 was also included in the groundwater baseline monitoring program, with seven (7) different quarters of water-quality data collected in 2013 and 2014 (SPF 2019a). This well is equipped with a dedicated submersible pump for water-quality sampling. Well 59761 is proposed to serve as an up-gradient monitoring well.

6.4.3. 59772

Well 59772 is also located near wells 59760 and 59761, up-gradient of the proposed mine (Figure 13). This well has a total depth of 207 feet, and a screened interval of 146 to 206 feet bgs. This well also targets the shallow aquifer system. The static water level measured in the well varied between approximately 91 and 93 feet bgs between March 2013 and September 2018, equivalent to a water surface elevation ranging from 3,672 to 3,674 feet (see Figure 14).

Well 59772 was also included in the groundwater baseline monitoring program, with seven (7) quarters of water-quality data. This well is equipped with a dedicated submersible pump. It is recommended that well 59772 serve as an up-gradient monitoring well.

![Figure 14. 59760, 59761, and 59772 groundwater elevations](image-url)
6.4.4. PW-1

Well PW-1 is proposed to serve as an up-gradient background monitoring well (Figure 13). This well is located about 800 feet up-gradient of the proposed collection pond, at an elevation of approximately 3,702 feet. This well has a total depth of 555 feet, and a screened interval of 320 to 340 feet and 400 to 420 feet bgs. This well is completed in the regional shallow aquifer system, found locally in sediments of the Grassy Mountain Formation (Abrams 2018). Between March 2013 and September 2018, the static water level measured in the well varied between approximately 51 and 60 feet bgs, equivalent to a water surface elevation ranging from 3,655 to 3,646 feet (see Figure 14). The lower static water level observed between September 2016 and March 2018 was due to the well being used for drill water supply. The recent “normal” water surface elevation in the well is at an elevation of approximately 3,655 feet.

Well PW-1 was included in the groundwater baseline monitoring program, with water-quality data collected during seven (7) different quarters in 2013 and 2014 (SPF 2019a). This well is equipped with a submersible pump that can be used for water-quality sampling.

It is recommended that well PW-1 serve as an up-gradient monitoring well because of its location, adequate yield to support groundwater sampling, and sampling history.

6.4.5. GW-1

Well GW-1 is also proposed to serve as an up-gradient background monitoring well (Figure 13). This well is located near PW-1, about 850 feet up-gradient of the proposed collection pond, at an elevation of approximately 3,703 feet. This well has a total depth of 160 feet, and a screened interval of 135.5 to 155.5 feet bgs. This well is completed in the regional shallow aquifer system, found locally in sediments of the Grassy Mountain Formation (Abrams 2018). Between March 2013 and September 2018, the static water level measured in the well varied between approximately 51 and 55 feet bgs, equivalent to a water surface elevation ranging from 3,654 to 3,650 feet (see Figure 14). The lower static water level observed between September 2016 and March 2018 was due to pumping interference from PW-1. The recent “normal” water surface elevation in the well is at an elevation of approximately 3,654 feet.

Well GW-1 was included in the groundwater baseline monitoring program, with water-quality data collected during seven (7) different quarters in 2013 and 2014 (SPF 2019a). This well is equipped with a dedicated submersible pump used for water-quality sampling. Well GW-1 is recommended to be used as an up-gradient monitoring well.
7. GROUNDWATER MONITORING

7.1. Water-Level Monitoring

At each of the monitoring wells, the static water level will be manually measured and recorded prior to pumping (if sampled) using a non-stretch electric-line well sounder. To ensure consistency of water-level measurements, measurement points will be clearly identified on both the sampling form and physically on the well casing. For any dry wells, the sounder will be lowered to the bottom of the well. The deep well down-gradient of the TSF (GMW19-3) that will be constructed to target the regional shallow aquifer system will be equipped with a water-level transducer to continuously monitor and record water-level data.

Any wells that are in close proximity to each other (i.e. less than 500 feet) will all be measured for static water level prior to pumping any of the wells to eliminate any interference effects from pumping.
7.2. Water-Quality Sampling Approach

7.2.1. Dedicated Pumps and Sampling Manifold

Dedicated submersible pumps and water-level sounding tubes will be installed in each monitoring well that produces adequate water for sampling (at least 1 gpm). Dedicated pumps will eliminate the potential for cross contamination of water-quality samples. Pumps will be selected based on available well capacity as determined through development pumping. For any wells that are initially dry but eventually produce at least 1 gpm, temporary sampling pumps may be used until it can be confirmed that the wells are reliable producers and dedicated pumps are warranted.

Water-quality samples will be collected using a sampling manifold constructed of PVC and stainless steel. The manifold will allow for non-filtered sample collection, field-filtered samples for metals, and continuous monitoring of field water-quality parameters.

The existing wells PW-1, GW-1, 59766, 59760, 59761, 59772, and GW-5 are recommended for inclusion in the groundwater-quality sampling program. All of these wells except for GW-5 are already equipped with sampling pumps. Well GW-5 will need to be equipped with a pump.

7.2.2. Purge Pumping

All of the monitoring wells will be purged a minimum of three (3) casing volumes of water prior to sampling; purging is a standard practice to remove stagnant water prior to ground water sample collection. Purge water will be discharged to waste at the well site. During purge pumping, the pumping rate will be measured using a five-gallon bucket and stopwatch and recorded on the field data collection form. The appearance and odor of the purged water will be noted.

During purge pumping, field water-quality parameters (pH, temperature, electrical conductivity, specific conductance, and dissolved oxygen) will be continuously monitored. These field parameters will be monitored continuously during purging to ensure parameters are stable prior to sampling, indicating that the well is producing stable groundwater representative of the aquifer.

Field parameters are considered stable when consecutive measurements taken 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 (ODEQ 2009). At least three measurements of field water-quality data will be measured and recorded on the data collection form. The field equipment will be calibrated according to manufacturer recommendations each day of sampling. Personnel performing equipment calibration will be adequately trained. Results of calibration will be recorded on calibration forms.
7.2.3. **Water-Quality Sampling**

Where applicable, sampling procedures will follow the ODEQ Field Sampling Reference Guide (ODEQ 2010) and the ODEQ Water Monitoring and Assessment Mode of Operations Manual (ODEQ 2009).

Water-quality samples will be collected after purging at least three (3) casing volumes from the well and after field water-quality parameters have stabilized. For dissolved samples, samples will be filtered in the field using a disposable high-capacity field filter with 0.45 µm membrane.

Samples will be collected in bottles supplied by the laboratory with the appropriate preservative as required by the testing method. Samples will be collected by field personnel wearing nitrile gloves discarded after each use. Following collection, sample bottles will be properly labeled and immediately packed in a cooler with ice packs. Samples will be mailed to the laboratory with proper chain-of-custody documentation and procedures. This laboratory will be accredited by NELAP (National Environmental Laboratory Accreditation Program) for water analysis. Analytical methods will meet ODEQ reporting and detection limits.

7.2.4. **Quality Assurance / Quality Control**

Quality assurance and quality control (QA/QC) protocols will be implemented as described in the ODEQ Water Monitoring and Assessment Mode of Operations Manual (ODEQ 2009) and the ODEQ Quality Manual (ODEQ 2011). Specific QA/QC methods could include collection of equipment blanks, transfer blanks, and duplicate samples. The laboratory will perform internal QA/QC procedures, with results provided with the analytical results as a Level 2 analytical report. The Level 2 analytical report also typically includes a case narrative, analytical results, data qualifiers, sample receipt checklist, and chain of custody forms.

7.3. **Water-Quality Analytes**

Water-quality samples will be collected from all new monitoring wells that produce appreciable water. The proposed water-quality analytes are the same analytes that were sampled for during the groundwater baseline monitoring (SPF 2019a). The analytes include primarily metals (total and dissolved) and general geochemical parameters. A list of proposed analytes along with the laboratory testing method, the laboratory detection limit, and the reporting limit (five times the detection limit) are summarized in Table 3.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Laboratory Method of Analyses</th>
<th>Detection Limit</th>
<th>Reporting Limit</th>
<th>Sample Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum, Al</td>
<td>EPA 200.7</td>
<td>0.03 mg/L</td>
<td>0.15 mg/L</td>
<td>total and dissolved</td>
</tr>
<tr>
<td>Total Arsenic</td>
<td>EPA 200.8</td>
<td>0.0002 mg/L</td>
<td>0.001 mg/L</td>
<td>total and dissolved</td>
</tr>
<tr>
<td>Barium, Ba</td>
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<td>0.003 mg/L</td>
<td>0.015 mg/L</td>
<td>total and dissolved</td>
</tr>
<tr>
<td>Cadmium Low</td>
<td>EPA 200.8</td>
<td>0.0001 mg/L</td>
<td>0.0005 mg/L</td>
<td>total and dissolved</td>
</tr>
<tr>
<td>Calcium, Ca</td>
<td>EPA 200.7</td>
<td>0.2 mg/L</td>
<td>1 mg/L</td>
<td>total and dissolved</td>
</tr>
<tr>
<td>Chromium Low</td>
<td>EPA 200.8</td>
<td>0.0005 mg/L</td>
<td>0.002 mg/L</td>
<td>total and dissolved</td>
</tr>
<tr>
<td>Copper Low</td>
<td>EPA 200.8</td>
<td>0.0005 mg/L</td>
<td>0.0025 mg/L</td>
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<tr>
<td>Iron, Fe</td>
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<td>0.05 mg/L</td>
<td>total and dissolved</td>
</tr>
<tr>
<td>Lead Low</td>
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<td>0.0001 mg/L</td>
<td>0.0005 mg/L</td>
<td>total and dissolved</td>
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<tr>
<td>Magnesium, Mg</td>
<td>EPA 200.7</td>
<td>0.2 mg/L</td>
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</tr>
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<tr>
<td>Mercury, Hg (Low Level)</td>
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<td>0.5 ng/L</td>
<td>total and dissolved</td>
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<tr>
<td>Nickel Low</td>
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<td>0.003 mg/L</td>
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<td>Potassium, K</td>
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<tr>
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</tr>
<tr>
<td>Silver Low</td>
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<td>Bismuth</td>
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<td>Boron</td>
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<td>0.001 mg/L</td>
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</tr>
<tr>
<td>Cobalt</td>
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<tr>
<td>Gallium</td>
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<td>Lithium</td>
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<tr>
<td>Molybdenum</td>
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<td>total and dissolved</td>
</tr>
<tr>
<td>Scandium</td>
<td>EPA 200.7</td>
<td>0.1 mg/L</td>
<td>0.5 mg/L</td>
<td>total and dissolved</td>
</tr>
<tr>
<td>Strontium</td>
<td>EPA 200.7</td>
<td>0.01 mg/L</td>
<td>0.05 mg/L</td>
<td>total and dissolved</td>
</tr>
<tr>
<td>Tin</td>
<td>EPA 200.8</td>
<td>0.0004 mg/L</td>
<td>0.002 mg/L</td>
<td>total and dissolved</td>
</tr>
<tr>
<td>Titanium</td>
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<td>0.005 mg/L</td>
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<tr>
<td>Vanadium</td>
<td>EPA 200.8</td>
<td>0.0002 mg/L</td>
<td>0.001 mg/L</td>
<td>total and dissolved</td>
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<tr>
<td>Uranium</td>
<td>EPA 200.8</td>
<td>0.0001 mg/L</td>
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<td>Nitrate+Nitrite (as N)</td>
<td>EPA 353.2</td>
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<tr>
<td>Ammonia Direct (as N)</td>
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<td>SM 2320B</td>
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<td>total</td>
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<tr>
<td>Bicarbonate</td>
<td>SM 2320</td>
<td>2 mg/L</td>
<td>20 mg/L</td>
<td>total</td>
</tr>
<tr>
<td>Carbonate</td>
<td>SM 2320</td>
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<td>20 mg/L</td>
<td>total</td>
</tr>
<tr>
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</tr>
<tr>
<td>Conductivity</td>
<td>SM 2510B</td>
<td>1 umhos/cm</td>
<td>10 umhos/cm</td>
<td>total</td>
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<td>Cyanide, Total</td>
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<td>SM 4500</td>
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<td>Fluoride, F</td>
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<td>0.1 C</td>
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<tr>
<td>Sulfate, SO4</td>
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<tr>
<td>Total Dissolved Solids</td>
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<td>Total Suspended Solids</td>
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<td>Total Phosphorus</td>
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<td>0.01 mg/L</td>
<td>0.05 mg/L</td>
<td>total</td>
</tr>
</tbody>
</table>
7.4. Monitoring Frequency and Duration

The proposed water level and water-quality sampling will be conducted on a quarterly basis, with the first event conducted shortly after well construction and development. Background monitoring will occur at all new wells and at GW-5 for at least a year prior to any facility use to develop a reliable background water-quality signature. For the existing wells PW-1, GW-1, 59766, 59760, 59761, and 59772, seven (7) quarters of baseline groundwater-quality data have already been collected. This data is considered adequate to describe background water quality at these locations. For existing well GW-5, there are no recent water-quality data so this well will be monitored at the same frequency as the new wells.

Monitoring at all wells identified in this proposal (proposed and existing) will occur throughout operation of the mine. Monitoring will also be conducted after the mining operation as ceased, for a period of time determined by the permitting entity.

8. WATER-QUALITY DATA ANALYSIS

8.1. Water-Quality Standards

The permit-specific concentration limit is defined as the maximum acceptable concentration of a contaminant allowed in groundwater at a compliance point (down-gradient well). For new permitted facilities, the concentration limits are the background water quality (OAR 340-040). Water-quality sampling from the monitoring well network prior to mining activity will be used to establish background water quality.

8.2. Data Analysis Procedure

Background water-quality sampling results will be analyzed to develop the permit-specific concentration limit. Enough samples will be collected to conduct statistical analysis of the data points, including mean, median, and standard deviation. Sampling will adequately describe natural variability and establish reliable thresholds to determine if groundwater contamination is occurring.

A statistically significant increase in a water-quality parameter above the background concentration could indicate that the groundwater is being affected by leakage from the TSF, waste rock storage facility, or collection pond.

As with water-quality data, groundwater-level data will be recorded and analyzed statistically (mean, median, and standard deviation). The data will be plotted to identify trends and changes.
9. REPORTING REQUIREMENTS

9.1. Well Completion Reports

Following construction and testing of the new monitoring wells, a report will be prepared
describing well drilling, construction, development, static groundwater level, and initial
water-quality results. The reports will be transmitted to ODEQ for review and comment.

9.2. Scheduled Reporting

Following each monitoring event, water-quality data will be reported to ODEQ, in a
format acceptable to the agency. The transmittal will include all data collected to date,
with updated statistics including mean, median, and standard deviation. Background
water-quality sampling prior to mining will be used to establish and recommend the
maximum acceptable concentration of a contaminant allowed in groundwater at a
monitoring well. Any sampling results collected during or after mining activity that
significantly exceed the permit-specific concentration limit will be noted. Any significant
changes in up-gradient water quality will also be identified. Data will be transmitted to
ODEQ as soon as practical after receiving the analytical results from the laboratory.

Water-level data with statistical summaries will also be reported to ODEQ following each
monitoring event. Updated plots of all water-level data will be included in the transmittal.
Any statistically significant changes in water levels will be noted. Any wells that were
previously dry but had measurable groundwater will be noted.

An annual report will be prepared summarizing the water-quality sampling and water-
level monitoring results. The report will describe the wells monitored, the sampling and
water-level measurement approaches, raw data, statistical summaries, data plots and
trends, QA/QC results, and statistically significant changes potentially indicating
groundwater contamination.

10. ACTION REQUIREMENTS

If monitoring indicates a significant increase in one or more water-quality parameters
above the established concentration limit, the monitoring well will be immediately
resampled following receipt and analysis of the water-quality results. If the resampling
results also exceed the concentration limit, the following actions will be taken:

1. ODEQ will be notified of the results within 10 days of receipt of the laboratory
analytical results; and

2. A Preliminary Assessment Plan (PAP) will be prepared within 30 days of receipt of
the laboratory analytical results (unless an alternative schedule is approved by
ODEQ). The PAP will evaluate the source and extent of the identified contaminant,
and predict potential migration of the contaminant. The PAP will also assess what
action, if any, is needed to prevent additional groundwater contamination as required
by ODEQ. A schedule will be presented for implementation of investigative activities.

ODEQ will review the PAP and may require a remedial investigation and/or feasibility study to protect groundwater quality, public health and safety, or the environment. The investigation will characterize the extent and nature of groundwater contamination, and provide information on the need for and selection of one or more remedial actions.

11. LIST OF PREPARERS

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12. REFERENCES


Red Quill Ventures, LLC (RQV), 2015. Calico Resources USA Corp, Grassy Mountain Project, Geology and Soils Baseline Study; February 2015.


Appendix A
Project Site Layout Map
Appendix B
Plant Site General Arrangement Plan
Appendix C
Geotechnical Exploration Location Map
Appendix D
Bore Logs
**RECORD OF BOREHOLE BH-01**

**SOIL PROFILE**

**DEPTH (ft)**

0.0  TOPSOIL

(SP), SAND, Fine to medium sand, yellow brown and tan, trace low plasticity fines, homogeneous; dense, moist; estimated 5% fines, 95% sand (ALLUVIUM/COLLUVIUM)

5.0  CL, LEAN CLAY, Few fine sand, gray-olive to brown, homogeneous; hard, moist; estimated 90% fines, 10% sand (LACUSTRINE)

10.0  CL, LEAN CLAY, Few fine sand, gray-olive to brown, homogeneous; very stiff to hard, moist; estimated 99% fines, 1% sand (LACUSTRINE)

20.0  CH, FAT CLAY, Trace fine sand, blue-gray to brown, homogeneous; very stiff to hard, moist; estimated 99% fines, 1% sand (LACUSTRINE)

**SAMPLING METHODS**

Hollow Stem Auger

**SAMPLING LOCATION**

Grassy Mountain

**SAMPLING COORDINATES**

N: 15,864,952   E: 1,542,787

**SAMPLING DATE**

11-19-22

**SAMPLING NUMBER**

41

**SAMPLING DESCRIPTION**

10: Sample S2: %Fines = 89; %Sand = 11; PI = 25; LL = 46; %MC = 16

**SAMPLING NOTES**

Log continued on next page
**SOCIAL PROFILE**

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>40.0</td>
<td>(CH), FAT CLAY, trace fine sand, blue-gray to brown, homogeneous; hard, moist; estimated 99% fines, 1% sand (LACUSTRINE) (continued)</td>
</tr>
</tbody>
</table>

**SHEETS**

**SOIL PROFILE**

**BOREHOLE RECORD BH-01**

**PROJECT:** Grassy Mountain  
**PROJECT NO.:** 1663241  
**LOCATION:** Vale, Oregon  
**COORDINATES:** N: 15,864.952  E: 1,542.787  
**DATE:** December 6, 2017 15:45  
**TOC ELEV.:** na  
**DATUM:**

**DEEP**

<table>
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<th>BOREHOLE METHOD</th>
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<tr>
<td>40.0</td>
<td>Hollow Stem Auger</td>
<td></td>
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</table>

**LOGGED:** Clay Johnson  
**CHECKED:** Margaret Pryor  
**REVIEWED:** Russ Browne  
**LOG SOFTWARE:** Bentley Golder Associates  
**LOG FILE:** C:\DOCUMENTS\BENTLEY\GINT\GRASSYMOUNTAINBORINGLOGS.GPJ
**Hollow Stem Auger**

(CH), FAT CLAY, trace fine sand, blue-gray to brown, homogeneous; hard, moist; estimated 99% fines, 1% sand (LACUSTRINE) (continued)

Bottom of borehole at 101.5 ft.
### Soil Profile

**Depth (ft)**

- **0.0**
  - Topsoil: Poorly graded sand with gravel, fine to coarse sand, little to coarse subrounded to subangular gravel, trace high plasticity fines, light brown, heterogeneous, iron oxide staining; very dense, moist; estimated 5% fines, 70% sand, 25% gravel (Alluvium/Colluvium)

- **10.0**
  - Clayey sand, tan, friable; very dense, moist; estimated 15% fines, 85% sand (Alluvium/Colluvium)

- **15.0**
  - Fat clay, trace fine sand, tan-gray to pink-brown, homogeneous; very stiff to hard, moist; estimated 99% fines, 1% sand (Lacustrine)

- **25.0**
  - Poorly graded sand, fine to medium sand, trace low plasticity fines, very light gray, homogeneous; very dense, moist; estimated 3% fines, 97% sand (Beach Deposits)

- **31.0**
  - Fat clay, trace fine sand, light pink-brown to light tan, moderately fissured; hard, moist; estimated 99% fines, 1% sand (Lacustrine)

### Additional Information

- **DRILLING CO.**: Haz Tech
- **LOGGED**: Clay Johnson
- **DRILLER**: Jerod Willard
- **CHECKED**: Margaret Pryor
- **REVIEWED**: Russ Browne

---

**Notes**

- **Depth (ft)**
  - **0.0**
  - **5.0**
  - **10.0**
  - **15.0**
  - **20.0**
  - **25.0**
  - **30.0**
  - **35.0**
  - **40.0**

**SOIL PROFILE**

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<td>Topsoil: Poorly graded sand with gravel, fine to coarse sand, little to coarse subrounded to subangular gravel, trace high plasticity fines, light brown, heterogeneous, iron oxide staining; very dense, moist; estimated 5% fines, 70% sand, 25% gravel (Alluvium/Colluvium)</td>
</tr>
<tr>
<td>10.0</td>
<td>Clayey sand, tan, friable; very dense, moist; estimated 15% fines, 85% sand (Alluvium/Colluvium)</td>
</tr>
<tr>
<td>15.0</td>
<td>Fat clay, trace fine sand, tan-gray to pink-brown, homogeneous; very stiff to hard, moist; estimated 99% fines, 1% sand (Lacustrine)</td>
</tr>
<tr>
<td>25.0</td>
<td>Poorly graded sand, fine to medium sand, trace low plasticity fines, very light gray, homogeneous; very dense, moist; estimated 3% fines, 97% sand (Beach Deposits)</td>
</tr>
<tr>
<td>31.0</td>
<td>Fat clay, trace fine sand, light pink-brown to light tan, moderately fissured; hard, moist; estimated 99% fines, 1% sand (Lacustrine)</td>
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**SHEETS: 1 of 2**

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**RECORD OF BOREHOLE BH-02**

**PROJECT**: Grassy Mountain

**PROJECT NO.**: 1663241

**LOCATION**: Vale, Oregon

**COORDINATES**: N: 15,865,924 E: 1,543,510

---

**DRILLING START**: December 6, 2017 08:40

**DRILLING END**: December 6, 2017 09:30

---

**REVIEWED**: Russ Browne

---

**LOGGED**: Clay Johnson

---

**CHECKED**: Margaret Pryor

---

**DRILLER**: Jerod Willard

---

**DRILLING CO.**: Haz Tech
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<th>SAMPLES</th>
<th>BOREING METHOD</th>
<th>ADDITIONAL LAB TESTING</th>
<th>PENETRATION RESISTANCE BLOWS / ft</th>
<th>NOTES</th>
<th>USCS</th>
<th>GRAPHIC LOG</th>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41.5</td>
<td>CH S7</td>
<td>14-24-29 (S3)</td>
<td>Automatic hammer 140 lb, 30 inch drop</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SOIL PROFILESHEET: 2 of 2**

**RECORD OF BOREHOLE BH-02**

**PROJECT:** Grassy Mountain  
**PROJECT NO.:** 1663241  
**LOCATION:** Vale, Oregon

**DRILLING START:** December 6, 2017 08:40  
**DRILLING END:** December 6, 2017 09:30  
**COORDINATES:** N: 15,865,924  E: 1,543,510  
**GS ELEV.:**  
**TOC ELEV.:** na  
**DATUM:**

**RECORD OF BOREHOLE BH-02**

**PROJECT:** Grassy Mountain  
**PROJECT NO.:** 1663241  
**LOCATION:** Vale, Oregon

**DRILLING START:** December 6, 2017 08:40  
**DRILLING END:** December 6, 2017 09:30  
**COORDINATES:** N: 15,865,924  E: 1,543,510  
**GS ELEV.:**  
**TOC ELEV.:** na  
**DATUM:**
**SOIL PROFILE**

0.0

**DESCRIPTION**

TOPSOIL

(SP), POORLY GRADED SAND, fine to medium sand, few fine rounded to subrounded gravel, trace high plasticity fines, light brown, heterogeneous; medium dense, moist; estimated 5% fines, 85% sand; 10% gravel (ALLUVIUM/COLLUVIUM)

8.0

(CH), FAT CLAY WITH SAND, fine to medium sand, dark tan and brown, homogeneous, iron oxide staining; very stiff to hard, moist; estimated 80% fines, 20% sand (LACUSTRINE)

**BLOWS per 6 in**

<table>
<thead>
<tr>
<th>SAMPLE TYPE &amp; NUMBER</th>
<th>WATER CONTENT (%)</th>
<th>PENETRATION RESISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wc</td>
<td>BLOWS / ft</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20 40 60 80</td>
</tr>
<tr>
<td>3-6-10</td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>6-8-11</td>
<td></td>
<td>19</td>
</tr>
<tr>
<td>7-7-15</td>
<td></td>
<td>22</td>
</tr>
<tr>
<td>8-7-10</td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>8-13-16</td>
<td></td>
<td>29</td>
</tr>
</tbody>
</table>

**NOTES**

8: Driller observed a change in material based on drill action

10: Sample S2: %Fines = 78; %Sand = 22; PI = 55; LL = 89; %MC = 29.9

Log continued on next page
**RECORD OF BOREHOLE BH-03**

**PROJECT:** Grassy Mountain  
**PROJECT NO.:** 1663241  
**LOCATION:** Vale, Oregon  
**DRILLING START:** December 5, 2017 08:40  
**DRILLING END:** December 5, 2017 14:30  
**COORDINATES:** N: 15,866,714 E: 1,544,313  
**GS ELEV.:** na  
**TOC ELEV.:** na  
**DATUM:**

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>SOIL PROFILE</th>
<th>BORING METHOD</th>
<th>DESCRIPTION</th>
<th>PENETRATION RESISTANCE BLOWS / ft</th>
<th>WATER CONTENT (%)</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>40.0</td>
<td>(CH), FAT CLAY, trace to few fine to medium sand, dark tan and brown, homogeneous, iron oxide staining; very stiff to hard, moist; estimated 95% fines, 5% sand (LACustrine)</td>
<td>Hollow Stem Auger</td>
<td>7-11-18 (29)</td>
<td>400 10</td>
<td>29</td>
<td>Fines = 96; % Sand = 4; PI = 99; LL = 124; %MC = 34.7</td>
</tr>
<tr>
<td>45.0</td>
<td></td>
<td></td>
<td>8-14-25 (39)</td>
<td>20 18</td>
<td>39</td>
<td>50: Sample S8: %Fines = 93; %Sand = 7; PI = 198; LL = 227; %MC = 34.5</td>
</tr>
<tr>
<td>50.0</td>
<td></td>
<td></td>
<td>8-14-20 (34)</td>
<td>22 18</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>55.0</td>
<td></td>
<td></td>
<td>13-25-49 (74)</td>
<td>20 18</td>
<td>74</td>
<td></td>
</tr>
</tbody>
</table>

Log continued on next page
**SOIL PROFILE**

- **DEPT (ft)**
  - 80.0
  - 85.0
  - 90.0
  - 95.0
  - 100.0
  - 105.0
  - 110.0
  - 115.0
  - 120.0

- **METHOD**
  - Hollow Stem Auger

- **DESCRIPTION**
  - (CH), FAT CLAY, trace to few fine to medium sand, dark tan and brown, homogeneous, iron oxide staining; very stiff to hard, moist; estimated 95% fines, 5% sand (LACUSTRINE) (continued)

- **BLOWS / ft**
  - 20 40 60 80
  - 20 17

- **WATER CONTENT (%)**
  - 20 40 60 80

- **NOTES**
  - Bottom of borehole at 100.2 ft.

---

**ADDITIONAL LAB TESTING**
Hollow Stem Auger

TOPSOIL
(SP), POORLY GRADED SAND, fine to medium sand, few fine rounded to subrounded gravel, trace high plasticity fines, light brown, heterogeneous; dense, moist; estimated 5% fines, 85% sand; 10% gravel

(CH), FAT CLAY, light tan and light brown, moderately fissured, iron oxide staining; very stiff to hard, moist; estimated 100% fines (LACUSTRINE)

3.5

(SP), POORLY GRADED SAND, fine to medium sand, few fine rounded to subrounded gravel, trace high plasticity fines, light brown, heterogeneous; dense, moist; estimated 5% fines, 85% sand; 10% gravel

(CH), FAT CLAY, light tan and light brown, moderately fissured, iron oxide staining; very stiff to hard, moist; estimated 100% fines (LACUSTRINE)

20.0

(SP), POORLY GRADED SAND, fine to medium sand, light tan and gray, homogeneous; hard, moist; estimated 90% fines, 10% sand (LACUSTRINE)

20: Sand content
**Hollow Stem Auger**

- CH, FAT CLAY, few fine to medium sand, light tan and gray, homogeneous; hard, moist; estimated 90% fines, 10% sand (LACUSTINE) (continued)

**SOIL PROFILE**

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>40.0</td>
<td>(CH), FAT CLAY, few fine to medium sand, light tan and gray, homogeneous; hard, moist; estimated 90% fines, 10% sand (LACUSTINE) (continued)</td>
</tr>
<tr>
<td>51.5</td>
<td>Bottom of borehole at 51.5 ft.</td>
</tr>
</tbody>
</table>

**ADDITIONAL LAB TESTING**

**USCS GRAPHIC LOG**

<table>
<thead>
<tr>
<th>SAMPLE TYPE &amp; NUMBER</th>
<th>BLOWS per 6 in</th>
<th>WATER CONTENT (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-40-50/5* (90/11&quot;)</td>
<td>20 17</td>
<td></td>
</tr>
<tr>
<td>9-18-35 (53)</td>
<td>20 18</td>
<td>53</td>
</tr>
<tr>
<td>5-10-17 (27)</td>
<td>20 18</td>
<td>27</td>
</tr>
</tbody>
</table>

**NOTES**

- Increases with depth

**RECORD OF BOREHOLE BH-04**

**PROJECT:** Grassy Mountain

**LOCATION:** Vale, Oregon

**DRILLING START:** December 1, 2017 14:40

**DRILLING END:** December 1, 2017 17:45

**COORDINATES:** N: 15,866,262 E: 1,545,284

**PROJECT NO.:** 1663241

**DRILLING CO.:** Haz Tech

**LOGGED:** Clay Johnson

**CHECKED:** Margaret Pryor

**REVIEWED:** Russ Browne

**DRILLER:** Jerod Willard

**DRILL RIG:** CME-75, Truck Mount

**GS ELEV.:** na

**TOC ELEV.:** na

**DATUM:**
Hollow Stem Auger

TOPSOIL
(CH), FAT CLAY, fine to medium sand, brown.

10.0
(SP), POORLY GRADED SAND, fine to coarse sand, few fine rounded to subrounded gravel, trace high plasticity fines, light brown, heterogeneous; dense, moist; estimated 5% fines, 85% sand, 10% gravel (ALLUVIUM/COLLUVIUM)

20.0
(CH), FAT CLAY, few fine to medium sand, dark tan and brown, homogeneous, iron oxide staining; very stiff to hard, moist; estimated 90% fines, 10% sand (LACUSTRINE)

30.0

Penetration Resistance
BLOWS / ft

NOTES

Log continued on next page
<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>DEPTH (m)</th>
<th>SOIL PROFILE</th>
<th>DESCRIPTION</th>
<th>UCSCS GRAPHIC LOG</th>
<th>SAMPLE TYPE &amp; NUMBER</th>
<th>BLOWS per 6 in</th>
<th>PENETRATION RESISTANCE BLOWS / ft</th>
<th>WATER CONTENT (%)</th>
<th>NOTES</th>
<th>ADDITIONAL LAB TESTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>40.0</td>
<td>12.2</td>
<td>CH</td>
<td></td>
<td></td>
<td>SS S7</td>
<td>20-31-30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41.5</td>
<td>12.7</td>
<td>Basal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Bottom of borehole at 41.5 ft.**
Hollow Stem Auger

Topsoil (SP), poorly graded sand with gravel, fine to coarse sand, little fine to coarse, subangular to angular gravel, trace low plasticity fines, brown, heterogeneous; very dense, moist; estimated <5% fines, 70% sand, 25% gravel (ALLUVIUM/COLLUVIUM)

CH, Fat Clay, tan to olive, homogeneous, iron oxide staining; hard, dry to moist; estimated 100% fines (LACUSTRINE)

CH, Fat Clay with sand, little fine to medium sand, tan to light brown, homogeneous, iron oxide staining; hard, moist; estimated 85% fines, 15% sand (LACUSTRINE)

CH, Fat Clay, olive-green, homogeneous, iron oxide staining; hard, dry to moist; estimated 100% fines (LACUSTRINE)

Bottom of borehole at 26.5 ft.
Hollow Stem Auger

SOIL PROFILE

DEPTH (ft)

0.0

TOPSOIL (SP-SC), POORLY GRADED SAND WITH GRAVEL AND CLAY, fine to coarse sand, little fine to coarse, subrounded to subangular gravel, few low plasticity fines, light tan to gray, heterogeneous, iron oxide staining; very dense, dry to moist; estimated 10% fines, 70% sand, 20% gravel (ALLUVIUM/COLLUVIUM)

SP-SC

15: stained red from 15 to 25 feet:

15

25

30

40

(52)

25-29-33

62

23-28-30

58

19-29-36

65

19-25-27

52

(65)

13-18-20

38

9-11-19

30

8-12-24

36

20

40

60

80

BLOWS / ft

WATER CONTENT (%)

NOTES

0 - GOLDER - BOREHOLE RECORD - DF STD US LAB E-M.GDT - 5/1/18 17:51

C:\USERS\PUBLIC\DOCUMENTS\BENTLEY\GINT\GRASSYMOUNTAINBORINGLOGS.GPJ
### Soil Profile

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Description</th>
<th>USCS</th>
<th>Graphic Log</th>
<th>BHP per 6 in</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>40.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41.5</td>
<td>Bottom of borehole at 41.5 ft.</td>
<td>CH</td>
<td>SS8</td>
<td>13-25-29</td>
<td>54</td>
</tr>
</tbody>
</table>

### Penetration Resistance

<table>
<thead>
<tr>
<th>Blows / ft</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>40.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Water Content (%)

<table>
<thead>
<tr>
<th>Wc</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-25-29</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes

- **Samples**
  - **Sample Type & Number**: Automatic hammer, 140 lb hammer, 30 inch drop
  - **REC**: 54
  - **ATT**:
SOIL PROFILE

0.0
TOPSOIL
(SC), CLAYEY SAND WITH GRAVEL, fine to coarse sand, little fine subrounded to subangular gravel, some high plasticity fines, brown, heterogeneous; medium dense, moist; estimated 20% fines, 50% sand, 30% gravel (ALLUVIUM/COLLUVIUM)

10.0
(CH), FAT CLAY WITH SAND, little fine to medium sand, olive-brown brown, heterogeneous; very stiff to hard, moist; estimated 80% fines, 20% sand (LACUSTRINE)

Hollow Stem Auger

SHEET: 1 of 2

RECORD OF BOREHOLE BH-08

PROJECT: Grassy Mountain
PROJECT NO.: 1663241
LOCATION: Vale, Oregon

DRILLING START: December 1, 2017 08:36
DRILLING END: December 1, 2017 10:50
COORDINATES: N: 15,865,318  E: 1,544,094

GS ELEV.: na
TOC ELEV.: na
DATUM:

DEPTH (ft)

0.0

5

10

15

20

25

30

35

40

0.0

6-11-6
(17)

17

5-8-10
(18)

18

8-10-14
(24)

20

6-10-14
(24)

24

7-16-26
(42)

42

6-10-10
(20)

20

8-13-17
(30)

30

Log continued on next page
(CH), FAT CLAY WITH SAND, little fine to medium sand, olive-brown brown, heterogeneous; very stiff to hard, moist; estimated 80% fines, 20% sand (LACUSTRINE) (continued)

Bottom of borehole at 51.5 ft.
Hollow Stem Auger

TOPSOIL (SP), POORLY GRADED SAND, fine to medium sand, few high plasticity fines, tan and dark brown, homogeneous, iron oxide staining; dense to very dense, dry to moist; estimated 10% fines, 90% sand (ALLUVIUM/COLLUVIUM)

SANDY FAT CLAY, some fine to coarse sand, brown-yellowish and pink-brown, moderately fissured, iron oxide staining; very stiff, moist; estimated 70% fines, 30% sand (LACUSTRINE)

25: Sample S5; %Fines = 68; %Sand =32; PI = 62, LL = 96
Hollow Stem Auger

50.0

(CH), SANDY FAT CLAY, some fine to coarse sand, brown-yellowish and pink-brown, moderately fissured, iron oxide staining; very stiff, moist; estimated 70% fines, 30% sand (LACUSTRINE) (continued)

55.0

(SP), POORLY GRADED SAND, fine to medium sand, trace low plasticity fines, tan, homogeneous; very dense, moist; estimated 3% fines, 97% sand (BEACH DEPOSITS)

60.0

(CL), SANDY LEAN CLAY, some fine to medium sand, gray and blue-gray, homogeneous, iron oxide staining; hard, moist; estimated 70% fines, 30% sand (LACUSTRINE)
**SOIL PROFILE**

- **DEPTH (ft)**
  - 80.0
  - 85
  - 90
  - 95
  - 100
  - 105
  - 110
  - 115
  - 120

**DESCRIPTION**

- (CH), FAT CLAY, light blue-gray and dark blue-gray, homogeneous; hard, dry to moist; estimated 100% fines (LACUSTRINE)

**BOREHOLE RECORD**

**METHODOLOGY**

- Hollow Stem Auger

**GRAPHIC LOG**

**SAMPLES**

- **SAMPLE TYPE & NUMBERS**
  - S11
  - S12
  - S13

**BLOWS per 6 in**

- Automatic hammer
- 140 lb hammer, 30 inch drop

**PENETRATION RESISTANCE**

- BLOWS / ft

**WATER CONTENT (%)**

**NOTES**

- Bottom of borehole at 101.5 ft.
**RECORD OF BOREHOLE BH-10**

**SOIL PROFILE**

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>DESCRIPTION</th>
<th>USCS</th>
<th>BLOWS</th>
<th>PENETRATION RESISTANCE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>TOPSOIL: CL, LEAN CLAY WITH SAND, little fine sand; trace fine subrounded to subangular gravel, light tan, homogeneous; hard, moist; estimated 80% fines, 15% sand, 5% gravel (ALLUVIUM/ COLLUVIUM)</td>
<td>CL</td>
<td>0-0</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>10.0</td>
<td>CL, Silty Sand, Fine to coarse sand, some low plasticity fines, light gray, heterogeneous, iron oxide staining; very dense, moist, 15% fines, 85% sand (WEATHERED ARKOSIC SANDSTONE)</td>
<td>SM</td>
<td>10-15-18 (33)</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>20.2</td>
<td>Bottom of borehole at 20.2 ft.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ADDITIONAL TESTING**

**WATER CONTENT (%)**

**PENETRATION RESISTANCE**

**BLOWS per 6 in**

- Automatic hammer: 160 lb hammer, 30 inch drop

**COORDINATES:** N: 15,864,954   E: 1,545,298

**DRILLER:** Jerod Willard

**CHECKED:** Margaret Pryor

**REVIEWED:** Russ Browne

**LOGGED:** Clay Johnson

**DRILLING START:** November 30, 2017 11:15

**DRILLING END:** November 30, 2017 12:45

**LOCATION:** Vale, Oregon

**DRILLING CO.:** Haz Tech

**PROJECT NO.:** 1663241

**PROJECT:** Grass Mountain

**GS ELEV.:** na

**TOC ELEV.:** na

**DATUM:**
**RECORD OF BOREHOLE BH-11**

**LOCATION:** Vale, Oregon

**PROJECT:** Grassly Mountain

**PROJECT NO.:** 1663241

**COORDINATES:** N: 15,865,251 E: 1,545,404

**DRILLING START:** November 30, 2017 13:20

**DRILLING END:** November 30, 2017 15:00

**TOC ELEV.:** na

**GS ELEV.:**

**DATUM:**

---

**SOIL PROFILE**

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>DESCRIPTION</th>
<th>USCS</th>
<th>GRAPHIC LOG</th>
<th>SAMPLE TYPE &amp; NUMBER</th>
<th>BLOWS per 6 in</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>TOPSOIL (CH), SANDY FAT CLAY, some fine to coarse sand, trace fine subrounded to subangular gravel, light tan to olive, homogeneous; stiff to hard, moist; estimated 60% fines, 37% sand, 3% gravel (ALLUVIUM/COLLUVIUM)</td>
<td></td>
<td><img src="soil_log1.png" alt="SOIL LOG" /></td>
<td>7-5-8 (13)</td>
<td>20 to 18</td>
<td>5: Sample S2; %Fines = 60; %Sand = 37; %Gravel = 3%; PI = 62, LL = 97</td>
</tr>
<tr>
<td>5.0</td>
<td><a href="soil_log2.png">SOIL LOG</a></td>
<td></td>
<td><img src="soil_log3.png" alt="SOIL LOG" /></td>
<td>12-13-19 (32)</td>
<td>19 to 18</td>
<td>10: S2 mottled with evaporite deposits but deposits do not react to HCL</td>
</tr>
<tr>
<td>10.0</td>
<td><a href="soil_log4.png">SOIL LOG</a></td>
<td></td>
<td><img src="soil_log5.png" alt="SOIL LOG" /></td>
<td>12-14-15 (29)</td>
<td>18 to 18</td>
<td></td>
</tr>
<tr>
<td>15.0</td>
<td><a href="soil_log6.png">SOIL LOG</a></td>
<td></td>
<td><img src="soil_log7.png" alt="SOIL LOG" /></td>
<td>50 (50&quot;)</td>
<td>7 to 6</td>
<td></td>
</tr>
<tr>
<td>20.0</td>
<td><a href="soil_log8.png">SOIL LOG</a></td>
<td></td>
<td><img src="soil_log9.png" alt="SOIL LOG" /></td>
<td>50 (50&quot;)</td>
<td>8 to 6</td>
<td></td>
</tr>
<tr>
<td>25.0</td>
<td><a href="soil_log10.png">SOIL LOG</a></td>
<td></td>
<td><img src="soil_log11.png" alt="SOIL LOG" /></td>
<td>50 (50&quot;)</td>
<td>8 to 6</td>
<td></td>
</tr>
<tr>
<td>30.0</td>
<td><a href="soil_log12.png">SOIL LOG</a></td>
<td></td>
<td><img src="soil_log13.png" alt="SOIL LOG" /></td>
<td>50 (50&quot;)</td>
<td>8 to 6</td>
<td></td>
</tr>
<tr>
<td>35.0</td>
<td><a href="soil_log14.png">SOIL LOG</a></td>
<td></td>
<td><img src="soil_log15.png" alt="SOIL LOG" /></td>
<td>50 (50&quot;)</td>
<td>8 to 6</td>
<td></td>
</tr>
<tr>
<td>39.0</td>
<td>Bottom of borehole at 39.0 ft.</td>
<td></td>
<td><img src="soil_log16.png" alt="SOIL LOG" /></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>40.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**ADDITIONAL LAB TESTING**

**WATER CONTENT (%):**

- 20
- 40
- 60
- 80

---

**LOGGED:** Clay Johnson

**CHECKED:** Margaret Pryor

**REVIEWED:** Russ Browne

---

**DRILLING CO.:** Haz Tech

**DRILLER:** Jerod Willard

**DRILL RIG:** CME-75, Truck Mount
Hollow Stem Auger

- TOPSOIL: CH (Clay), gray to very dark gray, moderately fissured, iron oxide staining; very stiff to hard, moist; estimated 98% fines, 2% sand (LACUSTRINE?)

- Color change to gray to dark gray.

- Bottom of borehole at 31.5 ft.
(CH), FAT CLAY WITH SAND, little fine to medium sand, tan, moderately fissured, iron oxide staining; very stiff, moist; 85% fines, 15% sand (LACUSTRINE)

(CH), SANDY FAT CLAY, some fine to coarse sand, heterogeneous, olive to gray, moist; estimated 60% fines, 40% sand (LACUSTRINE)

(CH), FAT CLAY, trace fine to coarse sand, heterogeneous, olive, iron oxide staining; very stiff to hard, moist; estimated 95% fines, 5% sand (LACUSTRINE)
**SOIL PROFILE**

<table>
<thead>
<tr>
<th>DEPTH (ft)</th>
<th>DESCRIPTION</th>
<th>USCS</th>
<th>GRAPHIC LOG</th>
<th>SAMPLE TYPE &amp; NUMBER</th>
<th>PENETRATION RESISTANCE</th>
<th>WATER CONTENT (%)</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>40.0 (CH), FAT CLAY, trace fine to coarse sand,</td>
<td></td>
<td></td>
<td>8-13-23 (36)</td>
<td>20/16</td>
<td>W_1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>heterogeneous, olive, iron oxide staining; very</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>stiff to hard, moist; estimated 95% fines, 5% sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(LACUSTRINE) (CONTINUED)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>45.0 (SM), SILTY SAND, fine to medium, some low</td>
<td></td>
<td></td>
<td>8-4-50/4&quot; (54/10&quot;)</td>
<td>20/16</td>
<td>W_2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>plasticity fines, tan, friable, iron oxide staining;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>very dense, moist;45% fines, 55% sand (ALLUVIUM/COLLUVIUM)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>50.0 (SM)</td>
<td></td>
<td></td>
<td>22-49-50/2&quot; (99/8&quot;)</td>
<td>18/14</td>
<td>W_3</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>55.0 (SM)</td>
<td></td>
<td></td>
<td>18-47-50/5&quot; (97/11&quot;)</td>
<td>24/17</td>
<td>W_4</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>60.0 (SM)</td>
<td></td>
<td></td>
<td>18-38-50/5&quot; (88/11&quot;)</td>
<td>20/17</td>
<td>W_5</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>65.0 (CH), FAT CLAY, gray and dark blue-gray,</td>
<td></td>
<td></td>
<td>9-13-47 (60)</td>
<td>20/16</td>
<td>W_6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>homogeneous; hard, moist; estimated 100% fines</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(LACUSTRINE)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>70.0 (CH)</td>
<td></td>
<td></td>
<td>13-27-34 (61)</td>
<td>20/16</td>
<td>W_7</td>
<td></td>
</tr>
</tbody>
</table>

**ADDITIONAL LAB TESTING**

- **Sample Type & Number**: 8-13-23 (36), 8-4-50/4" (54/10"), 22-49-50/2" (99/8"), 18-47-50/5" (97/11"), 18-38-50/5" (88/11"), 9-13-47 (60), 13-27-34 (61).
- **Penetration Resistance BLOWS / ft**: 20/16, 18/14, 24/17, 20/17, 20/16, 20/16, 20/16.
- **Water Content (%)**: W_1, W_2, W_3, W_4, W_5, W_6, W_7.

**LOGGED**: Clay Johnson

**CHECKED**: Margaret Pryor

**REVIEWED**: Russ Browne
Hollow Stem Auger

80.0
(CH), FAT CLAY, gray and dark blue-gray, homogeneous; hard, moist; estimated 100% fines (LACUSTRINE) (continued)

85

90

95

100

101.5

Bottom of borehole at 101.5 ft.
Hollow Stem Auger (SW-SM), WELL-GRADING SAND WITH SILT, fine to medium, few fine subangular gravel, little low plasticity fines, tan, homogeneous, iron oxide staining; dense to very dense, moist.

Estimated 15% fines, 78% sand, 7% gravel (WEATHERED ARKOSIC SANDSTONE)

Bottom of borehole at 26.1 ft.
### Soil Profile

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Description</th>
<th>USCS Sample Type &amp; Number</th>
<th>Penetration Resistance Bows / ft</th>
<th>Water Content (%)</th>
<th>Grain Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(SM) Silty Sand with Gravel, fine to coarse, little non-plastic fines, few fine gravels, yellow-brown, dry, loose to dense</td>
<td>SM</td>
<td>20 40 60 80</td>
<td>16-20-30 (50)</td>
<td>16 18</td>
</tr>
<tr>
<td>5</td>
<td>(CH) Fat Clay, medium to high plasticity, trace fine sand, gray and white, w&lt;PL, hard, possible lacustrine</td>
<td>CH</td>
<td>10 20 30 40</td>
<td>8-16-25 (41)</td>
<td>13 18</td>
</tr>
<tr>
<td>10</td>
<td>(SM) Silty Sand, fine, non-plastic fines, some fine sands, light gray mottled orange, dry, very dense, finer with depth</td>
<td>SM</td>
<td>20 40 60 80</td>
<td>19-23-28 (51)</td>
<td>17 18</td>
</tr>
<tr>
<td>15</td>
<td>(CL) Lean Clay, low plasticity, trace fine sand, light gray with orange stain on surfaces, w&lt;PL, hard</td>
<td>CL</td>
<td>10 20 30 40</td>
<td>17-28-45 (73)</td>
<td>18 18</td>
</tr>
<tr>
<td>20</td>
<td>(SC) Clayey Sand, fine, some medium plasticity fines, light gray, damp, very dense</td>
<td>SC</td>
<td>20 40 60 80</td>
<td>29-48-50/3 (88/9)</td>
<td>15 15</td>
</tr>
<tr>
<td>25</td>
<td>Some vertical stratification, approximately 20-30% orange mottle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Additional Notes:**

- PI = 38, PL = 28
- PI = 30, PL = 22
- PI = 40, PL = 22
- PI = 29, PL = 19
- PI = 21, PL = 14
**SOIL PROFILE**

**DEPTH** (ft) | **DESCRIPTION** | **Elev** | **USCS** | **SAMPLE** | **NUMBER** | **BLOWS per 6 in** | **REC ATT** |
---|---|---|---|---|---|---|---|
80.0 | SM | 3515.0 | CH | 17-27-40 | (67) | 18 | 18 |
81.5 | SM | 3513.5 | CH | 17-27-40 | (67) | 18 | 18 |
85.0 | CH | 3505.0 | SC | 17-28-32 | (60) | 18 | 18 |
90.0 | CH | 3495.0 | SC | 17-28-32 | (60) | 18 | 18 |
95.0 | CH | 3490.0 | SC | 17-28-32 | (60) | 18 | 18 |
100.0 | CH | 3490.0 | SC | 17-28-32 | (60) | 18 | 18 |
105.0 | CH | 3490.0 | SC | 17-28-32 | (60) | 18 | 18 |
110.0 | CH | 3490.0 | SC | 17-28-32 | (60) | 18 | 18 |
115.0 | CH | 3490.0 | SC | 17-28-32 | (60) | 18 | 18 |
120.0 | CH | 3490.0 | SC | 17-28-32 | (60) | 18 | 18 |

**GRAIN SIZE**

<table>
<thead>
<tr>
<th><strong>PI</strong></th>
<th><strong>PL</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>3</td>
</tr>
<tr>
<td>64</td>
<td>26</td>
</tr>
<tr>
<td>36.5</td>
<td></td>
</tr>
<tr>
<td>33.6</td>
<td></td>
</tr>
</tbody>
</table>

**ADDITIONAL TESTING**

- **WATER CONTENT (%)**
  - 20 40 60 80
  - 67
- **PI = 65, PL = 36**
- **PI = 64, PL = 26**

**RECORD OF BOREHOLE TP-15**

**LOCATION:** Vale, Oregon

**PROJECT:** Grassy Mountain

**PROJECT NO.:** 1663241

**COORDINATES:** Not Surveyed

**DRILLING START:** 2019 March 26 09:15

**DRILLING END:** 2019 March 26 15:45

**GS ELEV.:** 3595.0

**TOC ELEV.:** na

**DATUM:** Geodetic

**REVIEWED:** SAM

**LOGGED:** Brenda Borer

**CHECKED:** KDP

**LOGGED ON:** 2019 March 26 09:15

**CHECKED ON:** 2019 March 26 15:45

**REVIEWED ON:** 2019 March 26 15:45

**MARSHY AREA:**

- **SMILY SAND** fine, some non-plastic fines, dark blue-gray, damp, very dense
- More fine sand with depth

- **FAT CLAY** medium plasticity, dark blue-gray, white clay fleck and vein scattered throughout, w < PL, hard

- **CLAYEY SAND** fine, some non-plastic fines, dark blue gray, dry, very dense

- **FAT CLAY** high plasticity, gray-blue and white fleck scattered throughout, w > PL, hard

Medium plasticity, trace fine sand, w > PL
Bottom of borehole at 121.4 ft. Backfilled with bentonite chips.
**SOIL PROFILE**

0-1 ft ~ Topsoil

(CL) LEAN CLAY, low plasticity, gray and light gray, w < PL, very stiff, possible lacustrine

Density increasing with depth

10.0 ft ~ CLAY, low plasticity, light gray-green; white fleck scattered throughout with orange stain, w < PL, stiff

15.4 ft ~ SILT, low plasticity, yellow-brown with white specks and orange stain, w < PL, very stiff

25.7-26.7 ft ~ heavy orange stain

30.0 ft ~ CLAYEY SAND, fine to medium, little high plasticity fines, light yellow-brown, w < PL, very dense

37-42 ft ~ trace gravels

**GRAIN SIZE**

- Gravel
- Sand
- Fines

**ADDITIONAL LAB TESTING**

- ASTM D1586
- 140 lb hammer
- 30 inch drop
- Automatic hammer

**BLOWS per 6 in**

- 20
- 40
- 60
- 80

**REC ATT**

- 20
- 40
- 60
- 80

**WATER CONTENT (%)**

- 10
- 20
- 30
- 40
- 50
- 60
- 70
- 80
- 90

**USCS GRAPHIC LOG**

- CL
- ML
- CH
- SC

**SAMPLES**

- 0-1 ft ~ Topsoil
- 10.0 ft ~ CLAY
- 15.4 ft ~ SILT
- 25.7-26.7 ft ~ CLAYEY SAND

**PROJECT:** Grassy Mountain

**LOCATION:** Vale, Oregon

**COORDINATES:** Not Surveyed

**GS ELEV.:** 3535.0

**TOC ELEV.:** na

**GS ELEV.:** Geodetic

**PROJECT NO.:** 1663241

**DRILLING START:** 2019 March 22 14:45

**DRILLING END:** 2019 March 23 13:45

**DRILLING CO.:** Haz Tech

**LOGGED:** Brenda Boror

**CHECKED:** KDP

**REVIEWED:** SAM

**DRILL RIG:** CME-75, Truck Mount

**RECORD OF BOREHOLE TP-19**

**SHEET:** 1 of 4

**SOF Diagram:**

- Soil profile
- Boring method
- Additional lab testing
- Water content (%)
- Grain size

**Log continued on next page**
### Soil Profile

#### Description
- **40.0 ft** - Trace fine gravel
  - **(CL-ML) Silty Clay**, very low plasticity, light gray with some orange mottle, w < PL, hard
  - Sand content decreasing
- **41.5 ft** - Trace fine gravel
  - **(CH) Fat Clay**, high plasticity, light brown-gray, w ~ PL, very stiff
- **45.0 ft** - Trace fine gravel
  - **(ML) Sandy Silt**, non plastic, some fine sand, olive-gray, damp, hard
  - Sand content increasing with depth
  - Orange stain (~50%)
- **50.0 ft** - Trace fine gravel
  - **(CH) Fat Clay**, high plasticity, fine sands, yellow-brown, w ~ PL, hard
  - More fine sands, gray, moist, very dense
- **71.5 ft** - Trace fine gravel
  - **(CL) Silty Clay**, low plasticity, some fine sand, gray, moist, hard
- **75.0 ft** - Trace fine gravel
  - **(CH) Fat Clay**, high plasticity, dark gray, w < PL, hard

#### Samples

<table>
<thead>
<tr>
<th>Sample Type &amp; Number</th>
<th>ASTM D1586</th>
<th>140 lb hammer</th>
<th>30 inch drop</th>
<th>Automatic hammer</th>
</tr>
</thead>
<tbody>
<tr>
<td>BLOWS per 6 in</td>
<td>REC</td>
<td>ATT</td>
<td>PENETRATION RESISTANCE</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>BLOWS / ft</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>l</td>
<td>20</td>
<td>40</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>W</td>
<td>46</td>
<td>45.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>41</td>
<td>42.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>22.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>30.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>98</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Penetration Resistance
- **PI = 117, PL = 24**
- **PI = 179, PL = 27**
- **PI = 51, PL = 22**
- **PI = 61, PL = 28**

#### Additional Laboratory Testing

- **Gravel**
- **Sand**
- **Fines**

---

**Log continued on next page**
**RECORD OF BOREHOLE TP-19**

**SOIL PROFILE**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>80.0</td>
<td>(CH) FAT CLAY, medium plasticity, dark gray, w &lt; PL, hard (continued)</td>
</tr>
<tr>
<td>87.5-88.5ft</td>
<td>Rig chatter in rock, no recovery</td>
</tr>
<tr>
<td>90-90.5ft</td>
<td>Rig chatter in rock, no recovery</td>
</tr>
<tr>
<td>92.0</td>
<td>(SP-SM) POORLY GRADED SAND WITH SILT, fine, little non plastic fines, trace gravel, light gray, dry, very dense, homogeneous</td>
</tr>
<tr>
<td>108.0</td>
<td>(CL) LEAN CLAY, low plasticity, gray, w ~ PL, hard, stratified with black on layer surfaces</td>
</tr>
<tr>
<td>115.0</td>
<td>(CH) FAT CLAY, medium plasticity, some fine sands, gray, dry, very dense</td>
</tr>
</tbody>
</table>

**SAMPLES**

<table>
<thead>
<tr>
<th>Sample Type &amp; Number</th>
<th>ASTM D1586</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>140 lb hammer, 30 inch drop, Automatic hammer</td>
</tr>
</tbody>
</table>

**Penetration Resistance**

<table>
<thead>
<tr>
<th>BLOWS / ft</th>
<th>REC</th>
<th>ATT</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td></td>
<td></td>
</tr>
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</table>

**Water Content (%)**

<table>
<thead>
<tr>
<th>Water Content (%)</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**GRAIN SIZE**

- Gravel
- Sand
- Fines

**ADDITIONAL LAB TESTING**

- PI = 41, PL = 21
- PI = 24, PL = 24

---

**Log continued on next page**

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**Log continued on next page**
Bottom of borehole at 121.4 ft. Backfilled with bentonite chips.
RECORD OF BOREHOLE TP-23

SOIL PROFILE

DEPTH (ft)

0.0

3550.0

Elev

CH

(FAT CLAY WITH GRAVEL
medium plasticity, little coarse gravel, trace fine sand, light brown-gray, dry, soft

5.0

3545.0

(GC) CLAYEY GRAVEL
coarse subrounded to subangular, little medium plasticity fines, trace fine sand, gray, dry, dense, logged from auger return (drill chatter)

10.5

3539.5

(FAT CLAY
high plasticity, trace fine gravels, gray, w ~ PL, very stiff possible lacustrine

Gray-green, excavates blocky

20.0

3523.5

(SC) CLAYEY SAND
fine, some low plasticity fines, light gray mottled orange, heterogeneous, iron oxide and black stain on surfaces, damp, medium dense, possible lacustrine

30.0

3520.0

(CH) FAT CLAY
high plasticity, green-gray, w ~ PL, hard

Log continued on next page

Penetration Resistance

BLOWS / ft

20 40 60 80

W

W

W

Water Content (%)

REC ATT

20 40 60 80

PENETRATION RESISTANCE

BLOWS / ft

20 40 60 80

PI = 101, PL = 34

PI = 68, PL = 31
### Soil Profile

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>40.0</td>
<td><strong>(CH) FAT CLAY</strong>, high plasticity, green-gray, w ~ PL, hard (continued) Orange iron oxide mottle, increasing with depth Pink gray, w &lt; PL</td>
</tr>
<tr>
<td>45.0</td>
<td><strong>(CL) LEAN CLAY</strong>, medium plasticity, light gray mottled orange, w ~ PL, hard Dark gray and dark red Pink gray</td>
</tr>
<tr>
<td>50.0</td>
<td><strong>(CH) FAT CLAY</strong>, high plasticity, dark gray, w ~ PL, hard Trace fine sand</td>
</tr>
<tr>
<td>60.5</td>
<td>Orange mottle</td>
</tr>
<tr>
<td>61.5</td>
<td><strong>(MH) ELASTIC SILT</strong> non-plastic, light gray, w &lt; PL, hard</td>
</tr>
<tr>
<td>70.0</td>
<td><strong>(CH) FAT CLAY</strong>, high plasticity, gray, w &lt; PL, hard</td>
</tr>
<tr>
<td>75.0</td>
<td><strong>(SC) CLAYEY SAND</strong>, fine, some non-plastic fines, light gray, dry, very dense</td>
</tr>
</tbody>
</table>

### Penetration Resistance

<table>
<thead>
<tr>
<th>BLOWS per 6 in ASTM D1586 145 lb hammer 30 inch drop Automatic hammer</th>
<th>REC ATT</th>
</tr>
</thead>
<tbody>
<tr>
<td>12-15-50/4&quot; (65/10&quot;)</td>
<td>16</td>
</tr>
<tr>
<td>15-28-48 (76)</td>
<td>18</td>
</tr>
<tr>
<td>30-38-50/4&quot; (88/10&quot;)</td>
<td>16</td>
</tr>
<tr>
<td>50/5&quot;</td>
<td>16</td>
</tr>
<tr>
<td>35-49-50 (99)</td>
<td>18</td>
</tr>
</tbody>
</table>

### Water Content (%)

<table>
<thead>
<tr>
<th>WATER CONTENT (%)</th>
<th>REC</th>
<th>ATT</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>29.4</td>
<td>100</td>
</tr>
<tr>
<td>40</td>
<td></td>
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</tr>
<tr>
<td>60</td>
<td>22.8</td>
<td>76</td>
</tr>
<tr>
<td>80</td>
<td>19.5</td>
<td>100</td>
</tr>
<tr>
<td>100</td>
<td>26.0</td>
<td>96</td>
</tr>
</tbody>
</table>

### Grain Size

- **Gravel**
- **Sand**
- **Fines**

### Additional Testing

- **ASTM D1586**
- 140 lb hammer
- 30 inch drop
- Automatic hammer

### Depths

- 40.0 ft
- 45.0 ft
- 50.0 ft
- 60.5 ft
- 61.5 ft
- 70.0 ft
- 75.0 ft
- 80.0 ft

---

**PROJECT:** Grassy Mountain  
**PROJECT NO.:** 1663241  
**LOCATION:** Vale, Oregon  
**DRILLING METHOD:** ADDITIONAL LAB TESTING  
**SOIL PROFILE:** DESCRIPTION  
**SAMPLES:** BLOWS  
**SAMPLE NUMBER:** PENETRATION RESISTANCE  
**USCS:** GRAIN SIZE  
**GRAPHIC LOG:** PENETRATION RESISTANCE  
**ELEV:** WATER CONTENT (%)  
**DEPTH:** PENETRATION RESISTANCE  
**GS ELEV.:** 3550.0  
**DATE:** Geodetic

---

**PROJECT:** Grassy Mountain  
**LOCATION:** Vale, Oregon  
**DRILLING METHOD:** ADDITIONAL LAB TESTING  
**SOIL PROFILE:** DESCRIPTION  
**SAMPLES:** BLOWS  
**SAMPLE NUMBER:** PENETRATION RESISTANCE  
**USCS:** GRAIN SIZE  
**GRAPHIC LOG:** PENETRATION RESISTANCE  
**ELEV:** WATER CONTENT (%)  
**DEPTH:** PENETRATION RESISTANCE  
**GS ELEV.:** 3550.0  
**DATE:** Geodetic
<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Description</th>
<th>BOREHOLE METHOD</th>
<th>SAMPLES</th>
<th>PENETRATION RESISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>120.0</td>
<td>(CH) FAT CLAY, high plasticity, light gray, w ~ PL, hard Dark brown, laminated</td>
<td>3430.0</td>
<td>17-37-50/4&quot; (87/10&quot;)</td>
<td>REC ATT</td>
</tr>
<tr>
<td>121.3</td>
<td>Bottom of borehole at 121.3 ft. Backfilled with bentonite chips.</td>
<td>3428.7</td>
<td>16</td>
<td>80</td>
</tr>
</tbody>
</table>

**Grain Size**

Gravel, Sand, Fines

**USCS**

Gravel

Sand

Fines

**PI = 40, PL = 24**
**SOIL PROFILE**

40.0

**(SC) CLAYEY SAND,** fine, little medium plasticity fines, yellow-brown, moist, very dense (continued)

45.0

Few medium plasticity fines, trace fine gravel

50.0

Some medium plasticity fines

Grades finer with depth

55.0

Light gray with orange staining, trace fine gravel

60.0

**(CH) FAT CLAY,** medium plasticity, some fine to coarse sand, brown-gray mottled orange-red, w < PL, hard

65.0

High plasticity, White clay fleck scattered throughout

70.0

75.0

80.0

Log continued on next page
(CL) LEAN CLAY, low to medium plasticity, some fine to coarse sand, dark gray with white clay scattered throughout, w ~ PL, hard

(CH) FAT CLAY, medium plasticity, some fine to coarse sand, black brown and stratified with white clay flecks throughout, w < PL, hard, lacustrine

(CL) LEAN CLAY, low plasticity, trace fine sand, very light gray, dry, hard

Log continued on next page
**SOIL PROFILE**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Description</th>
<th>Elev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>120.0</td>
<td>Bottom of borehole at 120.5 ft. Backfilled with bentonite chips.</td>
<td>3488.0</td>
</tr>
</tbody>
</table>

**SAMPLES**

**GRAIN SIZE**

- Gravel
- Sand
- Fines

**ADDITIONAL LAB TESTING**

<table>
<thead>
<tr>
<th>BLOWS / ft</th>
<th>WATER CONTENT (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td>60</td>
<td>20</td>
</tr>
<tr>
<td>80</td>
<td>20</td>
</tr>
</tbody>
</table>

**BORING METHOD**

- Boring Method: 120.0 ft

**LOGGED:** Brenda Borer
**CHECKED:** KDP
**REVIEWED:** SAM

**PROJECT:** Grassy Mountain
**LOCATION:** Vale, Oregon
**PROJECT NO.:** 1663241
**COORDINATES:** Not Surveyed

**GS ELEV.:** 3608.0
**TOC ELEV.:** na
**DATUM:** Geodetic

**RECORD OF BOREHOLE TP-44**

**SHEET:** 4 of 4

**GRAPHIC LOG**

- Soil profile
- Water content
- Grain size

**DESCRIPTION**

- Depth
- USCS
- ASTM D1586
- Automatic hammer
- 30 inch drop

**PENETRATION RESISTANCE**

- Blows per 6 in
- RECATT
- Penetration resistance
- GRAIN SIZE

**ADDITIONAL LAB TESTING**

- GS ELEV.
- TOC ELEV.
- DATUM

**Hazardous Technology**

- Jerod Willard
- KDP
- SAM
Appendix E
Lithologic Cross-Sections
Appendix F
Well Driller’s Reports
**STATE OF OREGON**
**MONITORING WELL REPORT**
(as required by ORS 537.765 & OAR 690-240-005)

(1) **OWNER/PROJECT:** Newmont Gold

<table>
<thead>
<tr>
<th>WELL NO.</th>
<th>MWS-8</th>
</tr>
</thead>
</table>

(2) **TYPE OF WORK:**
- X New Construction
- Deepening
- Abandonment

(3) **DRILLING METHOD:**
- X Rotary Air
- Other

(4) **BORE HOLE CONSTRUCTION**

<table>
<thead>
<tr>
<th>Special Standards</th>
<th>Yes</th>
<th>No</th>
<th>Depth completed well</th>
<th>45 ft.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Land Surface</th>
<th>Protect: casing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monument</td>
<td>Locking Cap</td>
</tr>
</tbody>
</table>

(5) **WELL TEST:**

- Pump
- Air

Permeability Yield

<table>
<thead>
<tr>
<th>Conductivity</th>
<th>pH</th>
<th>Temperature of water F/C</th>
<th>Depth artesian flow found ft.</th>
</tr>
</thead>
</table>

Was water analysis done? Yes

By whom? M. Palladino

Depth of strata to be analyzed. From To ft.

Remarks: bottom hole backfilled w/257-76.3" sil\n
Name of supervising Geologist/Engineer: M. Palladino

(6) **LOCATION OF WELL By legal description**

- Well Location: County
- Township 22S (N/S) Range 44E (W/E) Section 6
- 1/4 of SE 1/4 of above section
- Street address of well location: GRASSY MOUNTAIN
- Tax lot number of well location: N/A
- ATTACH MAP WITH LOCATION IDENTIFIED

(7) **STATIC WATER LEVEL:**

- Artesian Pressure: Dry to 45.5 Feet below land surface.
- Date: October 2, 1993

(8) **WATER BEARING ZONES:**

<table>
<thead>
<tr>
<th>Depth at which was first found</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th>From</th>
<th>To</th>
<th>SWL...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gravely sandy loam, mod. gray brown</td>
<td>0</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Silstone tan-gray</td>
<td>10</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Sandstone-yellow-tan</td>
<td>29</td>
<td>32.5</td>
<td></td>
</tr>
<tr>
<td>Sandstone-orange</td>
<td>32.5</td>
<td>33.5</td>
<td></td>
</tr>
<tr>
<td>Sandstone, yellow-tan</td>
<td>33.5</td>
<td>46.5</td>
<td></td>
</tr>
<tr>
<td>Clayey siltstone, grey and tan with sand</td>
<td>46.5</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Sandstone, tan-brown</td>
<td>48</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Clayey siltstone, tan-gray</td>
<td>59</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>Sandstone, yellow-tan</td>
<td>62</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>Carbonaceous shale</td>
<td>64</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>Silstone, med. gray-brown</td>
<td>68</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td>Sandstone, tan-orange</td>
<td>71</td>
<td>76.5</td>
<td></td>
</tr>
</tbody>
</table>

(9) **WELL LOG:**

Ground elevation

<table>
<thead>
<tr>
<th>Material</th>
<th>From</th>
<th>To</th>
<th>SWL...</th>
</tr>
</thead>
</table>

| Bendonite plug >2 ft. thick |
| Screen Material interval(s): | From | To |

Filter Pack:

| Material: Colorado Silica |
| Size: 10-20 in. |

(10) **(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] Date: 1-2-94

MWC Number: 10098

(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] Date: 1-2-94

MWC Number: 10096
STATE OF OREGON
MONITORING WELL REPORT
(As required by GRS 337.765 & OAR 646-240-005)

(1) OWNER/PROJECT:  
Name: Nokomis Gold  
Well NO: 145-6

(2) TYPE OF WORK:  
[ ] New construction  [ ] Repair  [ ] Recondition  
[ ] Conversion  [ ] Deepening  [ ] Abandonment

(3) DRILLING METHOD:  
[ ] Rotary Air  [ ] Rotary Mud  [ ] Cable  
[ ] Hollow Stem Auger  [ ] Other

(4) BORE HOLE CONSTRUCTION

Special Standards  [ ] Yes  [ ] No  
Depth of completed well: 36 ft.

(5) WELL TEST:

[ ] Pump  [ ] Bailer  [ ] Air  [ ] Flowing Artesian

Permeability:  PH:  
Yield: GPM

Conductivity:  F/T:  
Temperature of water: F/T:  
Depth artesian flow found:  ft.

Was water analysis done?  [ ] Yes  [ ] No

By whom?  
Depth of strata to be analyzed: From  ft. to  ft.

Remarks: Not Just no measurable water

Name of supervising Geologist/Engineer: Mike Pappalardo

(6) LOCATION OF WELL By legal description

Well Location: County: Malheur  
Township: 22S  
Range: 6E  
Section: 6

1. SE 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:

Water level: 23 ft. below land surface.

Date: 10/04/93

(8) WATER BEARING ZONES:

Depth at which water was first found

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Est. Flow Rate</th>
<th>SWL</th>
</tr>
</thead>
</table>

(9) WELL LOG:

Ground elevation:  

<table>
<thead>
<tr>
<th>Material</th>
<th>From</th>
<th>To</th>
<th>SWL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Sandy siltstone medium</td>
<td>tan brown</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Silty sandstone medium</td>
<td>brown silt green</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Rine friable</td>
<td>Sandstone silty olive</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Brown</td>
<td>26.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clayey sandstone med.</td>
<td>26.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gray brown</td>
<td>Sandstone medium gray</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Brown</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Siltstone dark gray</td>
<td>Clayey siltstone med</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Gray gray</td>
<td>dark gray</td>
<td>37</td>
<td></td>
</tr>
</tbody>
</table>

Date started: 10/03/93  
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:  Date:  MWC Number:  

(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:  Date:  MWC Number:  
STATE OF OREGON
MONITORING WELL REPORT
(as required by ORS 537.765 & OAR 690-240-0395)

(1) LAND OWNER
Owner Well I.D. GMW-17-31
First Name ___________________ Last Name ___________________
Company CALICO RESOURCES USA CORP.
Address P.O. BOX Q
City VALE State OR Zip 97918

(2) TYPE OF WORK
[ ] New [ ] Deepening [ ] Conversion
[ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD
[ ] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Hollow Stem Auger [ ] Cable Mud
[ ] Reverse Rotary [ ] Other

(4) CONSTRUCTION
Piezometer Well [ ] Special Standard [ ]
MONUMENT/VAULT
From _____ To _____
Bore Hole Diameter _____ From _____ To _____
Casing Dia. _____ From _____ To _____
Gauge _____ Material [ ]Steel [ ] Plastic [ ]
LINER Dia. _____ From _____ To _____
Gauge _____ Material [ ]Steel [ ] Plastic [ ]
SEAL
From _____ To _____
Material Bentonite Chips
Amount _____ Sacks [ ] Grout weight ______________
SCREEN
Casing/Liner Material [ ] PVC
Diameter _____ From _____ To _____
Slot Size 0.020
FILTER Material SAND SEAL Size of pack 20/40

(5) WELL TESTS
[ ] Pump [ ] Bailer [ ] Air [ ] Flowing Artesian
Yield gal/min __________ Drawdown __________ Drill stem/Pump depth __________ Duration (hr) __________
Temperature °F Lab analysis [ ] Yes [ ] By __________
Supervising Geologist/Engineer SPF Water Engineering
Water quality concerns? [ ] Yes (describe below)
From __________ To __________ Description __________ Amount __________ Units __________

(6) LOCATION OF WELL (legal description)
County MALHEUR Tax 22.06 S Range 44.00 E
Sec 1/4 of the NW 1/4 Tax Lot 100
Lot __________
Lat __________ DMS or DD
Long __________ DMS or DD
Street address of well __________
Nearest address __________

(7) STATIC WATER LEVEL
Date SWL(ps) + SWL(ft)
Existing Well/Predeepening __________ __________
Completed Well __________ __________
Flowing Artesian? [ ] Dry Hole? [ ]

(8) WELL LOG
Ground Elevation 3711.00
Material From __________ To __________
soft brown clay-top soil 0 __________
brown decomposed sand & gravel 3 __________
soft light brown sandstone 8 __________
hard green sandstone 17 __________
med. hard green sandstone 22 __________
hard green sandstone 28 __________
soft orange sandstone 41 __________
soft red sandstone 47 __________
sticky red clay 55 __________
soft red clay same white clay strips 60 __________
hard dark red strips of claystone 82 __________
soft red & white clay 107 __________
soft tan & red clay 122 __________
med. hard red claystone 142 __________
hard grey sandstone 147 __________
med. hard orange, tan & red claystone 157 __________
hard red yellow claystone 177 __________
soft red clay 197 __________
broken black basalt 202 __________

Date Started 8/1/2017 Completed 11/30/2017

(1) Monitor Well Constructor Certification
I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon monitoring well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
License Number 1896 Date 12/14/2017
Password: [if filing electronically]

(2) Monitor Well Constructor Certification
I accept responsibility for the construction, deepening, 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 monitoring well construction standards. This report is true to the best of my knowledge and belief.
License Number 1899 Date 12/14/2017
Password: [if filing electronically]

Form Version: 2018-01-01
### (4) CONSTRUCTION

**BORE HOLE**
<table>
<thead>
<tr>
<th>Dia</th>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>98</td>
<td>520</td>
</tr>
</tbody>
</table>

**FILTER PACK**
<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Material</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>455</td>
<td>499</td>
<td>SILICA SAND 5/12</td>
<td></td>
</tr>
</tbody>
</table>

**SEAL**
<table>
<thead>
<tr>
<th>Material</th>
<th>From</th>
<th>To</th>
<th>Amt</th>
<th>lbs</th>
<th>weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS</td>
<td>0</td>
<td>453</td>
<td>200</td>
<td>S</td>
<td>14.1</td>
</tr>
<tr>
<td>Cement</td>
<td>38</td>
<td>98</td>
<td>41</td>
<td>S</td>
<td>15.6</td>
</tr>
<tr>
<td>Cement</td>
<td>499</td>
<td>520</td>
<td>9</td>
<td>S</td>
<td>15.6</td>
</tr>
</tbody>
</table>

### (7) STATIC WATER LEVEL

**Water Bearing Zones**
<table>
<thead>
<tr>
<th>SWL Date</th>
<th>From</th>
<th>To</th>
<th>Est Flow</th>
<th>SWL (psig)</th>
<th>SWL (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

### (8) WELL LOG

**Material**
<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>212</td>
<td>217</td>
</tr>
<tr>
<td>217</td>
<td>242</td>
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<td>481</td>
<td>498</td>
</tr>
<tr>
<td>498</td>
<td>520</td>
</tr>
</tbody>
</table>

### (5) WELL TESTS

<table>
<thead>
<tr>
<th>Yield gal/min</th>
<th>Drawdown</th>
<th>Drill stem/Pump depth</th>
<th>Duration (hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### (6) WATER QUALITY CONCERNS

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Description</th>
<th>Amount</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6" x 5' MONUMENT COVER
TOP OF PVC TO BOTTOM - 225.3'
2' SLIP CAP
2' x 2' x 3" CONC. PAD

CEMENT/BENTONITE GROUT MIX
2" BLANK SCH 40 PVC

BENTONITE GROUT
2" BLANK SCH 80 PVC

100 lbs. BENTONITE CHIPS
No. 8-12 SILICA SAND PACK
CENTRALIZER(TYP.)
2" .010" SLOT SCREEN SCH 80
2" BOTTOM PLUG

ATLAS PRECIOUS METALS, GRASSY MTN. PROJECT
MONITOR WELL GW-5
STATE OF OREGON
MONITORING WELL REPORT
(As required by ORS 537.765 & OAR 690-240-095)
WATER RESOURCES DEPT.
SALEM, OREGON

59760

(1) OWNER/PROJECT:

Newmont Gold

WELL NO. TW-1

(2) TYPE OF WORK:

X New Construction  Repair
Conversion  Recondition
Deepening  Abandonment

(3) DRILLING METHOD:

X Rotary Air  Rotary Mud
Rotary Stem Aug.  Other

(4) BORE HOLE CONSTRUCTION

Special Standards  Yes  No
Depth completed well  203 ft.

(5) WELL TEST:

X Pump  Air
Basalt  Flowing Artesian
Punctureability  Yield  45 GPM
Conductivity
Temperature of water  60°F
Depth of strata to be analyzed.
By whom?
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
4. ATTACH MAP WITH LOCATION IDENTIFIED.

(7) STATIC WATER LEVEL:

88 Feet below land surface.  Date  October 11, 1993
Artsian Pressure

(8) WATER BEARING ZONES:

Depth at which was first found

From  To  Estimated Flow Rate  SWL

160  205  45-50  88

(9) WELL LOG:

Material  From  To  SWL
Alluvial silt with basalt float
Silstone, brown, with basalt pebbles
Silstone, Brown
Silstone, Brown, with basalt cobbles
Silstone, brown w/ increasing basalt
Basalt, Red w/ 40% brown silstone
Basalt, Red and Black, vesicular, fine grained
Basalt, vesicular w/cleat in vesicles
Basalt w/increased oxidation
Basalt w/20% clays

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 Oregon well construction
standards. Materials used and information reported above are true to the
best knowledge and belief.
Signed  MWC Number  100398  Date

 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  MWC Number  100396  Date
(1) OWNER/PROJECT:
Name: Newmont Gold
Address: 318 A Street
City: West Vale
State: OR
Zip: 97918

(2) TYPE OF WORK:
- [ ] New construction
- [x] Repair
- [ ] Recondition
- [ ] Conversion
- [ ] Deepening
- [ ] Abandonment

(3) DRILLING METHOD:
- [x] Rotary Air
- [ ] Hollow Stem Auger
- [ ] Rotary Mud
- [ ] Cable
- [ ] Other

(4) BORE HOLE CONSTRUCTION:
- Special Standards: [ ] Yes  [x] No
- Depth of completed well: 118 ft.

(5) WELL TEST:
- Pump: [ ]
- Bailer: [ ]
- Air: [ ]
- Flowing Artesian: [x]
- Permeability: -
- Yield: -
- GPM: -
- Conductivity: -
- PH: -
- Temperature of water: 51.6°F
- Depth artesian flow found: - ft.
- Was water analysis done: [ ] Yes  [x] 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: - lbq. in.

(8) WATER BEARING ZONES:
- Depth at which water was first found: 100

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Est. Flow Rate</th>
<th>SWL</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>120</td>
<td>60</td>
<td>88</td>
</tr>
</tbody>
</table>

(9) WELL LOG:
- Ground elevation

<table>
<thead>
<tr>
<th>Material</th>
<th>From</th>
<th>To</th>
<th>SWL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluvian silt &amp; cobbles</td>
<td>0</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Clayey siltstone brn</td>
<td>13</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Siltstone brown</td>
<td>15</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Clayey siltstone brn</td>
<td>36</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Siltstone with basalts</td>
<td>65</td>
<td>70</td>
<td></td>
</tr>
<tr>
<td>Basalt with some</td>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Siltstone</td>
<td>70</td>
<td></td>
<td>72.5</td>
</tr>
<tr>
<td>Basalt</td>
<td>72.5</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>Basalt with some</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcite filling</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vesicles</td>
<td></td>
<td>92</td>
<td></td>
</tr>
<tr>
<td>Basalt with fractures</td>
<td>92</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>Basalt with clay seams</td>
<td>105</td>
<td>120</td>
<td></td>
</tr>
</tbody>
</table>

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 of my knowledge and belief.
Signed: [Name] MWC Number: 10058
Date: 11/2/94

(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: [Name] MWC Number: 10096
Date: 11/2/94
STATE OF OREGON
MONITORING WELL REPORT
WATER RESOURCES DEPT., SALEM, OREGON

(1) OWNER/PROJECT:
Name: Newmont Gold
Address: 318 A. Street
City: West Vale

(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
Depth completed well: 207 ft.

- Protective casing
- Locking Cap
- Protective post
- Cement Monument
- Casing diameter: 4 in.
- 4 PVC
- Welded
- Threaded
- Glued
- Liner Diameter: 3 in.
- Liner material
- Welded
- Threaded
- Glued
- Well Seal Material: Cement-bond
- Amount: 35
- Bentonite plug >2 ft. thick
- Screen Material: PVC
- Interval(s):
  - From: 146
  - To: 206
- Slot Size: .020 in.
- Filter Pack: Colorado Silica
- Size: 10-20 in.

(5) WELL TEST:
☐ Pump
☐ Bailer
☐ Air
☐ Flowing Artesian
Permeability
Yield
GPM
Conductivity
pH
Temperature of water: 52°F
Depth artesian flow found:
Was water analysis done?: Yes
☐ No
By whom?:
Depth of strata to be analyzed. From:
To:
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. SE
2. Street address of well location: GRASSY MOUNTAIN VALE, OREGON
3. Tax lot number of well location: N/A

(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

(9) WELL LOG
Ground elevation
Material
Brown silt and clayey silt
Brown silstone with basalt
Brown silstone with cobbles
Brown silstone with some
some claystone
Basalt weathered and
fractured
Basalt, very weathered
Basalt
From
To
SWL
0 9
9 27
27 137
137 156
156 165
165 207

[monitor well contractor certification statements]

MWC Number: 10098
Signed: [signature]
Date: 11-12-94

MWC Number: 10098
Signed: [signature]
Date: 1-12-94
(1) OWNER:
Name: Atlas Precious Metals Inc.
Address: 318 A St
City: Vale
State: OR
Zip: 97888

(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: [ ] None
Amount: 

(6) SEASON:
Season: [ ] Winter
[ ] Summer
[ ] Spring
[ ] Fall

(7) PERFORATIONS/SCREENS:
[ ] Perforations Method:
[ ] Screens
Type: [ ] Wired
[ ] Wound
Material: [ ] Low Carbon

(8) WELL TESTS: Minimum testing time is 1 hour
[ ] Pump
[ ] Galv./min
[ ] Drawdown
[ ] Drill stem at
[ ] Temperature of water

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Slot size</th>
<th>Number</th>
<th>Diameter</th>
<th>Telepipe size</th>
<th>Casing</th>
<th>Liner</th>
</tr>
</thead>
<tbody>
<tr>
<td>350</td>
<td>400</td>
<td>0.250</td>
<td>1,050</td>
<td>6&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>420</td>
<td>0.150</td>
<td>1,030</td>
<td>6&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(9) LOCATION OF WELL by legal description:
County: Marion
Latitude: [ ] North
[ ] South
Longitude: [ ] East
[ ] West

Township: 24 S
[ ] North or South
[ ] Range: 44 E
[ ] East or West
[ ] Section: 8 NE 1/4

Street Address of Well (or nearest address):

(10) STATIC WATER LEVEL:
Artesian pressure: 52 ft. below land surface.
Date: 12/6/89

(11) WATER BEARING ZONES:
Depth at which water was first found:
From | To | Estimated Flow Rate | SWL
---|---|---------------------|---
320 | 340 | 20
400 | 420 | 20

(12) WELL LOG:
Final location of shot(s): [ ] None

Material: [ ] Soil
[ ] Clay
[ ] Basalt
[ ] Brown Clay
[ ] Siltstone

Material:

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>SWL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>2.8</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>6.6</td>
<td>13.5</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>173</td>
<td></td>
</tr>
<tr>
<td>173</td>
<td>170</td>
<td></td>
</tr>
<tr>
<td>315</td>
<td>323</td>
<td></td>
</tr>
<tr>
<td>323</td>
<td>340</td>
<td></td>
</tr>
<tr>
<td>340</td>
<td>395</td>
<td></td>
</tr>
<tr>
<td>395</td>
<td>406</td>
<td></td>
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<td>406</td>
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<td>441</td>
<td>471</td>
<td></td>
</tr>
<tr>
<td>471</td>
<td>555</td>
<td></td>
</tr>
</tbody>
</table>

Date started: 12/7/89
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.

WPC Number: 297

(Signed) 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.

WPC Number: 297

(Signed) Date: 12/1/89

WPC Number: 297

(Signed) Date: 12/1/89
STATE OF OREGON
WATER WELL REPORT
(as required by ORS 537.765)

(1) OWNER:
Name: Atlas Precious Metals
Address: 2025 Century Way
City: Boise

(2) TYPE OF WORK:
☑ New Well ☐ Deconcentric ☐ 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: ☑ Other ☐ Monitored
Amount

<table>
<thead>
<tr>
<th>Diameter</th>
<th>From</th>
<th>To</th>
<th>Material</th>
<th>From</th>
<th>To</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>12&quot;</td>
<td>160</td>
<td>122</td>
<td>Colos, Sand</td>
<td>160</td>
<td>122</td>
<td>9 sacks</td>
</tr>
<tr>
<td>12&quot; +1</td>
<td>115</td>
<td>115</td>
<td>Enviro Plug</td>
<td>122</td>
<td>115</td>
<td>2 sacks</td>
</tr>
<tr>
<td>115 +1</td>
<td>115</td>
<td>115</td>
<td>cement grout</td>
<td>115</td>
<td>115</td>
<td>432 sacks</td>
</tr>
</tbody>
</table>

Backfill placed to:
Gravel placed to:

(6) CASING/LINER:
Casing: Diameter 12": +2 | 8 | 250 |
Steel |
Plastic |
Welded |
Threaded |
Liner:

Final location of shoe(s):
no shoe screw on plug

(7) PERFORATIONS/SCREENS:
From | To | Slot size | Diameter | Telepipe 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 ☐ Artesian Flowing
Yield gal/min: 60
Drawdown: NA
Drill stem at Time: 1 hr.

Temperature of water: NA
Depth Artesian Flow Found: 140

Was a water analysis done? ☐ Yes ☐ No
By whom:

Did any strata contain water not suitable for intended use? ☐ Yes ☐ No
☐ Too Little
☐ Salty ☐ Moody ☐ Odor ☐ Colored ☐ Other

Street Address of Well (or nearest address): NA

(9) LOCATION OF WELL by legal description:
County: Malheur
Township: 22S N or S, Range: 44E E or W, WM.
Section: 17 NW 1/4 NW 1/4
Tax Lot: 0 Lot: 0 Block: 0 Subdivision: NA

(10) STATIC WATER LEVEL:
49 ft. below land surface.
Date: 1/21/89
Artesian pressure: na lb. per square inch.
Date: 1/21/89

(11) WATER BEARING ZONES:

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Estimated Flow Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>140</td>
<td>160</td>
<td>60</td>
</tr>
</tbody>
</table>

(12) WELL LOG:
Ground elevation: 3698

<table>
<thead>
<tr>
<th>Material</th>
<th>From</th>
<th>To</th>
<th>SWL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown Clay</td>
<td>0</td>
<td>35</td>
<td>0</td>
</tr>
<tr>
<td>Brown clay w/gravelly sand</td>
<td>35</td>
<td>56</td>
<td>0</td>
</tr>
<tr>
<td>Blue Clay</td>
<td>56</td>
<td>122</td>
<td>0</td>
</tr>
<tr>
<td>Blue Clay &amp; Gravel</td>
<td>122</td>
<td>140</td>
<td>3</td>
</tr>
<tr>
<td>Gravel</td>
<td>140</td>
<td>160</td>
<td>49</td>
</tr>
</tbody>
</table>

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. Cody
WWC Number: 202
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. Cody
WWC Number: 383
Date: 2-13-89

ORIGINAL & FIRST COPY - WATER RESOURCES DEPARTMENT
SECOND COPY - CONSTRUCTOR
THIRD COPY - CUSTOMER
98393 3/88