GOLDEN
MINERALS COMPANY

Rodeo Project

Technical Report Summary

Rodeo, Durango, Mexico

March 2023

Project No. 117-8133006

TETRA TECH

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PRESENTED TO

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This report titled “S-K 1300 Rodeo Project Technical Report Summary, Durango Mexico” is current as of December 31, 2022 and was prepared and signed by Tetra Tech

Dated March 22, 2023

(Signed and sealed)
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TETRA TECH

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ACRONYMS & ABBREVIATIONS

3D	Three dimensional
Ag	Silver
Au	Gold
CAPEX	Capital expenditures
cm	Centimeter
cu ft	Cubic feet
ft	Feet
g/t	Grams/tonne
HP	Horsepower
IDW	Inverse distanced weighted
in	Inch
IRR	Internal rate of return
k	Thousand
kg	Kilogram
km	Kilometer
kt	Thousand tonnes
LOM	Life of mine
m	Meter
M	Million
MI	Measured and Indicated
MII	Measured, Indicated, and Inferred
mm	Millimeters
Mt	Million tonnes
MXN	Mexican Pesos
mya	Million years ago
NPV	Net present value
NSR	Net smelter return
OPEX	Operating expenditure
oz	Troy ounce
QA/QC	Quality assurance/quality control
QP	Qualified Person
SEMARNAT	Secretaria del Medio Ambiente y Recursos Naturales
t	Tonnes
tpd	Tonnes per day
tpy	Tonnes per year
TRS	Technical Report Summary
TSF	Tailings storage facility
USD	United States dollars
yd	Yard
yr	year

1. EXECUTIVE SUMMARY

This Technical Report Summary (TRS) is prepared for Golden Minerals Company (Golden Minerals) to report Mineral Resources for the Rodeo Project (the Project) located in Rodeo, Durango Mexico. The purpose of this report is to summarize the results of an Initial Assessment for the property as defined under the U.S. Securities and Exchange Commission's Regulation S-K 1300.

1.1 Property Description and Ownership

The Rodeo Project is located 2 km east of the town of Rodeo in Durango State, Mexico, at latitude 25°09'3.3"N, longitude 104°31'3.3"W (WGS84) as shown in **Figure 1-1**. Full services are available in the large regional cities of Torreón (189 km to the east) and Durango (157 km to the south), with basic amenities available in the town of Rodeo.

Figure 1-1: Rodeo Project location map

The Project consists of an open pit mine that is held by Minera de Cordilleras S.A. de R.L. de C.V. (Minera Cordilleras), and an oxide processing plant (Plant 2) that is held by Minera William S.A. de R.L. de C.V. (Minera William). Both Minera Cordilleras and Minera William are wholly owned subsidiaries of Golden Minerals.

The Project contains two mineral concessions totaling 1,865.7 hectares. The Rodeo R1 concession is held under a purchase agreement subject to royalty payments with La Cuesta International S.A. de C.V., a wholly owned subsidiary of La Cuesta International, Inc. (La Cuesta). The Rodeo 2 concession was purchased by Minera

Cordilleras from Rojo Resources and is wholly owned by Golden Minerals. Surface rights to the concessions are held by ejidos (rural agricultural co-operatives) and private landowners. Access to the concession areas is through surface rights agreements with the Francisco Márquez Ejido and the private owner of the Rancho La Pequeña. These agreements were formalized before a notary and are in good standing.

1.2 Geology and Mineralization

The Rodeo concessions lie on the eastern boundary of the Sierra Madre Occidental, a dissected volcanic plateau elongated in a NNW direction. It is approximately 1,200 km long with an average altitude of approximately 2,000 m above sea level. The geology of the Sierra Madre Occidental is divided into two principal volcanic groups:

- **Upper Volcanic Supergroup** (27-34 mya): Rhyolitic and rhyodacitic ignimbrites, caldera complex with associated high level intrusives, minor andesites, and mafic lavas
- **Lower Volcanic Complex** (45-100 mya): Andesitic to rhyolitic extrusives, intruded by batholithic complexes

The formation of these volcanic complexes can be related to late Mesozoic and Tertiary subduction processes along the Middle America Trench. The dominant structural event affecting these rocks, particularly the Upper Volcanic Supergroup, is a tensional one, possibly coeval with the spreading episode which was opening the Gulf of California to the Northwest. This event led to the formation of a complex of normal faults within and on the margins of the volcanics. Displacements on these faults is never very great, particularly on the eastern margin of the Sierra Madre Occidental, but tilting of structural blocks was extensive. Wedges of coarse clastic rocks now fill the associated half grabens. A number of these faults have been the loci of possible late-stage volcanic alteration/silicification/mineralization events which are the targets for exploration efforts.

The immediate Rodeo deposit area is approximately 300 m along strike and 200 m wide and extends to a depth of 200 m below surface. The deposit strikes at 330° and dips to the ENE with various vein phases dipping from sub-vertical to 30°. The deposit is entirely hosted within Tertiary Rodeo volcanics, which are strongly silicified and brecciated. The deposit is bound to the east by the Rodeo Fault, however drilling to date has not demonstrated that the deposit reaches or is truncated by the fault. Along strike to the north and south, the mineralization is offset slightly by near vertical faulting; mineralization does not terminate at these faults, but the intensity of the trend is either diminished or has yet to be located.

Mineralization at the deposit is epithermal low-sulfidation (quartz-adularia) type. Although very little mineralization is hosted in or centered on the Rodeo Fault itself, it is likely the fault played a role as a pathway at depth for the Rodeo deposit. Quartz veins 15 m or greater in width have been located throughout the property. The high-grade Au mineralization appears limited to a distinctive veining event. Evidence of ancillary veining events pre- and post-dating the high-grade event carry low-grade to anomalous level of Au mineralization.

1.3 Property Status

The Rodeo mine is operating without reported Mineral Reserves. Material from the mine is hauled to Plant 2 in Velardeña, Durango, Mexico for processing in an agitated leach/Merrill-Crowe circuit to produce Au-Ag doré bars. Exploration by Golden Minerals includes a 2016 drilling campaign totaling 14 holes and 2,083.7 m. Golden Minerals also performed regional mapping sampling, metallurgical test work on the mineralization, and completed a Mineral Resource Estimate technical report on the deposit.

In 2019, Golden Minerals conducted a regional mapping and sampling program that identified additional exploration targets and received permits to conduct a Resource definition program at Rodeo totaling 35 holes and 1,414 meters in 2020, as well as a second Resource definition drilling and exploration campaign in 2021 that

totaled 82 holes and 5,648 meters. Mining from the Rodeo open pit began December 2020 and doré production from Plant 2 began in January 2021.

1.4 Mineral Resource Estimates

Mineral Resources were calculated with an effective date of December 31, 2022. The Resources are reported at a cutoff of 1.0 g/t Au for stockpiling and 1.45 g/t Au for processing. Reported Resources are constrained within an open pit mine design using the 1.0 g/t Au cutoff grade and are shown in **Table 1-1**.

Table 1-1: Estimated Rodeo Resources for stockpile and processing

Classification	Cutoff Au (g/t)	Tonnes	Au (g/t)	Au (oz)	Ag (g/t)	Ag (oz)
Low-Grade (Stockpile)						
Measured	1.0	79,600	1.20	3,100	11.69	29,900
Indicated	1.0	11,400	1.18	400	4.82	1,800
Measured + Indicated	1.0	91,000	1.20	3,500	10.83	31,700
High-Grade						
Measured	1.45	88,300	2.55	7,200	17.56	49,900
Indicated	1.45	18,000	3.21	1,900	11.00	6,400
Measured + Indicated	1.45	106,300	2.66	9,100	16.45	56,200

** Columns may not total due to rounding*

1.5 Mineral Reserve Estimates

Mineral Reserves have not been estimated for the Rodeo Project.

1.6 Capital and Operating Costs

Capital and operating costs have not been estimated as part of this Initial Assessment.

1.7 Economic Analysis

An economic analysis has not been performed for this Initial Assessment of the Rodeo Project.

1.8 Permitting Requirements

The Rodeo Project began operations in 2021. To comply with applicable federal, state, and municipal laws and regulations regarding environmental protection and mining operations, Golden Minerals reports that it holds and/or has applied for the permits, agreements, and other instruments required by law. Details of the permits obtained for the Project are available in **Section 17.3**.

1.9 Conclusions and Recommendations

1.9.1 Geology & Resources

The author has reviewed the Resource model for the Rodeo deposit estimated by Golden Minerals staff. The inputs, parameters, and estimation results are within industry best practices. The estimation, classification, and reporting of the Resources constrained by the mine design are conservative in nature. Production data validates the previous drilling and Resource estimates.

1.9.2 Mining

Open pit surface mining is performed at the Rodeo site using a diesel excavator and over highway trucks to transport the mineralized material to the processing plant at the company's Velardeña property. Mine production averages 1,800 tpd of total movement and the pit has an expected mine life of six months. Tetra Tech has reviewed the mine plan created by Golden Minerals staff and finds it to be within industry best practices. The pit parameters are considered to be conservative in nature.

Golden Minerals plans to process the stockpiled low-grade material after the high-grade Resource is mined out. This material has not been included in the economic analysis for this study.

1.9.3 Metallurgy and Processing

The metallurgical report prepared by Resource Development Inc. (RDi) for the Rodeo Project provided data sufficient for use in this TRS. Golden Minerals demonstrated recovery of gold and silver approaching that achieved in the RDi studies from processing Rodeo mineralized material at Plant 2. Installation and commissioning of an additional ball mill circuit in April 2021 provided the ability to process harder material at a rate of 520 tpd or more.

The tailings pond at Plant 2 was expanded in 2019 providing capacity for the storage of the Rodeo Project's tailings. Golden Minerals has a permit that will allow further expansion of the pond if required.

1.9.4 Environmental Permitting

Tetra Tech has reviewed the available information on permits, agreements, and environmental aspects. Based on this information, the author does not know of any outstanding issues on this regard that will affect the current operations or mine life.

1.9.5 Significant Risk Factors

The mine is operating and selling a product at a demonstrated profit and has a relatively short mine life. These factors reduce some of the significant risk factors for the Project. Risks include changes in agreements with landowners for access, mining, and water use.

2. INTRODUCTION

This Technical Report Summary (TRS) is prepared for Golden Minerals Company (Golden Minerals) to report Mineral Resources for the Rodeo Project (the Project) in Rodeo, Durango, Mexico. The Project contains an open pit mine that is held by Minera de Cordilleras S.A. de R.L. de C.V. (Minera Cordilleras), and an existing oxide processing plant (Plant 2) that is held by Minera William S.A. de R.L. de C.V. Both Minera Cordilleras and Minera William are wholly owned Mexican subsidiaries of Golden Minerals. The purpose of this report is to summarize the results of an Initial Assessment for the property as defined under the U.S. Securities and Exchange Commission's Regulation S-K 1300.

All references to dollars in this report are US dollars (USD) unless otherwise noted. Distances, areas, volumes, and masses are expressed using metric units unless indicated otherwise. All tonnages are in tonnes (1,000 kilograms), precious metal grade values are reported in grams per tonne (g/t), and precious metal quantities are presented as troy ounces (oz).

Golden Minerals is a Delaware corporation based in Golden, Colorado, USA, and its shares are listed on the New York Stock Exchange and the Toronto Stock Exchange under the symbol AUMN.

2.1 Sources of Information

This TRS summarizes the information contained in the Canadian National Instrument 43-101 compliant Preliminary Economic Assessment/Initial Assessment level report *Preliminary Economic Assessment Update, Rodeo Project, Rodeo, Durango, Mexico* prepared by Tetra Tech, with an effective date of December 31, 2022. Additional sources of information include materials and comments provided to Tetra Tech by Golden Minerals personnel as described in **Section 25** and previous NI 43-101 compliant technical reports.

2.2 Site Inspection

Dr. Guillermo Dante Ramírez-Rodríguez and Ms. Kira Johnson performed a site inspection January 18–21, 2022. During the inspection, they visited the Rodeo open pit mine, stockpiles, waste dumps, assay laboratory, and the processing plant. Mr. Randolph P. Schneider visited the plant in December 2019.

3. PROPERTY DESCRIPTION

The Rodeo Project is located 2 km east of the town of Rodeo in Durango State, Mexico, at latitude 25°09'3.3"N, longitude 104°31'3.3"W (WGS84) as shown in **Figure 3-1**. Full services are available in the large regional cities of Torreón (189 km to the east) and Durango (157 km to the south), with basic amenities available in the town of Rodeo.

Figure 3-1: Rodeo Project location map

3.1 Mineral Tenure

The property contains two mineral concessions totaling 1,865.7 hectares. The Rodeo R1 concession is held under an exploration agreement subject to advanced and actual royalty payments to La Cuesta International, S.A. de C.V., a wholly owned subsidiary of La Cuesta International, Inc. (La Cuesta). On commencement of commercial production, La Cuesta is entitled to a 2% NSR royalty from production. Once five million dollars have been paid under the agreement, the royalty reduces to 1%. The Rodeo 2 concession was purchased by Minera Cordilleras from Rojo Resources. Golden Minerals reports that it has filed an application with the Public Registry of Mining for an area reduction to 1,344.7 ha in the Rodeo 2 concession that has not yet been processed. The reduced concession boundaries are shown in **Figure 3-2**, and details of the concessions are listed in **Table 3-1**. All concessions are valid and there is no evidence of any lien, encumbrance, burden, or judicial proceeding currently affecting the concessions.

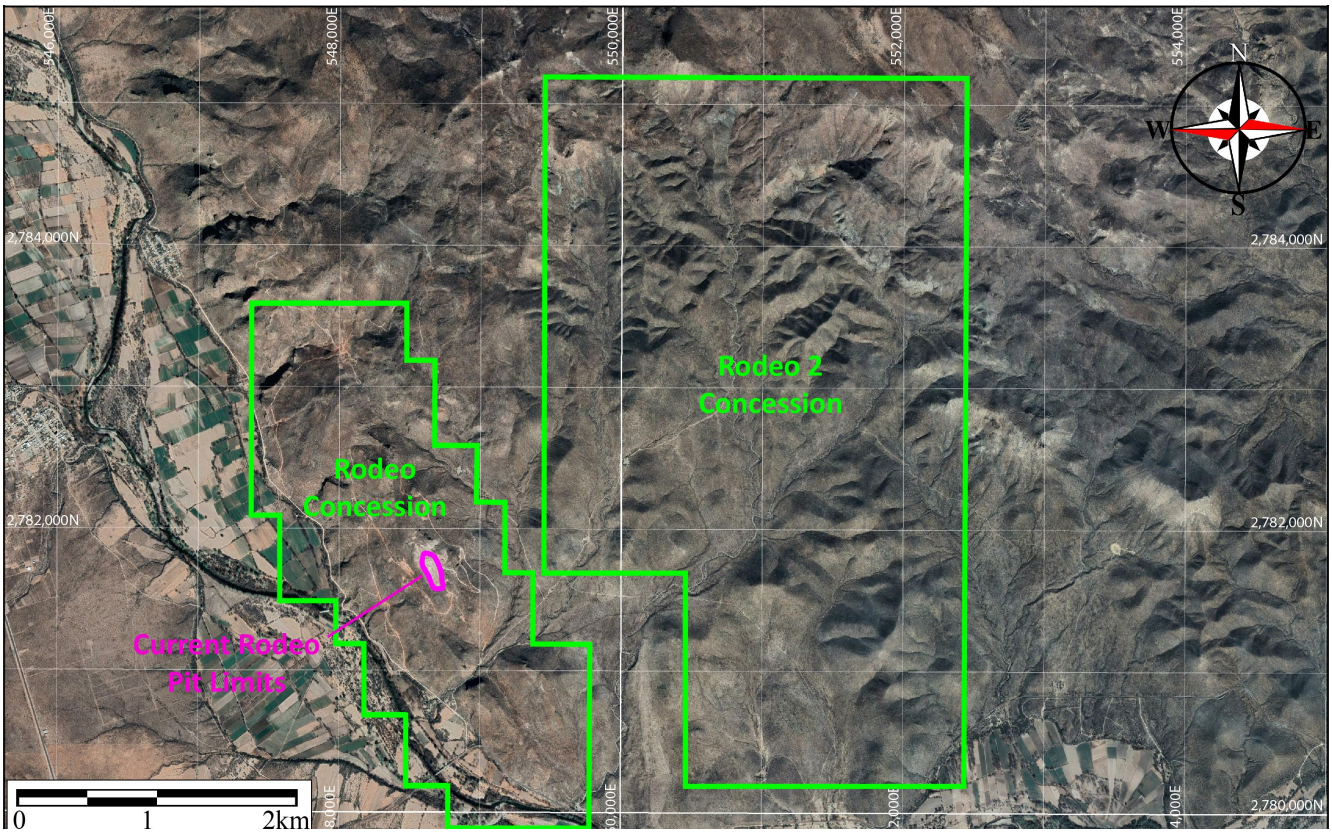

Figure 3-2: Map of mineral concessions

Table 3-1: Rodeo Mineral concessions

	Lot	Holder	Area (ha)	Title	Type of Concession	Term	Location
1	Rodeo R1	La Cuesta International	521.0000	246464	Mining	Sep 17, 2052	Rodeo, Durango
2	Rodeo 2	Minera de Cordilleras	1,344.7345[1]	241666	Mining	Jul 20, 2054	Rodeo, Durango

[1] *Current title shows 2,020.9592 ha; Golden Minerals has applied for a reduction in this concession to 1,344.7 ha.*

3.2 Surface Rights

Surface rights to the concessions are held by ejidos (rural agricultural co-operatives) and private landowners. Access to the concession areas is through surface rights agreements with the Francisco Márquez Ejido and the private owner of the Rancho La Pequeña. These agreements were formalized before a notary and are in good standing.

The surface agreement with the Francisco Márquez Ejido allows Golden Minerals and its authorized contractors the right to access the concessions with equipment and personnel to perform exploration and mining activities. The agreement is dated March 29, 2020 and is valid for ten years.

The surface agreement with the private landowner of the Rancho La Pequeña allows Golden Minerals and its authorized contractors rights of access and to perform mineral exploration, exploitation, and transportation within a 40-ha area. To retain these rights, Golden Minerals has agreed to pay $3,000 per hectare annually to the landowner, plus an additional fixed amount of $120,000 per year. The agreement is dated May 14, 2022 and is valid for ten years.

3.3 Permitting

The Rodeo Project began operations in December 2020. To comply with applicable federal, state, and municipal laws and regulations regarding environmental protection and mining operations, Golden Minerals reports that it holds and/or has applied for the permits, agreements, and other instruments required by law. Details of the required permits for the Project are available in **Section 17.3**.

3.4 Encumbrances

The author is not aware of any encumbrances, violations, or fines affecting the Rodeo Project.

3.5 Other Significant Factors and Risks

The claims are located on the Ejido Francisco Márquez, Ejido Animas, and Rancho La Pequeña (private). Access to the claim block is granted by agreement between the concession holder and the affected landowners. The author is unaware of any significant risk factors that may affect access, title, or right or ability to perform work on the property.

4. ACCESSIBILTY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE, AND PHYSIOGRAPHY

4.1 Topography, Elevation, and Vegetation

The property covers the hills and flatlands bordering the Nazas River valley, within the Mesa Central physiographic region, between the mountain ranges of the Sierra Madre Occidental and the Sierra Madre Oriental. The Nazas River valley is locally bounded to the west by the rugged mountains of the Pilar Sierra de San Francisco and to the east by the rolling hills and rounded mountains of the Pilar Sierra de Nazas. Bedrock exposures are common along ridge crests, road cuts, and drainages. Relief within the property is moderate with elevations ranging from approximately 1,130 m to over 1,800 m above sea level.

Vegetation is dominated by scrub brushes with various types of cacti, maguey, sage, coarse grasses, and yucca also present.

4.2 Access

There is a good network of roads in the region, including paved Mexican National Highways 45 and 34. Gravel roads intersecting the highways provide access to the concessions. The primary access road to the mine intersects Highway 34 and is in good condition for year-round use.

The major cities of Durango (157 km to the south) and Torreón (189 km to the east) have airports that are served by major regional and international carriers.

4.3 Climate

The climate is dry and semi-arid, typical of the high-altitude Mesa Central region. Annual precipitation for the area is approximately 700 mm, mostly during the rainy season in June and July. Temperatures commonly range from 20° to 45°C in the summer and 15° to 0°C in the winter. The climate is suitable for year-round operation.

4.4 Infrastructure

The Nazas River flows year-round and provides a water source for local agricultural operations. Golden Minerals has reached an agreement with the Ejido Francisco Márquez to construct a pump station along the Nazas River to provide water for use at Rodeo. As part of the agreement, Golden Minerals agrees to pay the ejido an annual sum of $14,000 MXN (approximately $675 USD). Power to the mine is provided by diesel generators. Tanks are located on the property for water and diesel storage. The cities of Durango and Torreón have a rich history of mining and are a source of services and supplies required for the project. Basic amenities and services are available in the nearby town of Rodeo. Experienced mining personnel are also available throughout the region. Personnel working at the mine live in the town of Rodeo.

5. HISTORY

Two prospects, called the Los Murciélagos gold-silver-lead-copper prospect and the Francisco Márquez gold-copper prospect, were identified in the vicinity of the Los Murciélagos arroyo on the Rodeo property. Little information is available on these historic prospects other than gold- and silver-bearing mineralization was apparently extracted from short adits driven in sheared and altered rhyolitic volcanic rocks.

Recent exploration work on the Rodeo property was carried out by La Cuesta and Monarch Resources de Mexico, S.A. de C.V. in the 1990s and by Canplats de Mexico, S.A. de C.V., a wholly owned subsidiary of Canplats Resource Corporation Mexico in 2003, 2004 and 2007.

In 2015 the property was acquired by Minera de Cordilleras, a subsidiary of Golden Minerals Company, from La Cuesta International. In 2016, Golden Minerals drilled 14 holes, totaling 2,083.7 m, exploring the NE down-dip continuation of the high-grade mineralization, conducted regional mapping and sampling, and conducted metallurgical test work on the Rodeo mineralization and completed a preliminary assessment report on the deposit.

In 2019 Golden Minerals conducted a regional mapping and sampling program that identified additional exploration targets and received permits to conduct a Resource definition program at Rodeo, which was completed in 2020 and led to the decision to start mining in December 2020. Doré production began in January 2021.

6. GEOLOGICAL SETTING, MINERALIZATION, AND DEPOSIT

6.1 Regional Geology

The Rodeo concessions lie on the eastern boundary of the Sierra Madre Occidental, a dissected volcanic plateau elongated in a north-northwest direction. It is approximately 1,200 km long with an average altitude of approximately 2,000 m above sea level. The geology of the Sierra Madre Occidental is divided into two principal volcanic groups:

- **Upper Volcanic Supergroup** (27-34 Mya): Rhyolitic and rhyodacitic ignimbrites, caldera complex with associated high level intrusives, minor andesites, and mafic lavas
- **Lower Volcanic Complex** (45-100 Mya): Andesitic to rhyolitic extrusives, intruded by batholithic complexes

The formation of these volcanic complexes can be related to late Mesozoic and Tertiary subduction processes along the Middle America Trench. The dominant structural event affecting these rocks, particularly the Upper Volcanic Supergroup, is a tensional one, possibly coeval with the spreading episode which was opening the Gulf of California to the Northwest. This event led to the formation of a complex of normal faults within and on the margins of the volcanics. Displacements on these faults is never very great, particularly on the eastern margin of the Sierra Madre Occidental but tilting of structural blocks was extensive. Wedges of coarse clastic rocks now fill the associated half grabens. A number of these faults have been the loci of possible late-stage volcanic alteration/silicification/mineralization events which are the targets for exploration efforts. **Figure 6-1** shows the stratigraphy of the regional geology.

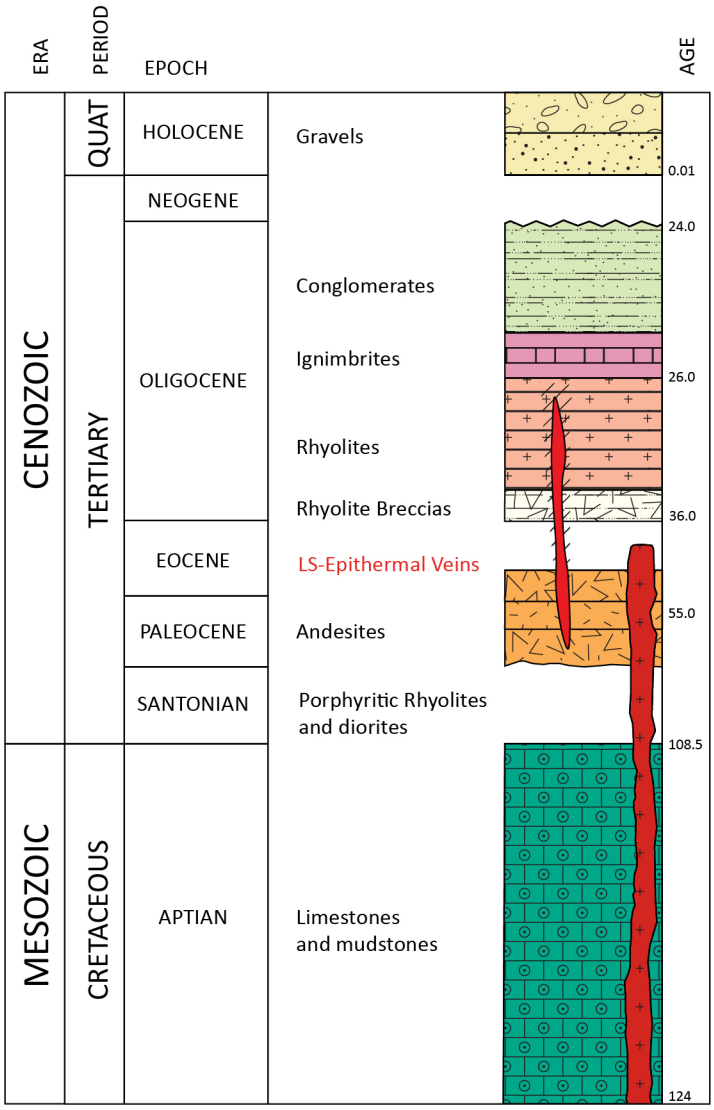

Figure 6-1: Regional geology stratigraphic column

To the east of Rodeo lies the morphotectonic province of the Sierra Madre Oriental. This is largely composed of Mesozoic sedimentary rocks, evolving from a mixed clastic continental and marine succession with minor volcanics in the early part of the era, to platform and basinal carbonates of Cretaceous time. These rocks were subjected to strong compressional tectonism-oriented WSW-ENE at the end of the Cretaceous. Again, this can be related to the subduction of the Cocos Plate beneath the North American Plate. The boundary between the two tectonomorphic provinces, with their highly contrasting regional facies and structural style, is marked by a NNW trending normal fault or complex of faults. On the property that is the subject of this report, the structural trend is expressed by the Rodeo Fault, also known as the Falla Héroes de México.

6.2 Local Geology

Rodeo is located along a major northwest-trending system of basin-and-range normal faults juxtaposing silicified, iron-stained, and locally clay altered Tertiary intermediate-to-felsic volcanic and sub-volcanic rocks against altered, silicified, and brecciated Cretaceous silty limestones and shales. In the southern portion of the property, the Cretaceous rocks are on the NE side of the fault system (footwall) and the volcanic rocks are on

the SW side of the fault system (hanging wall). At the north end of the property, the fault system juxtaposed volcanic rocks against volcanic rocks.

Mapping carried out by Monarch indicated the geology consists primarily of Tertiary (Oligocene?) acidic volcanics to the WSW separated from Mesozoic (Cretaceous?) carbonates by the NNW trending Rodeo Fault. The latter have been ascribed as the Indidura Formation (Durning and Hillemeyer, 1994 & 1995) and the former, while having no strict stratigraphic assignation, are referred as the Rodeo Volcanics.

- **Rodeo Volcanics** (Oligocene? 23-34 mya): Rhyolitic, rhyodacitic and andesitic lithologies; including welded and non-welded (ash flows) tuffs, ash flow breccias to volcanic breccias. Unfolded, dip at low angles (5-15) to West. Systematic and non-systematic joint sets with the dominant trend sub-parallel to the Rodeo Fault, i.e., NNW.
- **Rodeo Fault**: Normal fault, strikes NNW, dips 60-25 degrees WSW.
- **Grupo Mezcalera** (Cretaceous 97.5-124 mya): Thinly interbedded carbonates and clastics, ranging from and gradational between; limestones, argillaceous limestones, calcareous shales to black shales. Possibly interfingered with welded to non-welded tuffs in the northern part of the concession. Recumbent, sub-horizontal tight to isoclinal folds in thinly interbedded limestones and clastic to gently inclined sub-horizontal close chevron folds in more thickly interbedded units. Complex joint systems related to fold geometries. WSW-ENE compression.

Generally, exposure of the Rodeo Volcanics is good, particularly in the East-West oriented arroyos and canyons on the western margin of the concession.

The Rodeo Fault is a normal fault, which locally may vary from a single fracture to a multiple structure, dips at approximately 60° to the WSW shallowing to 25° at depth. In addition to separating rocks of differing ages and origins, the rocks on either side of the Rodeo Fault also belong to different structural regimes.

An overview of the local geology is shown in **Figure 6-2** and **Figure 6-3**.

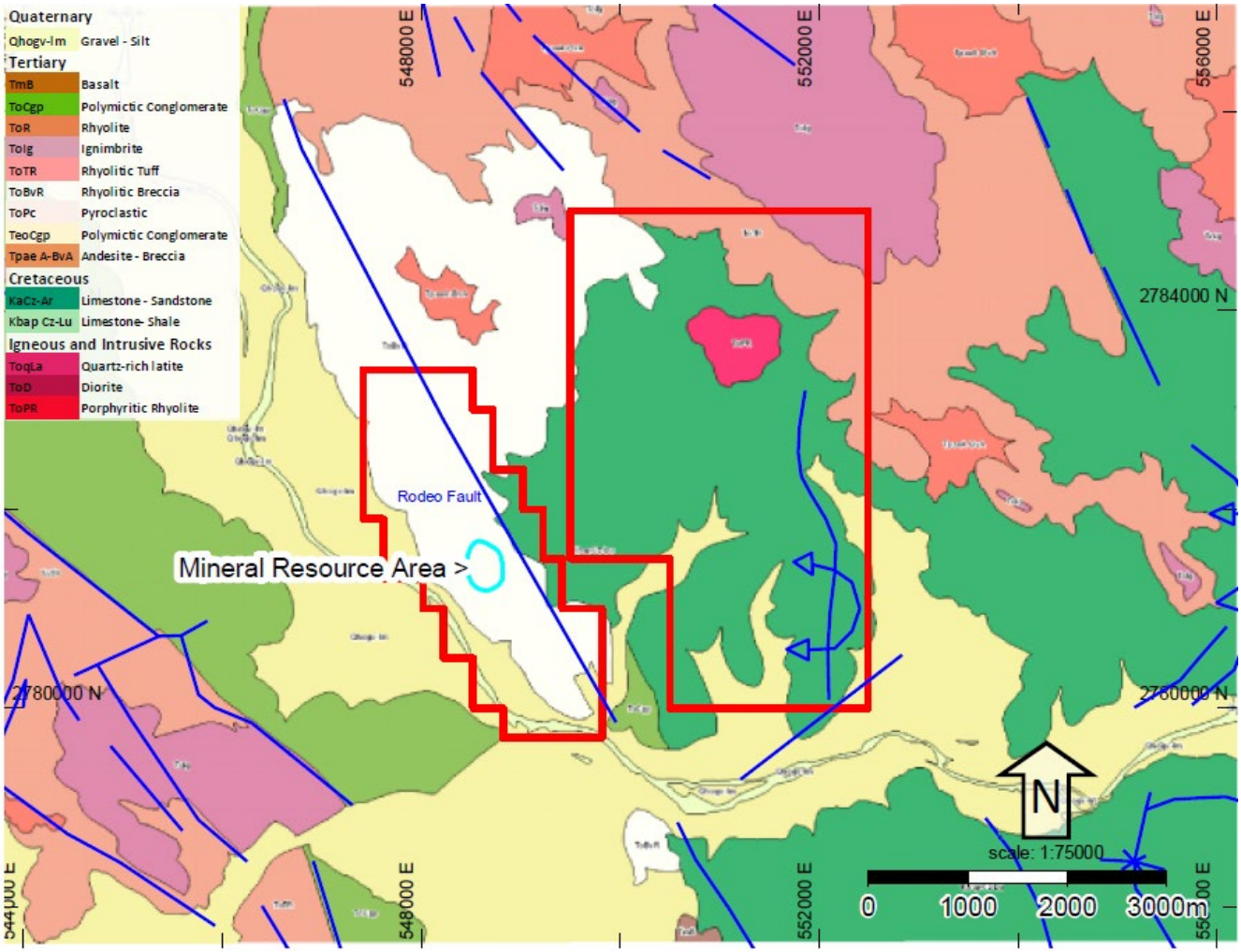

Figure 6-2: Local surface geology (Modified from GSM G13-D42, 2003)

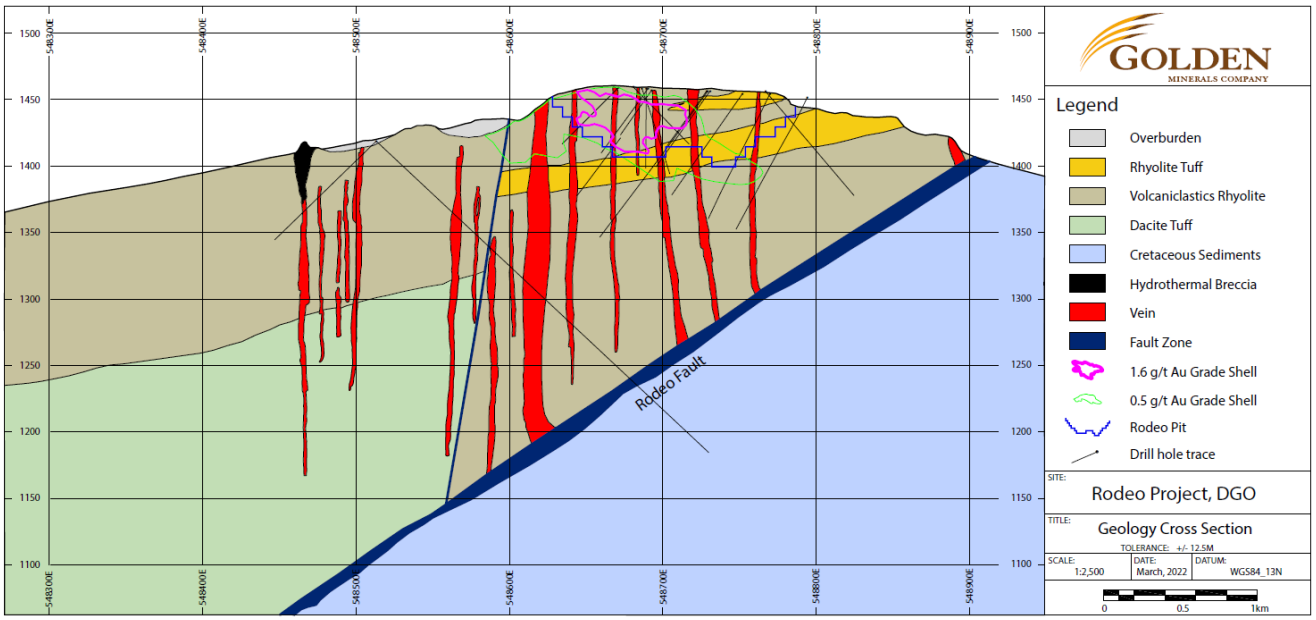

Figure 6-3: Rodeo geology cross-section

6.3 Property Geology

The immediate Rodeo deposit area is approximately 300 m along strike and 200 m wide and extends to a depth of 200 m below surface. The deposit strikes at 330° and dips to the ENE with various vein phases dipping from sub-vertical to 30°. The deposit is entirely hosted within Tertiary Rodeo volcanics that are strongly silicified and brecciated. The deposit is bounded to the east by the Rodeo Fault, however drilling to date has not demonstrated that the deposit reaches or is truncated by the fault. Along strike to the north and south, the mineralization is offset slightly by near vertical faulting; mineralization does not terminate at these faults, but the intensity of the trend is either diminished or high-grade mineralization has yet to be located.

Mineralization at the deposit is epithermal low-sulfidation (quartz-adularia) type. Although very little mineralization is hosted in or centered on the Rodeo Fault itself, it is possible that the fault played a role as a pathway at depth for the Rodeo deposit. Quartz veins 15 m or greater in width have been located throughout the property. The high-grade Au mineralization appears limited to a distinctive veining event. Evidence of ancillary veining events pre- and post-dating the high-grade event carry low-grade to anomalous level of Au mineralization.

The gold event is associated with a restricted vein stage characterized by small smoky quartz veinlets cut by banded blue opaline quartz and later brecciated and cemented by glassy smoky quartz hosting very fine disseminated pyrite. In the main zone, the veinlets generally trend NNW and dip steeply to the east or west, but the core angle in some drill holes suggests these veins may also have developed along ENE to EW structures. The envelope of the high-grade event appears to be restricted to a preferential volcanic layer or elevation (or both). Movement on the Rodeo Fault is likely responsible for the current orientation of the envelope.

6.4 Deposit Types

The Rodeo property hosts gold- and silver-bearing mineralization commonly associated with a low-sulfidation (adularia-sericite) epithermal mineralizing system. Epithermal systems are defined to occur from depths of less than 2 km to superficial hot spring settings. Mineral deposition occurs as hydrothermal fluids undergo cooling and degassing and are commonly zoned vertically over 250 to 350 m from a base metal-poor, gold- and silver-rich top to a relatively silver-rich base metal zone and an underlying base metal-rich zone grading at depth into a sparse base metal, pyritic zone.

7. EXPLORATION

Exploration activities conducted by Minera Cordilleras consist of:

- Surface geologic mapping of the property and immediate deposit area
- Trench sampling and surface sampling
- High-quality topography and aerial image from a drone survey conducted in 2020 and continued monthly drone images of the mine as development proceeds
- Regional ASTER survey
- Five drilling campaigns totaling 12,270 meters

Activities conducted by previous operators include:

- Surface geologic mapping of the property and immediate deposit area at 1:25,000 scale
- Alteration intensity mapping
- Airborne magnetic and radiometric survey, 1,519 line-kilometers in 2010 and 2011 (raw data has not been located or provided to the author)
- Induced polarization geophysical surveying, 42 line-kilometers in 2010 and 2011 (raw data has not been located or provided to the author)
- Large scale magnetic surveys are available from Servicio Geológico de México (GSM)
- Landsat false color imagery to identify for alteration signatures
- Spectral analysis to determine alteration types
- The collection of approximately 1,500 rock samples
- Some of the rock samples have recorded length and direction information, samples that do have this information have been used where appropriate
- 467 soil samples and 100 stream sediment samples

The Rodeo and Rodeo 2 concession boundaries have been reduced since their initial staking; therefore, portions of the activities of previous explorers have taken place outside the current concession boundaries.

7.1 Trench Samples

Minera Cordilleras cut eleven trenches in 2015. The trenches were cut perpendicular to the strike of the Rodeo deposit using a gasoline powered diamond saw and chipped into sample bags using a rock hammer. Care was taken to cut continuous samples but in many cases the terrain and vegetation caused gaps to exist in the lines. The trench lines are assumed to be continuous, although some have unsampled lengths greater than approximately 1 m where rock was not exposed. Trenches were mapped during collection followed by location corrections using a total station surveying instrument, as well as correction to the topographic surface.

The trenches are located 40 m west of the where the highest-grade portion of the deposit is located. The core of the deposit is not exposed at surface because it is covered by an apparently impermeable/less permeable volcanic layer. In the area of the trench samples this volcanic layer is absent and the silicification and mineralization is visible in outcrop. However, the Au grade is less than observed in the drilling in the best portion of the deposit. **Figure 7-1** shows the trench sample lines as well as colored coded Au grades.

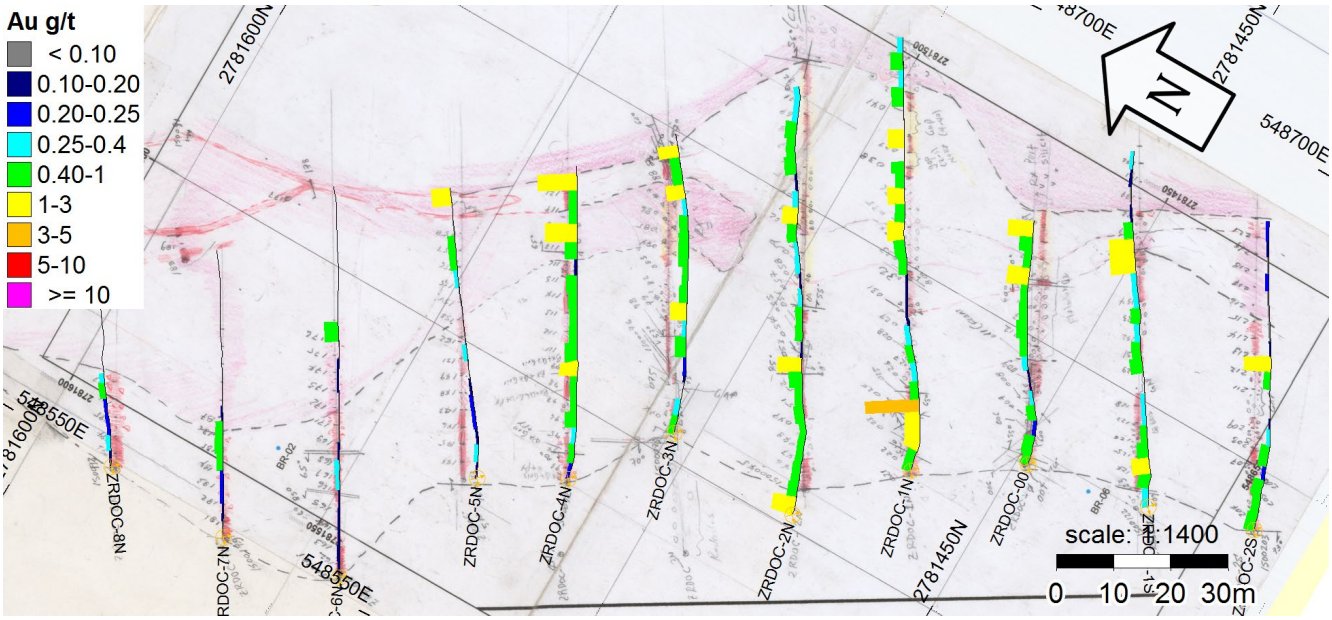

Figure 7-1: Trench sample location map

Figure 7-2 shows a picture of the Rodeo pit highwall (looking northwest) showing the low-angle fault separating post-mineral volcanics from underlying mineralized rhyodacites. The red rectangle shows the approximate trench locations on the periphery of the Rodeo mineralized system.

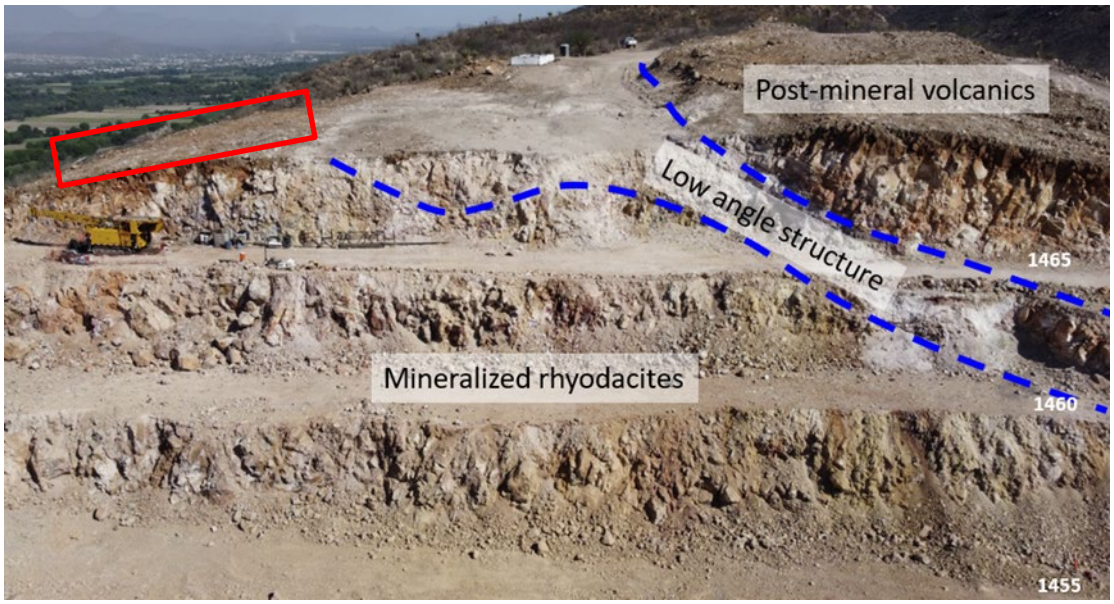

Figure 7-2: Rodeo trenching and pit highwall (looking NW)

A total of 178 samples were collected from the trenches and submitted to ALS Chemex for Au-AA24 and ICP ME-41 analysis. The samples have a mean Au grade of 0.55 Au g/t and a mean Ag grade of 1.4 Ag g/t. A summary of the significant trench samples is shown below in **Table 7-1**.

Table 7-1: Significant high grade trench intervals

Trench ID	Sample ID	From	To	Au (g/t)	Ag (g/t)
ZRDOC-1N	1500024	11.98	14.22	3.76	14.9
ZRDOC-4N	1500121	53.88	56.71	2.74	6.6
ZRDOC-4N	1500117	44.84	48.02	2.21	1.5
ZRDOC-2S	1500212	29.07	32.05	1.9	1.9
ZRDOC-00	1500019	43.79	46.69	1.765	3.8
ZRDOC-1S	1500135	43.96	47.07	1.74	2.7
ZRDOC-1S	1500136	47.07	50.04	1.73	2.3
ZRDOC-2N	1500054	26.94	29.73	1.7	4.9
ZRDOC-2N	1500045	0	3.46	1.61	7.6
ZRDOC-00	1500016	35.11	38.17	1.505	1.3
ZRDOC-3N	1500091	50.72	52.72	1.405	3.6
ZRDOC-5N	1500159	51.11	54.15	1.33	1.1
ZRDOC-3N	1500087	43.31	45.92	1.26	0.4
ZRDOC-4N	1500098	19.76	23.04	1.26	1.3
ZRDOC-1S	1500124	6.6	9.74	1.235	1.8
ZRDOC-1N	1500036	50.24	52.99	1.165	1.3
ZRDOC-1N	1500034	43.9	47	1.15	3.5
ZRDOC-1N	1500039	59.98	63.14	1.14	0.9
ZRDOC-3N	1500079	21.41	24.56	1.14	2.4
ZRDOC-2N	1500064	54.63	57.58	1.075	2
ZRDOC-1N	1500022	3.68	6.88	1.055	5.3
ZRDOC-1N	1500023	6.88	11.97	1.03	3.3
ZRDOC-1N	1500024	11.98	14.22	3.76	14.9
ZRDOC-4N	1500121	53.88	56.71	2.74	6.6
ZRDOC-4N	1500117	44.84	48.02	2.21	1.5
ZRDOC-2S	1500212	29.07	32.05	1.9	1.9
ZRDOC-00	1500019	43.79	46.69	1.765	3.8
ZRDOC-1S	1500135	43.96	47.07	1.74	2.7
ZRDOC-1S	1500136	47.07	50.04	1.73	2.3
ZRDOC-2N	1500054	26.94	29.73	1.7	4.9
ZRDOC-2N	1500045	0	3.46	1.61	7.6
ZRDOC-00	1500016	35.11	38.17	1.505	1.3

7.2 Geochemistry

Minera Cordilleras compiled historic rock, soil, and stream sediment samples collected by previous operators. All location data was converted into WGS84 datum, zone 12 to allow samples to be visualized for the identification of additional Au-Ag occurrences within the property boundary.

In total 1,600 rock chip and channel samples, excluding the trenches, have been collected from the Rodeo Project. They show evidence for a large low-sulfidation epithermal system that has been emplaced along a large NW-SE striking fault system.

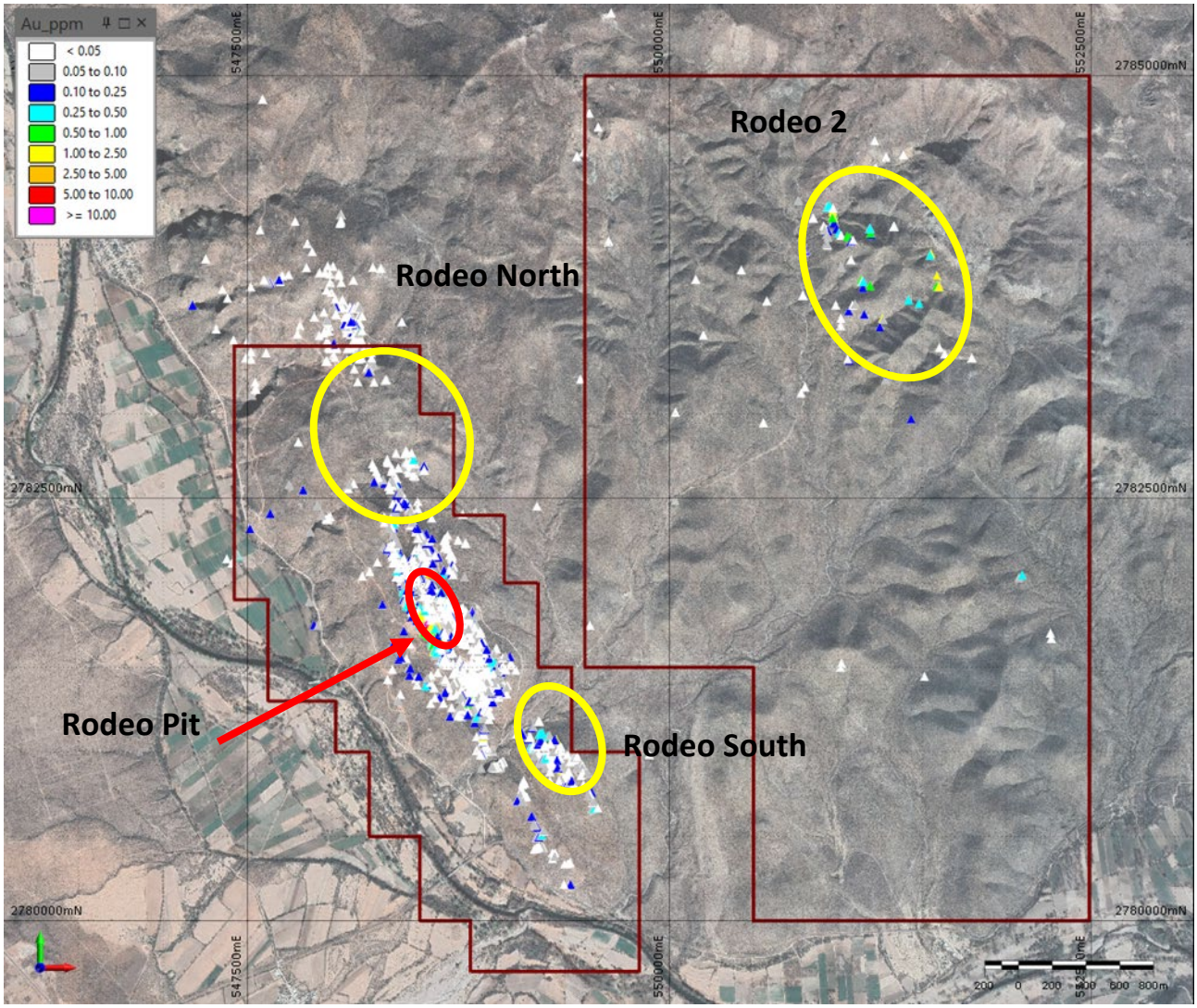

Figure 7-3: Rodeo property rock samples and gold values (in ppm), and exploration targets (yellow outlines)

7.3 Drilling

The project database contains 246 exploration drill holes, totaling 24,041 m, drilled from 1995 to 2022. Of the total, 13,083 m were drilled using diamond drilling core (DD) equipment and 10,958 m with reverse circulation rotary (RC) equipment. **Table 7-2** summarizes the project drilling by company, year, and type.

Table 7-2: Project drilling by company and type

Company	Year	Type	Length (m)
Monarch Resources	1995	RC	2,251
Canplats Resources Corp.	2004	RC	2,396
Canplats Resources Corp.	2007	DD	1,034
Camino Minerals Corp.	2011	DD	6,090
Minera Cordilleras	2016	DD	2,084
Minera Cordilleras	2020	DD	1,414
Minera Cordilleras	2021	RC	3,187
Minera Cordilleras	2021	DD	2,462
Minera Cordilleras	2022	RC	3,123
Total			24,041

Minera Cordilleras has continued exploration at the Rodeo site. From 2020-2021, an additional 117 exploration holes were drilled at the site, for a total of 7,062 m meters of core and RC drilling. In 2022, 47 additional holes were drilled. Due to the short mine life, they were not used in the block model estimation, but were used to confirm the existing Resource block model and mine plan. Additional holes were drilled in the south to confirm the limits of the mineralization. **Figure 7-4** shows a location map of the project drilling. Diamond drilling was completed by Eco Drilling, utilizing a track-mounted rig with a 1,000 m depth capacity. Drill holes started as HQ size and reduced to NQ where necessary. Three PQ-diameter holes were drilled in 2020 to collect material for metallurgical samples. Reverse circulation drilling was conducted by Major Drilling utilizing a MX-47 rig.

Surface drill hole collar locations were surveyed by handheld GPS and by a professional surveyor with the aid of a Differential GPS and Total Station. Drill hole orientations were established by measurements of casing using a field compass. For diamond drill holes the down-hole survey was conducted with a magnetic Reflex instrument. For the reverse circulation holes, down-hole surveys were conducted with an Axis gyro.

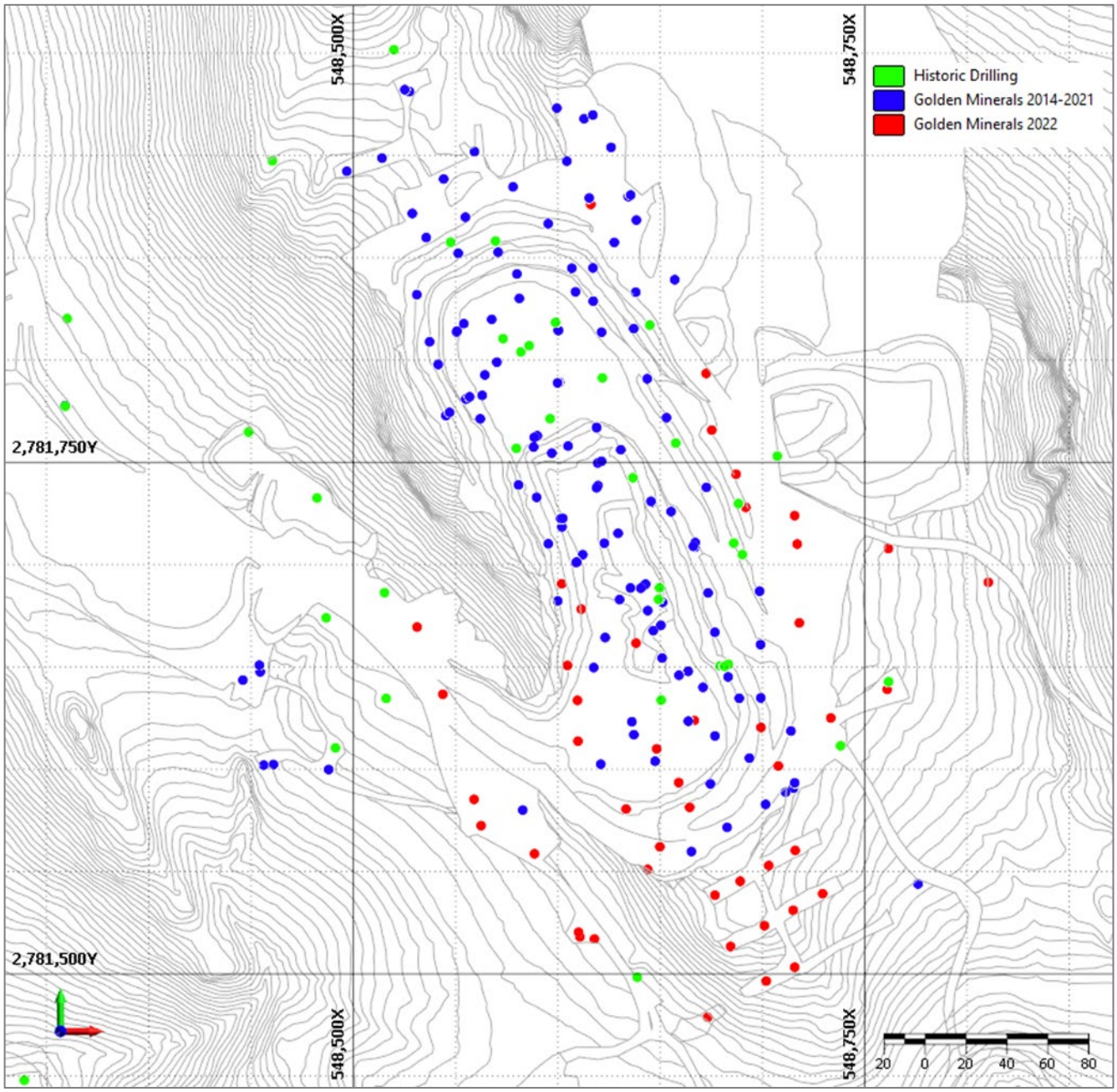

Figure 7-4: Drill hole location map for the Rodeo property

Drill holes have primarily been oriented perpendicular to strike and inclined at approximately 55 degrees. The prevailing silicification of the Rodeo deposit dips from 35 to 55 degrees ESE along with the volcanic host; drill orientations have been aligned to intersect this strike and dip. Varying vein stages and structural controls cause mineralization to exist at a range of dips from 35 degrees to near vertical.

Drilling is reported to be slow and difficult given the high level of silicification. However, in general recovery is high (91%), but a visual review of the drill-core show there are multiple zones of faulting, producing broken and rubbly core, which means that there is a low rock quality designation (RQD) of 38% for the deposit.

7.4 Adequacy of Data

The procedures followed by the Minera Cordilleras staff is within Industry Best Practices and the data is adequate for the use in this level of study.

8. SAMPLE PREPARATION, ANALYSES, AND SECURITY

Data summarized in this section and utilized for estimation of resources was collected by Minera Cordilleras staff. The sample preparation, analyses and security procedures implemented by Minera Cordilleras meet standard practices. The data collected is of adequate quality and reliability to support the estimation of mineral resources. Only project level staff are involved with the selection, preparation, and delivery of samples to the laboratory.

Blasthole samples and some exploration samples are analyzed at the laboratory owned by Golden Minerals at their Velardeña property. All exploration and Resource definition samples are submitted to ALS Chemex for analysis. The on-site laboratory is not considered independent, but umpire sampling is conducted on a regular basis to confirm best practices at the company owned laboratory. The property has experienced exploration and sampling by several companies and several campaigns, including open pit mining operations by Golden Minerals that commenced in late December 2020.

8.1 Sample Preparation and Analysis

8.1.1 Drill Core

Diamond drill core is transported by truck from the rig to the core preparation site located in the city of Rodeo, by truck. Following geotechnical logging by field assistants, geologists log the core and select sample intervals. Sample intervals are selected only where the geologist anticipates mineralization to exist. In practice, the core is sampled extensively, but is not sampled continuously from top to bottom (note most holes from the 2020 and 2021 drilling campaigns were sampled from collar to end depth). Drill core that is selectively unsampled can be considered waste, however no numeric value or null place holder is inserted in the project database. Sample selection begins and terminates at alteration or lithologic contacts, sampled at a minimum length of 20 cm and maximum of 2 m, with few exceptions exceeding 4.0-5.0 m. During the process of sample selection, the geologist draws a centerline to guide the core cutters. The center line is rotated by the geologist to align with the apex of observable vein structures to minimize sample selection bias.

A sample sheet is provided to the core cutters containing sample numbers and from, to intervals. In addition to a cut sheet the sample number and meters are annotated on the white plastic core box using a marker. Sample numbering begins where the previous sample batch left off. The core cutters have been instructed to cut the core down the marked centerline using an electric powered wet diamond saw, and to always place the right-hand portion of the cut core in the sample bag. Sections of broken core or low recovery are carefully divided to reduce bias; however, these sections are inherently less reliable than sections of competent core. The core cutters write the sample number using a marker on a clear plastic bag and tie off the bag using twine when complete. A tear-away sample tag system has been implemented since Golden Minerals started drilling in 2016. Five samples are grouped and placed in a large rice sack. The beginning and ending number of the five samples contained in the sack is written on the outside of the bag. The sack is tied shut with twine when full. Sample batches are delivered to ALS Chihuahua for preparation and then shipped to Vancouver, British Columbia, Canada (ALS Vancouver) for analysis. The ALS Vancouver laboratory is independent of Golden Minerals and Minera Cordilleras and is ISO 17025 accredited, the accreditation of ALS Vancouver encompasses preparation processes completed at ALS Chihuahua.

Samples are initially analyzed for Au using fire assay with atomic absorption spectroscopy finish (AA24) with re-run for values exceeding 10 g/t Au using fire assay with gravimetric finish (GRA22); however, only quality control standard samples triggered the GRA22 rerun.

Drill hole samples were analyzed for the basic multi-element suite using four-acid digestion followed by inductively coupled plasma-atomic emission spectroscopy (ME-ICP61).

8.1.2 RC Drilling

An RC drill rig was used for part of the 2021 drilling campaign in addition to a core drilling rig. The RC drill rig allowed for faster drilling of the deposit area where the geology, alteration, and structures were well known. The resulting rock chips are placed in plastic trays and logged by the geologist. Samples were collected and organized on 2.0 m regular intervals for the entire hole. A rotary splitter was used to better split the material to a representative sample, reducing the sample by 75% down to a 25% sample. Clear sample bags were then filled with 5-6 kg of sample material, tagged using a sample book, sample number written on the sample bag, and then transported to the Velardeña lab for analysis of Au and Ag.

Drill hole samples were analyzed for the basic multi-element suite using four-acid digestion followed by inductively coupled plasma-atomic emission spectroscopy (ME-ICP61).

8.1.3 Trench Samples

Trench samples were cut using a gasoline powered diamond saw and chipped into sample bags using a rock hammer. Care was taken to cut continuous samples but in many cases the terrain and vegetation caused gaps to exist in the lines. The trench lines are assumed to be continuous with only runs of unsampled lengths greater than approximately 1 m being identified. Preparation, analyses, and security of trench and drill hole sampling are the same from placing the material in a clear plastic bag onward, until analysis.

Trench samples were analyzed at ALS Vancouver for the basic multi-element suite using aqua regia followed by inductively coupled plasma - atomic emission spectroscopy ME- (ICP41). Samples initially exceeding 100 g/t Ag are rerun using (Ag-OG62).

8.1.4 Blasthole Samples

Blasthole drilling and sampling commenced in December of 2020 with the start of the open pit mining operation. The blastholes are drilled with a track-mounted air core rig which produces core cuttings very similar to an RC drill rig. The blastholes are drilled on a 5 m bench height with a single sample per blasthole. Sample material is collected in a specially designed geometric pan which helps collect a more representative sample. Sample material is then filled in a clear plastic bag, tagged using a sample book, sample number written on the sample bag, and then transported to the Velardeña lab for analysis of Au and Ag. The sample weights vary depending on the length of the blasthole, with 5 m samples weighing around 4-7 kg.

8.1.5 Surface & Pit Highwall

Surface and pit highwall samples are collected on the property and around the pit area. Samples are collected by rock hammer or circular saw, typically on structures or alternation zones. Sample material is then filled in a clear plastic bag, tagged using a sample book, sample number written on the sample bag, and then transported to the Velardeña lab for analysis of Au and Ag. The sample weights are generally around 4-7 kg.

8.2 Security, Transport, and Storage

The core preparation facility is located in the town of Rodeo and is enclosed by a cement wall and locked gate. Samples awaiting delivery to the ALS preparation facility in Chihuahua further stored within locked building in the facility when staff is not present. Samples are delivered to ALS Minerals in Chihuahua City, Chihuahua, Mexico (ALS Chihuahua) by Golden Minerals staff by road as needed, typically every two weeks during the drilling campaign.

8.3 Quality Control

Minera Cordilleras' quality assurance (QA) measures involve the use of standard practice procedures for sample collection for both drill core and channel sampling as described above; and include oversight by experienced geologic staff during data collection. Quality control (QC) measures implemented by Minera Cordilleras include in-stream sample submittal of standard reference material, blank material, and duplicate sampling.

The insertion of control samples is dictated by the last digit of the sample id number, the sequence is independent of the drill hole or channel sample set and is continuous through the sampling campaign. For example, the first instance of a drill core sample id ending in "36" or "86" is a blank sample and is placed in a sample bag rather than a collected core sample. On the next instance of a "46" or "96" the lab is instructed on the sample submittal sheet to create and test a fine duplicate following pulverizing. The next instance of a "06" or "56" the lab is instructed to create a coarse duplicate at the crushing stage. On the next instance of "16" or "66" a low-grade standard sample is placed in the sample bag instead of a collected sample and the next "26" or "76" a high-grade standard.

The 2020-2021 campaigns operated a similar but reworked QA/QC workflow procedure using regularly inserted blanks, duplicates, and standards on fixed sample numbers, accounting for about 10% of samples as control samples for drill holes and about 5% for blastholes.

8.3.1 Standards

Standard material (CRM) from OREAS was used as they demonstrated greater performance and accuracy compared to other CRM brands used in the past (ex. Rock Labs). All standards used were checked thoroughly by both the on-site Velardeña lab and by ALS Chemex to ensure their integrity. Sampling is regularly performed by ALS Chemex in Chihuahua to verify lab results at the Velardeña laboratory.

8.3.2 Duplicates

Pulp duplicates are analyzed within the drill hole sample stream. Coarse duplicates are prepared in the field using a splitter to reduce potential sample bias. Review of the duplicates indicate good reproducibility. Any noted issues in the standards and duplicates are infrequent and do not suggest invalidation of the results from the on-site laboratory.

8.3.3 Blanks

Blanks are inserted into the sample stream. Previous work indicated a contamination of low-grade Ag in the blank material. The material being used for blanks was replaced and was sourced from Abrasivos de Laguna S.A. de C.V. Samples of the new blank material were submitted to both the Velardeña Lab and to ALS Chemex for analysis for Au and Ag to ensure that the material contained minimal Au and Ag. The results were in tolerance for blank material and both labs had similar results. The blank material is stored in a safe and secure location, in a very low contamination area, with material pre-packaged into individual plastic bags to be inserted into the sample stream.

As part of the updated QA/QC procedures, the QA/QC data is reviewed continually to check for problems with the analytical data including reviewing the standard, blank, and duplicate samples. Scheduled analytical maintenance occurs regularly with additional lab checks reviewed by lab management over short and long-term schedules.

8.4 Data Adequacy

The procedures followed by the Minera Cordilleras staff is within Industry Best Practices and the data is adequate for the use in this level of study.

9. DATA VERIFICATION

The data collected by the mine staff is in support of operations planning and many of the data inputs provided by Minera Cordilleras are supported by current production actuals and through this activity have been verified. Additional verification procedures are described below.

9.1 Geologic Data Inputs

The quality of data collected by Minera Cordilleras meets industry standard practice and is sufficient to support the estimation of mineral resources. Data collected by previous operators has in part been verified by the corroborating data collected by Minera Cordilleras, as well as existing physical and digital records and verification sampling performed by Minera Cordilleras, as well as the previous operators. Coupled with the data collected by Minera Cordilleras, data from previous explorers is sufficient to support the estimation of mineral resources, however some details regarding QA/QC protocols and performance were not available for review.

Data verification conducted during the site visit included observations of drill hole collar locations and orientations, drill core, trench sample locations, review of previously drilled core, recently drilled core, and RC chip trays. Mineralization was witnessed in outcrop and orientations were observed. Confirmatory sampling of drill core while conducting the site visit was not deemed necessary because several generations of exploration by past explorers and the 2016 drilling campaign have confirmed the presence of mineralization, limited core resampling has been completed by previous authors.

Drill hole collars and their orientations were observed in the field and a handheld global positioning system (GPS) was used to check their location. Verification of collars locations and orientations were found to correspond to those provided by Minera Cordilleras.

For purposes of data verification collected by previous explorers Mineral Cordilleras reanalyzed 94 pulps from Canplats BR series holes. For both Au and Ag, the duplicated values compared well on a case-by-case basis with the original values stored in the project database.

9.2 Mine Plan Data Inputs

Tetra Tech conducted a site visit to the Rodeo mine to verify that parameters used in mine planning are adequate for use in this study. This site visit allowed for verification of mining parameters used in this study, confirming that the parameters are adequate.

9.3 Mineral Processing Inputs

Technical and cost data were obtained during the Project site visit and in subsequent communications with Golden Minerals personnel at the processing plant and in Golden Minerals' Golden, Colorado office. The data provided by Golden Minerals conforms to industry standards and is within the accuracy of this study and verified for use in this study.

9.4 Economic Data Inputs

A technical economic model template and cost data were obtained in communications with Golden Minerals. The data provided by Golden Minerals conforms to industry standards and is within the accuracy of this study and verified for use in this study.

9.5 Data Adequacy

At no time was there any limitation to, or failure to provide the requested technical and cost data for the Rodeo mine during or after the site visit.

Data provided was adequate for the assemblage and production of this study.

10. MINERAL PROCESSING AND METALLURGICAL TESTING

Two metallurgical studies have been performed on mineralized material from the Rodeo Project: A study by Process Research Associates Ltd. (PRA) of Vancouver, BC, Canada in 2011, and a study by Resource Development Inc. (RDi) of Lakewood, CO, USA in 2017. Both laboratories are independent of Golden Minerals Company.

Both PRA and RDi found that the material was not amenable to a heap leach process but showed positive results from an agitated leach process. Results of RDi's testing showed a maximum gold extraction of 85.7% and silver extraction of 76.3%. A summary of the relevant test work completed by RDi in 2017 is provided in the following subsection.

10.1 2017 RDi Test Work Program

The objective of the RDi test program was to complete a leach test program to determine gold extractions from low-grade and high-grade gold mineralized material from the Project. RDi received 30 kg of sample which was crushed and split into 1 kg charges. Representative samples of both the high and low grade were pulverized and submitted for head analysis using fire assay, atomic absorption, acid digestion, and ICP techniques. The low-grade sample assayed at 1.37 g/t Au and 5.6 g/t Ag, while the high-grade sample assayed at 3.31 g/t Au and 14.0 g/t Ag. Samples were also submitted for mineralogical analysis. The primary minerology for both samples was quartz, representing approximately 92% of the low-grade sample and 76% of the high-grade sample. Gold occurs as 2.5- to 5-micron grains locked in quartz.

The high-grade sample was subjected to flotation and cyanide bottle roll leach testing. Results of the flotation testing were poor, however the bottle leach tests resulted in gold recoveries of 80.0% to 85.6% and silver recoveries of 72.1% to 76.3%. **Table 10-1** shows the results of the bottle roll leach testing at various grind sizes.

Table 10-1: Bottle roll leach test results

Grind (P_{80})	Extraction %		Residue Grade		Calc Head Grade		NaCN Consumption (kg/mt)	Lime Consumption (kg/mt)
	Au	Ag	Au (g/t)	Ag (g/t)	Au (g/t)	Ag (g/t)		
0 mesh	80.0	72.1	0.54	2.8	2.70	10.1	1.648	9.114
150 mesh	83.8	76.3	0.47	2.4	2.90	10.1	1.584	9.227
200 mesh	85.7	73.4	0.40	3.0	2.79	11.3	1.786	11.102

The low-grade sample was subjected to static leach testing. Results showed unfavorable gold and silver extraction from static cyanide leaching.

Metal recovery in the bottle roll leach test was observed to be dependent on grind size. A Bond's Ball Mill Work Index test was completed with the sample at a closed size of 100 mesh (150 microns). The work index was determined to be 25.3 kWh per short ton which indicates that the sample is very hard. Due to the hardness of the mineralized material, economic analysis will be required to evaluate the most economical grind size for leaching.

Based on the results of the metallurgical testing and production actuals from the process plant, metallurgical recovery assumptions used in this TRS are 80% for gold assuming a grind size of 80% passing 325 mesh.

10.2 Adequacy of Data for the Technical Report Summary

The metallurgical report prepared by RDi for the Rodeo Project provided data sufficient for use in this TRS. Golden Minerals demonstrated recovery of gold and silver approaching that achieved in the RDi studies from processing Rodeo mineralized material at Plant 2.

11. MINERAL RESOURCE ESTIMATES

Mining from the Rodeo open pit began December 2020 and doré production from Plant 2 began in January 2021. Doré is being sold by the company for a profit. This mining validates the exploration, drilling, and Resource estimation methods being used. A 3D block model was created for the Rodeo deposit by Golden Minerals and validated by Tetra Tech. Wireframes of the mineralized domains were created using Leapfrog software as a guide. Three domains were modeled based on Au grade properties, as well as geological and structural considerations. A high-grade domain and a low-grade domain were modeled for the deposit, and a third domain was created for mineralized material over 0.15 g/t Au and under 1.0 g/t. The Leapfrog wireframes were used as a guide to establish the domain wireframes in Micromine for estimation, using a sectional method to review and adjust the wireframes as appropriate. The deposit is steeply dipping, at approximately 75 degrees along a strike of 330. The block model estimation was completed using ordinary kriging (OK). Data was flagged by domain and a soft boundary was used between the high-grade and low-grade domains, as well as the low-grade and mineralized domain boundary, for the purposes of estimation.

The estimation was performed in four passes for each domain. Details of the estimation passes can be found in **Table 11-1**.

Table 11-1: Estimation pass parameters

Pass	Method	Search Ellipse (m)	Sectors	Max Comp Per Sector	Comp Min	Comp Max
High Grade Domain						
First	OK	34-20-10	4	3	10	12
Second	OK	64-36-20	2	5	6	10
Third	OK	120-68-36	1	10	4	10
Fourth	OK	240-136-72	1	10	3	10
Low Grade Domain						
First	OK	34-20-10	4	3	10	12
Second	OK	64-36-20	2	5	6	10
Third	OK	120-68-36	1	10	3	10
Fourth	OK	240-136-72	1	10	2	10
Mineralized Domain						
First	OK	34-20-10	2	5	5	12
Second	OK	64-36-20	2	6	4	10
Third	OK	120-68-36	1	10	3	10
Fourth	OK	240-136-72	1	10	2	10

11.1 Input Data

Data used to estimate the model included reverse circulation (RC) drill holes, diamond drilling/core drill holes (DD), blasthole samples, and a limited number of surface trenches and pit samples. Careful attention was given to the blastholes to prevent bias due to the high density of data available. Blastholes were only allowed to contribute to the estimation of blocks in Pass 1 in the high-grade domain and in Pass 1-2 in the low-grade and mineralized material domains. Based on a statistical review, the grades were capped at 17.0 g/t Au and 140 g/t Ag. **Table 11-2** shows the input intervals for the mineralized material by type before and after capping was applied. Due to the short mine life, the block model was not updated for the 2023 report. Additional drill holes were drilled in 2022 to define the limits of the deposit and to confirm the block model estimations.

Table 11-2: Input data statistics

Data Type	Count	Mean Au (g/t)	Capped Mean Au (g/t)	Mean Ag (g/t)	Capped Mean Ag (g/t)
RC	3,064	0.64	0.63	9.12	9.07
DD	4,455	0.78	0.77	7.39	7.35
Blasthole	9,700	1.38	1.35	3.83	3.83
Trench	193	0.57	0.57	1.38	1.38
Pit	16	1.21	1.21	3.00	3.00
All	17,428	1.09	1.07	5.64	5.63

Intervals were composited to 2 meters for exploration holes and 3.5 meters for trenches. A single composite was created for the blastholes.

11.2 Classification

Classification was considered using statistical analysis of the estimation pass, average and closest distance of the composites, and number of drill holes used to complete the estimation. Professional judgement was used to smooth out the classification boundaries using wireframes. **Table 11-3** lists the criteria for Measured, Indicated, and Inferred blocks. Blocks within the final mine design were designated as Inferred and coded with Indicated or Measured where the criteria are satisfied.

Table 11-3: Classification parameters

Classification	Closest Composite (m)	Average Distance to Composite (m)
Pass 1		
Measured	<15	<30
Indicated	<30	<60
Pass 2		
Measured	<10	<20
Indicated	<25	<50
Pass 3		
Measured	None	
Indicated	<30	<60 or 3 or more drill holes
Inferred	<60	<120 or 2 or more drill holes

Classification	Closest Composite (m)	Average Distance to Composite (m)
Pass 4		
Measured	None	
Indicated	<30	<60 or 4 or more drill holes
Inferred	<60	<120 or 3 or more drill holes

11.3 Resources

Resources were calculated through the effective date December 31, 2022. The Resources are reported at a cutoff of 1.0 g/t for stockpiling and 1.45 g/t for processing. Numbers reported as Resource are constrained to a mine design of 1.0 g/t and are reported in **Table 11-4**.

Table 11-4: Estimated Rodeo Resources for stockpile and processing

Classification	Cutoff Au (g/t)	Tonnes	Au (g/t)	Au (oz)	Ag (g/t)	Ag (oz)
Low-Grade (Stockpile)						
Measured	1.0	79,600	1.20	3,100	11.69	29,900
Indicated	1.0	11,400	1.18	400	4.82	1,800
Measured + Indicated	1.0	91,000	1.20	3,500	10.83	31,700
High-Grade						
Measured	1.45	88,300	2.55	7,200	17.56	49,900
Indicated	1.45	18,000	3.21	1,900	11.00	6,400
Measured + Indicated	1.45	106,300	2.66	9,100	16.45	56,200

**Columns may not total due to rounding*

11.4 Cutoff Grade

Resources have been tabulated using a 1.0 g/t Au cutoff grade for stock piling and 1.45 g/t Au for processing based on the assumptions shown in **Table 11-5**. The Resource tabulation is presented using the previous year average metal prices, considered with bank projections for the life of mine. The prices used are US$25/troy ounce Ag and US$1,800/troy ounce Au. Prices were not updated for the 2023 update, as the mine life is short, and mining is expected to be completed in 2023.

Table 11-5: Cutoff price assumptions

Assumption	Value
Au Price	$1,800
Au Recovery	80%
Ag Price	$25.00
Ag Recovery	80%
Mining Cost	$16.93
Processing Cost	$39

11.5 Opinion of Tetra Tech

Tetra Tech has reviewed the Mineral Resource estimate update. The inputs, parameters, and estimation results are within industry standards. Current mining and profitable processing of the mineralized material from the Rodeo open pit shows the continued prospects of reasonable extraction of the Resource material.

12. MINERAL RESERVE ESTIMATES

Mineral Reserves have not been estimated for the Rodeo Project.

13. MINING METHODS

Due to the near-surface nature and continuity of the orebody, mining at Rodeo is conducted with open pit mining methods. Blasted material is mined with a diesel excavator and loaded into on-highway trucks for haulage to the plant site approximately 115 km away from the mine. Loading and hauling to the plant is typically carried out on the weekdays during the morning, to ensure adequate mineralized material delivery while allowing for mining of waste and low-grade materials to occur later in the day. If needed to supply mill feed, haulage to the plant may continue over the weekend. Separating the mining activities based on haulage destinations allows for more efficient use of resources while creating a safer working environment. There are four stockpiles at the mine site for stockpiling mineralized material for potential future processing, and additional stockpiling area exists at the plant to allow for better material management and potential blending. Mine production averages 1,800 tpd of total movement and the pit has an expected mine life of six months. **Figure 13-1** shows the final pit outline for the Rodeo Project.

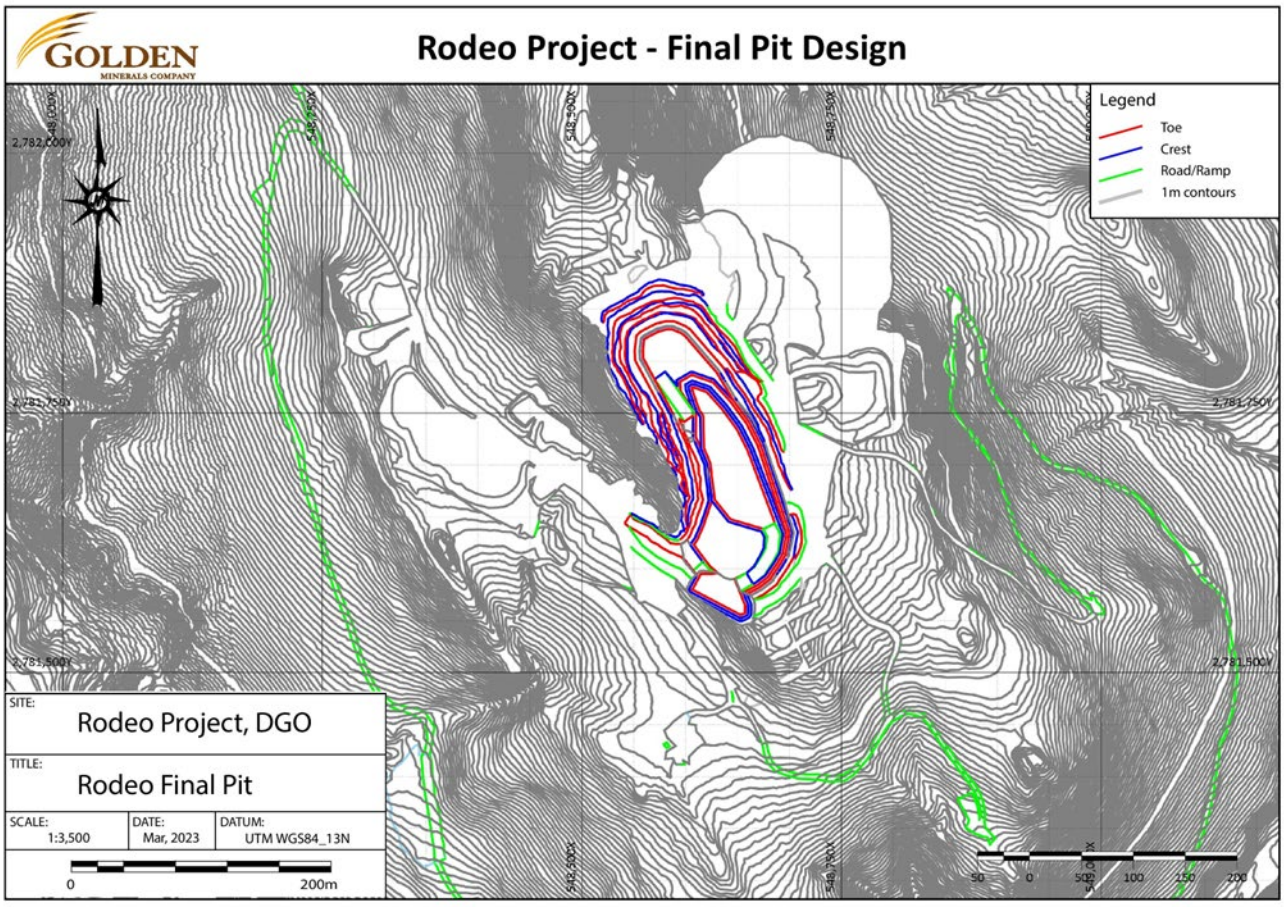

Figure 13-1: Rodeo final pit design

No detailed geotechnical or hydrogeological studies have been performed for Rodeo. Design parameters for pit design are shown in **Table 13-1**. Mining is conducted in 5 m benches which are double benched to 10 m.

Table 13-1: Rodeo pit design parameters

Parameter	Value
Bench Face Angle	60
Inter-ramp Angle	43
Bench Height	10 m (2x 5 m benches)
Catch Bench Width	10 m

Mining and hauling to the plant are carried out using contractors. The mining equipment fleet available for use at the Project is shown in **Table 13-2**. Haul truck quantities vary depending on scheduled weekly deliveries to the plant.

Table 13-2: Contractor mining fleet

Equipment Type	Available Quantity
Bulldozer	2
Wheel Loader	1
Track Excavator	1
Haul Truck	4
Road Grader	1
Water Truck	1
Track Drills	2
Drum Compactor	1

Labor requirements are minimal and are provided by the contractor. Golden Minerals personnel are responsible for blasthole sampling, supervisory, administrative, and engineering tasks.

13.1 Life of Mine Production

The Rodeo pit has an estimated mine life of six months. The mine production for the year 2023 is shown in **Table**13-3. The low-grade material is stockpiled at the mine site and is not considered for processing.

Table 13-3: Life of Mine production

Description	Units	2023
High Grade Mined	kt	98
Low Grade Mined	kt	64
Waste Mined	Kt	226
Grades		
Gold – High Grade	g/t	2.33
Silver – High Grade	g/t	14.96
Contained Metal		
Gold – High Grade	koz	7.4
Silver – High Grade	koz	47.3

14. PROCESSING AND RECOVERY METHODS

Mineralized material from the Rodeo mine is hauled approximately 115 km via on-highway trucks and stockpiled for process at the agitated leach plant in Velardeña, Durango (Plant 2). The plant is owned by Minera William S.A. de R.L. de C.V. and operated by Servicios Velardeña S.A. de C.V., both wholly owned subsidiaries of Golden Minerals. The plant has a design throughput of 520 tpd or more. A jaw crusher followed by a cone crusher provide primary and secondary crushing of feed material. Crushed material enters a grinding circuit comprised of a 10.5 x 13 ft ball mill and a recently installed 8 x 22 ft regrind (secondary) mill, both in closed circuit with cyclones. The product from the mills at 80% passing 325 mesh is thickened and sent to a series of eight agitated lixiviation tanks where cyanide is added with a planned consumption of 3.0 to 3.1 kg/t, and precious metals are leached from the mineralized material at a design flow rate of 1,700 m^3/day and a total leaching time of 84 hours. Rich solution is separated using counter-current decantation and sent to the Merrill-Crowe circuit for clarification and precipitation of the gold and silver that is then refined into gold and silver doré bars for transport. Tailings from the decantation are sent to the tailings storage facility at the plant site. A flowsheet of the recovery process at the Velardeña plant is shown in **Figure 14-1**.

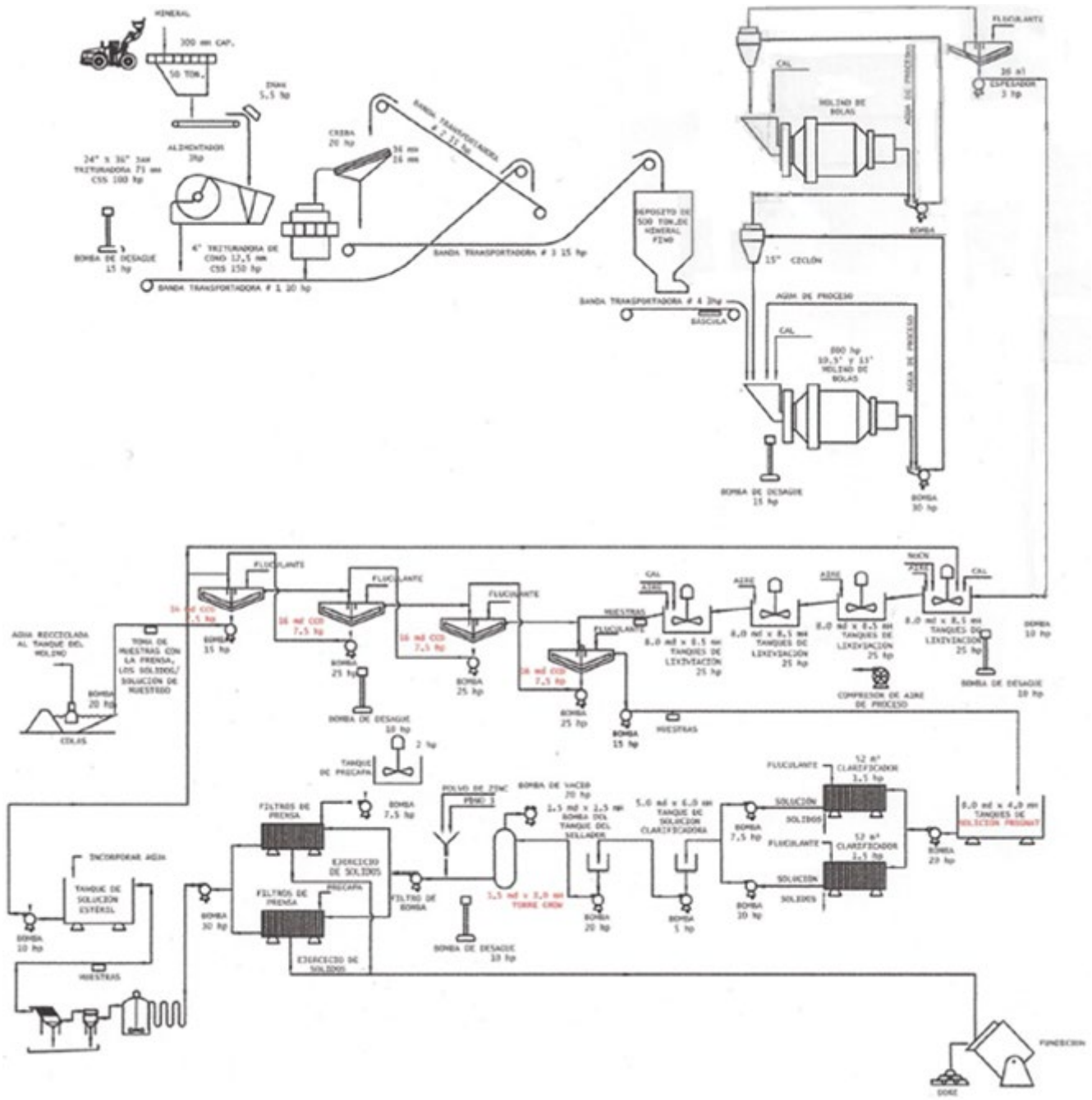

Figure 14-1: Plant 2 flowsheet

The plant facilities and equipment are in good operating condition. The tailings pond was recently expanded and is expected to have adequate capacity for the tailings generated by the Rodeo Project.

Budget and production results for 2022 are summarized in **Table 14-1**. The plant has processed 195,599 t of mineralized material with an average head grade of 2.6 g/t-Au. Gold recovery has averaged 74.7%, and silver recovery has averaged 81.2%.

Table 14-1: Budget and production results

Parameter	Budget	Actual 2022
Throughput		
t/h	22.9	22.3
t/d	550	535
Grind		
% -325 mesh	74	74.3
Head Grade (g/t)		
Au	1.96	2.6
Ag	11.79	10.6
NaCN Consumption (kg/t)		2.47
Recovery (%)		
Au	75	74.7
Ag	80	81.2
Production (oz)		
Au	10,900	11,982
Ag	65,700	53,486

Water consumption at Plant 2 averaged 0.73 m^3/t for 2022. Average power consumption at the plant was 12,149,150 kWh for the same period. The plant employs 98 workers.

Plant consumables for the 2022 production period are summarized in **Table 14-2** below.

Table 14-2: Plant 2 consumables

Consumables – 2022								
	Cyanide	Calcium/Lime	Flocculant	Zinc	Diatomaceous Earth	3.5" Balls	2" Balls	1.25" Balls
Period	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes	tonnes
2022	483	177.8	1.05	65.95	18.08	501.7	20	165.6
	kg/tonne	kg/tonne	kg/tonne	kg/tonne	kg/tonne	kg/tonne	kg/tonne	
2022	2.47	0.91	0.005	0.34	0.09	2.57	0.10	0.85

15. INFRASTRUCTURE

The Rodeo Project requires minimal infrastructure at the site due to the size and duration of the operation. As material is being processed off-site at the Velardeña plant, no processing infrastructure is present at Rodeo.

Infrastructure at the Rodeo Project includes access roads, a waste rock dump, and low-grade mineralized material stockpiles. The primary road for mine access is gravel and is maintained in good condition for year-round use. Its design is adequate for the transportation of supplies onto the site as well as haulage of mineralized material from the Rodeo pit to the Velardeña plant. The waste rock dump and low-grade stockpile have sufficient capacity to meet the expected production from the pit. A layout of the key project infrastructure is shown in **Figure 15-1**.

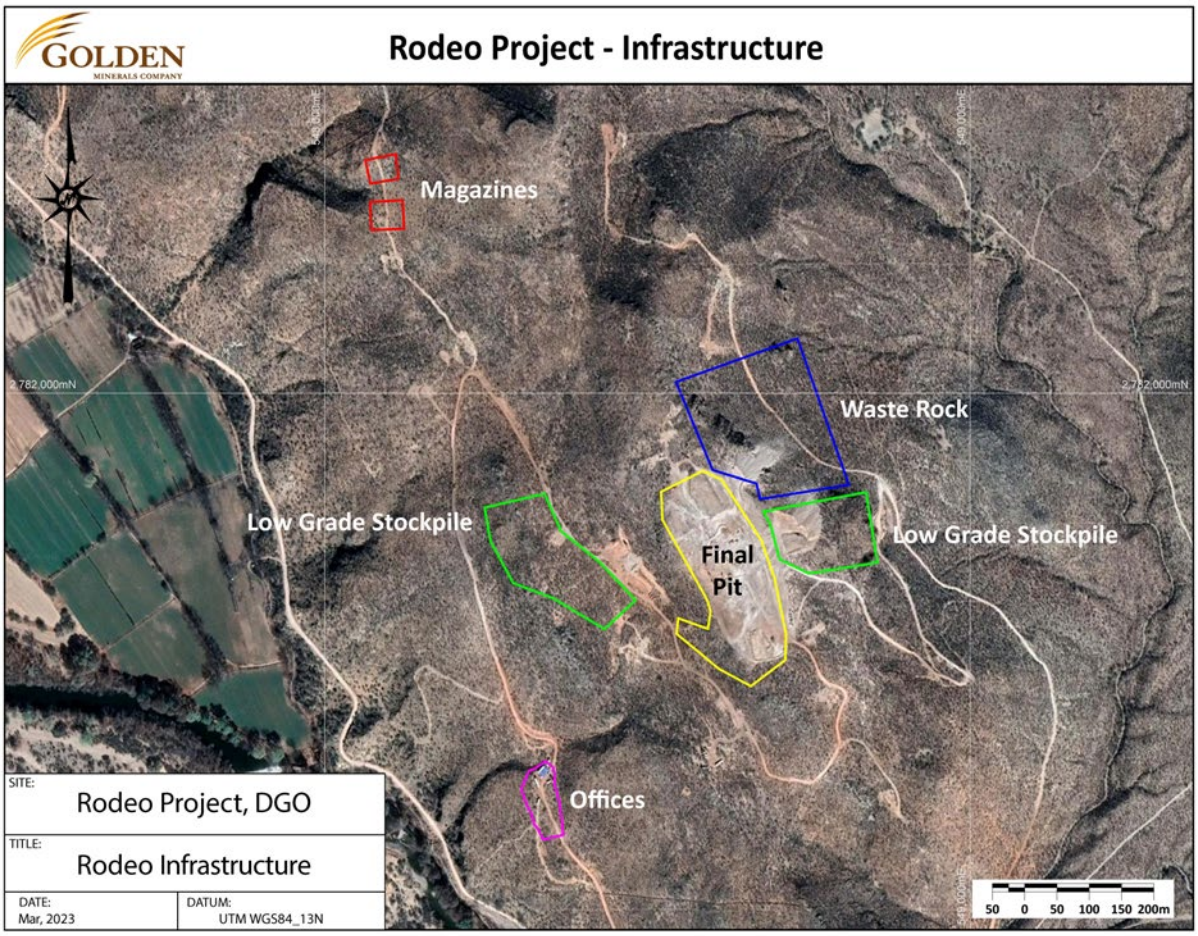

Figure 15-1: Rodeo Project infrastructure

16. MARKET STUDIES

Detailed market studies were not performed or reviewed for the purposes of this Initial Assessment TRS. The Rodeo Project is producing doré that meets industry standards for quality. Golden Minerals has a contract with Asahi Refining USA Inc. (Asahi) to refine the doré bars produced at the Velardeña plant. Asahi is independent of Golden Minerals, and is located in Salt Lake City, Utah, USA. Asahi will provide credit for 99.9% of the gold and 98.0% of the silver and apply a Treatment Charge of $0.35/oz of doré and a Refining Charge of $1.00/oz of recovered gold. The contract was renewed in March 2022 and will expire December 31, 2023.

The Rodeo mine is operating as a contract mining operation with Triturados del Guadiana, S.A. de C.V. (TRIGUSA). The contract has been executed and is valid through the expected life of the Project.

Commodity price assumptions used in this TRS are based on bank projections from 22 financial institutions for the life of mine. Each institution's estimate was as of a date between June 2021 and September 2021. The median gold price was $1,805 for 2021, $1,800 for 2022, and $1,750 for 2023, while the median silver price was $26.14 for 2021, $25.44 for 2022, and $24.00 for 2023.

Given that the Rodeo mine is expected to remain in production only into the third quarter of 2023, this TRS retained the 2022 TRS price assumptions of $1,800/oz for gold and $25/oz for silver. The existing prices at year-end 2022 were $1,812.35/oz and $23.95/oz for gold and silver, respectively.

17. ENVIRONMENTAL STUDIES, PERMITTING, AND PLANS, NEGOTIATIONS, OR AGREEMENTS WITH LOCAL INDIVIDUALS OR GROUPS

17.1 Environmental Baseline Studies

The terrain of the sites proposed for development of the Project presents slopes, which are not very pronounced, and in some relatively flat areas its surroundings can be observed rough terrain, irregular features, and an open valley topography of mountains with low hills where the slopes are usually in average of 11.91°.

The soil represented is Chernozem (CH) and Leptosol (LP), which present a smooth surface layer of light brown, low in organic matter, and low base content. These soils are of medium texture with stony surface.

Wildlife is relatively average for the region, predominately the avifauna and mammals, however there are reptiles present. There is a river nearby the mine site, but due to terrain, there is no water on site.

The Environmental Impact Statement generated for this project indicates that the operations will be developed in an area with xerophilic vegetation, where there are some threatened/protected species that will be considered for relocation. This zone contains 19 shrub species with ecological value, as well as 11 tree species, and 10 cacti and special plants.

Regarding fauna, 61 species of mammals (two threatened) have been identified, as well as 221 species of birds (seven threatened and 20 with special protection), 11 species of amphibians (one threatened and three with special protection), and 31 reptiles (eight threatened and six with special protection).

17.2 Requirements and Plans for Waste and Tailings Disposal, Site Monitoring, and Water Management during Operations and after Mine Closure

The open pit mine life will be short and will be focused in a small area. Waste generation will be managed during mine operations and the waste rock will be part of the closure plan for the site. No tailings will be generated on site. Tailings are produced at Plant 2, which has sufficient tailings storage capacity for the LOM of the Project. Golden Minerals has the necessary permits and agreements to obtain water from the nearby Nazas River for mine operations. The water amount required for operations at the open pit is minimal. There will be no water remaining on site at closure.

17.3 Project Permitting Requirements and Status

Permitting requirements, surface rights agreements, and commercial agreements are shown in **Table 17-1** and **Table 17-2** below. According to the information provided, and given the nature of the project, there is no reclamation bond required for this operation.

17.4 Plans, Negotiations, or Agreements with Local Individuals or Groups

Golden Minerals has reached several agreements with the communities and specific individuals of those communities. Agreements with the ejido for right of way of some specific zones of the project have been achieved. Owners of other private lands have agreed to lease portions of their land for mine operations. Tetra Tech has verified those agreements are in place and current.

17.5 Mine Closure Plans and Costs

Golden Minerals has generated a closure plan for the mine by an independent consultant, since the plant for mineral processing is expected to continue to operate beyond the life of mine for another project Golden

Minerals owns. The plan is to stabilize the waste rock dumps, as well as the low-grade stockpiles, the pit area will be fenced, the explosive magazines will be dismantled, and the roads will be reforested. The estimated cost for these activities is approximately US$447,000.

17.6 Data Adequacy and Compliance with Environmental Compliance, Permitting, and Local Individuals or Groups

The information provided by Golden Minerals contains legal documentation related to environmental compliance, and SEMARNAT, the governmental office in charge of the environmental aspects. Golden Minerals also has provided documents that support operations from the permitting side, which are official files for mine operations, haulage, waste, and water aspects. There are also documents related to agreements with the communities for other related activities that are described next. The data provided is in good standing to the knowledge and understanding of the QPs of this report.

17.7 Commitments to Ensure Local Procurement and Hiring

There are several agreements with the communities around the Project. These agreements are related to temporary use of land, local workforce for loading and hauling mineralized material from the mine to the plant, land leasing from the owners of the land required for mine operations, and other community related activities.

Table 17-1 includes a summary of the Mexican environmental authorities and documents that include descriptions of studies and procedures for obtaining the required permits according to SEMARNAT Durango for Environmental Studies, CONAGUA for Water use and Landowners, Communities and Private Owners, conditions, costs, and payments associated and time frames for operating the Rodeo Project by Minera de Cordilleras, a Mexican subsidiary of Golden Minerals.

Table 17-2 includes a summary list of contracts and authorizations for operating the Rodeo Project, including contractors for diamond drilling, transportation of minerals from the open pit mining operations to the Processing Plant 2, located at Velardeña, within property controlled by Golden Minerals.

Table 17-1: Environmental and legal documents for the Rodeo Project

Authorization	Number	Effective Date	Type	Expiration/ Duration
1.- Change Use of Soil (CUS) in Forest Land.	SG/130.2.2/01423/20	Sep 22, 2020.	CUSTF - 13.1887 Ha.	5 years.
2.A.- Solid Waste Management.	SRNyMA. SMA.0861.2021	Jan 2021.	RERET-1-SRNYMA-426-21	1 year
2.B.- Provisional Permit for Unloading. Contractor "SANIEXPRES**".**	SN.	Feb. 10, 2022.	Direct Discharge from Plant.	Feb. 10, 2023.
3.A.- Re-validation of General Permit for the Use of Explosives & Acc.	4596-Dgo.	Jan 1 to Dec 31, 2023.	Permit for use of Explosives.	Dec 31, 2023.
3.B.- Re-validation of General Permit for the use of Explosives & Acc.	5219-Dgo.	Jan 1 to Dec 31, 2023.	Permit for use of Explosives.	Dec 31, 2023.
4 A.- Re-validation of Permit for Management of Hazardous Waste.	MWIMJ1000421.	Nov 21,2014.	Mining Operations.	Extension 2025.

Authorization	Number	Effective Date	Type	Expiration/ Duration
4 B.- Re-validation of Permit for Management of Hazardous Waste.	10/EV-0561/05/08.	May 28, 2008.	Mining Operations.	Extension 2025.
4 C.- Re-validation of Permit for Management of Hazardous Waste.	10/EV-0312/10/09.	Oct 15, 2009.	Mining Operations.	Extension 2025.
4 D.- Re-validation of Permit for Management of Hazardous Waste.	10/EV-0225/04/18.	Apr 11, 2018.	Generator Operations.	Extension.
5.- Second Notification in Environmental Impact.	SG/130.2.1.1/0013/22.	Jan 18, 2022.	Extension of Tailings Dam.6 yrs.	Extension due to inactivity.
7.- Records of Management of Metallurgical Waste.	MWIMJ1000411.	Dec 11, 2017.	Application for Registration.	Approval July 31, 2018 (0006148).
8.- Extension of Tailings Dam III, Phase 2A and 3A	SG/130.2.2/0132/2022	Jan 18, 2022.	Application Extension 2 years.	Approval for 2 more years.
9.- Surface Rights Agreement with Ejido Francisco Márquez.	Ejido Francisco Márquez	Mar 29, 2020.	Rights to drive through Ejido.	Duration 10 years with ability to re-new

Table 17-2: Commercial service contracts for Minera de Cordilleras

Contract Name	Purpose	Effective Date	Description	Contractor	Term	Comment
10.- Mineral Transport from Rodeo Project to GM Velardeña Plant.	Transportation distance 115 km.	Contract from Aug 2, 2021.	Transportation via: Rodeo, Nazas, Pedriceña and Velardeña.	Llanos de Zapata, S.P.R. Ced. AR6551/2021.	Renewable, under negotiation for renewal.	Insurance per Load $4,000. US.
11 A.- Diamond Drilling Contract for Rodeo Project.+-40 DHs t +-100 m depth.	Drilling 2,000 m in NQ, HQ and PQ	Duration of contract 4 months.	Drilling at the Rodeo Project 2,000m, +- 100 ea. Diam. NQ, HQ, PQ.	Contractor Site: Tlajomulco de Zúñiga, Jalisco.	Contract: 4 Mo. Drill 2,000 m in 40 DHs.	Advance pay. $15,000 US + $3,000 mobilization.
11 B.- Diamond Drilling Contract for Rodeo Project DH of 4.5” to 5.5” Diam.	Drilling 2,500 m minimum.	Contract from July 30, 2021/Copl.	Drilling at the Rodeo Project 2,500m, Diam. 4.5 to 5.5 Inches.	Major Drilling de México, Calle Nogales 29, Hillo.	Contract: Drill 2,500 m minimum.	Payments upon presentation of Invoice c/15 days.
11 C.- Rental of Crushing Equipment for Excavation, Drilling & Construction (*).	Workings at Rodeo Project.	Duration to Dec 31, 2021.	Machinery and equipment rented includes operators.	Triturados del Guadiana, S.A.C.V.	Annual contract to Dec 31, 2021.	Contract may be extended by Minera Cordilleras.

18. CAPITAL AND OPERATING COSTS

Capital and operating costs for the Rodeo Project have not been estimated as part of this Initial Assessment Technical Report Summary.

19. ECONOMIC ANALYSIS

An economic analysis has not been performed for the Rodeo Project for this Initial Assessment Technical Report Summary.

20. ADJACENT PROPERTIES

There are no relevant adjacent properties to the Rodeo mine.

21. OTHER RELEVANT DATA AND INFORMATION

Relevant data pertaining to the Project is detailed in the other sections of this TRS and the authors do not consider any additional information necessary to provide a balanced and complete description of the Project.

22. INTERPRETATION AND CONCLUSIONS.

The Rodeo mine has been in production since Q1 2021. The operation utilizes contract drilling, mining, and hauling services, and processes mineralized material at Golden Minerals' wholly owned processing plant in Velardeña. The Project has been successfully producing and selling doré to the market.

22.1 Geology and Resource

The author has reviewed the Resource model for the Rodeo deposit estimated by Golden Minerals staff. The inputs, parameters, and estimation results are within industry best practices. The estimation, classification, and reporting of the Resources constrained by the mine design are conservative in nature. Production data validates the previous drilling and Resource estimates.

22.2 Mining

Open pit surface mining is completed at the Rodeo site using a diesel excavator and over highway trucks to transport the mineralized material to the processing plant at the company's Velardeña property. Mine production averages 1,800 tpd of total movement and the pit has an expected mine life of six months, and the LOM includes two additional months of production from the high-grade stockpile at the plant. Tetra Tech has reviewed the mine plan created by Golden Minerals staff and finds it to be within industry best practices. The pit parameters are considered conservative in nature.

22.3 Metallurgy and Processing

The metallurgical report prepared by RDi for the Rodeo Project provided data sufficient for use in this TRS. Golden Minerals demonstrated recovery of gold and silver from Rodeo mineralized material at Plant 2. Installation of an additional ball mill circuit in April 2021 provided the ability to process material with varying degrees of hardness at a rate of 520 tpd or more.

The tailings pond at Plant 2 was expanded in 2019 providing capacity for the storage of the Rodeo Project's tailings. Golden Minerals has a permit that will allow further expansion of the pond if required.

22.4 Environmental and Permitting

Tetra Tech has reviewed the available information on permits, agreements, and environmental aspects. Based on this information, the author does not know of any outstanding issues on this regard that will affect the current operations or mine life.

22.5 Significant Risk Factors

The mine is operating and selling a product and has a relatively short mine life. These factors reduce some of the significant risk factors for the Project. Risks include changes in agreements with landowners and/or communities for access, mining, and water use.

23. RECOMMENDATIONS

23.1 Geology and Resource

Continue to reconcile the block model with the blast hole information as mining progresses.

23.2 Mining

Mining of the Rodeo pit is expected to be completed by the third quarter of 2023. No mining recommendations are made for the Rodeo mine.

23.3 Metallurgy and Processing

Based on the author's review of the metallurgical testing, it is recommended that Golden Minerals continue to investigate ways to improve gold leach recovery through mineralogical studies and laboratory leach test work.

24. REFERENCES

Mineral Resources Engineering. 2020. "Preliminary Economic Assessment, Rodeo Project." NI 43-101 Technical Report, Salt Lake City, UT.

Tetra Tech. 2022. "Preliminary Economic Assessment - Rodeo Project." NI 43-101 Technical Report, Golden, CO.

25. RELIANCE ON INFORMATION PROVIDED BY THE REGISTRANT

The authors are relying on documents and statements provided by Golden Minerals personnel regarding:

- Resource estimation
- Mine and plant production data
- Legal status of mineral concessions
- Status and timelines of permits, contracts, and agreements required for the future or that are under negotiation
- Material contracts
- Mine closure plans and associated costs