Preliminary Economic Assessment, Yauricocha Mine, Yauyos Province, Peru

Effective Date: June 30, 2020
Report Date: November 19, 2020

Prepared for

Sierra Metals Inc.

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2US043.007
November 2020

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Project No: 2US043.007

File Name: Yauricocha_TR_PEA_2US043.007_20201119_rev47.docx

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1 Executive Summary

This PEA report was prepared as a Canadian National Instrument 43-101 (NI 43-101) Technical Report (Technical Report) for an updated Mineral Resource estimate prepared for Sierra Metals Inc. (Sierra), on the Yauricocha Mine (Yauricocha or Project), which is located in the eastern part of the Department of Lima, Peru. Sierra engaged various specialist groups to evaluate how, on a conceptual level; mining, mineral processing, and tailings management could be adapted at the Property to achieve a sustainable and staged increase in mine production and mill throughput.

Sierra Metals prepared life of mine (LOM) production and development plans based on four production rate options ranging from the base case of 3,780 tonnes per day (tpd) to 7,500 tpd (Table 1-1). The specific details for these production options are described in Section 16, operating and capital cost information is provided in Section 21, and an economic analysis of each production rate option is provided in Section 22.

Table 1-1: LOM Production Rates

Tonnes/Day	Tonnes/Year	Comments
3,780 tpd (base case)	1.3 M	Constant production rate through LOM *
5,500 tpd	2.0 M	Increases from 3,780 tpd to 5,500 tpd in 2024
6,500 tpd	2.4 M	Reaches 6,500 tpd in 2024
7,500 tpd	2.8 M	Reaches 7,500 tpd in 2024

Source: Sierra Metals, Redco, 2020
Note: * *3780 tpd used as the base case assumes that permits will be received to reach that level, which is in the initial process.

This Preliminary Economic Assessment (PEA) report was prepared in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum Standards on Mineral Resources and Reserves: Definitions and Guidelines, May 10, 2014 (CIM, 2014).

The reader is reminded that PEA studies are indicative and not definitive and that the resources used in the proposed mine plan include Inferred Resources as allowed for by the Canadian Securities Administrators (CSA) NI 43-101 in PEA studies. The PEA is preliminary in nature; it includes Inferred Mineral Resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as Mineral Reserves, and there is no certainty that the results of the PEA will be realized.

This PEA report is not a wholly independent report as some sections have been prepared and signed off by qualified persons (QPs) from Sierra Metals, the project owner and producing issuer. The terms ‘QP’ and ‘producing issuer’ are used here as defined under NI 43-101 Standards of Disclosure for Mineral Projects. The QPs responsible for this report are listed in Sections 2.2 and 2.3. Additionally, Sierra is a producing issuer as defined in the NI 43-101 guidelines.

1.1 Property Description and Ownership

The Yauricocha Mine is in the Alis district, Yauyos province, Department of Lima, approximately 12 km west of the Continental Divide and 60 km south of the Pachacayo railway station. The active mining area within the mineral concessions is located at coordinates 421,500 m east by 8,638,300 m north on UTM Zone 18L on the South American 1969 Datum, or latitude and longitude of 12.3105º S and 75.7219º W. It is geographically in the high zone of the eastern Andean Cordillera, and within one of the major sources of the River Cañete which discharges into the Pacific Ocean. The mine is at an average altitude of 4,600 masl (Gustavson, 2015).

The current operation is an underground polymetallic sulfide and oxide operation, providing material for the nearby Chumpe process facility. The mine has been operating continuously under Sociedad Minera Corona S.A. (Minera Corona) ownership since 2002 and has operated historically since 1948. Sierra purchased 82% of Minera Corona in 2011.

1.2 Geology and Mineralization

The Yauricocha Mine features several mineralized bodies, which have been emplaced along structural trends, with the mineralization itself related to replacement of limestones by hydrothermal fluids related to nearby intrusions. The mineralization varies widely in morphology, from large, relatively wide, tabular manto-style deposits to narrow, sub-vertical chimneys. The mineralization features economic grades of Ag, Cu, Pb and Zn, with local Au to a lesser degree. The majority of the deposits are related to the regional high-angle NW-trending Yauricocha fault or the NE-trending and less well-defined Cachi-Cachi structural trend. The mineralization generally presents as polymetallic sulfides but is locally oxidized to significant depths or related to more Cu-rich bodies.

1.3 Status of Exploration, Development and Operations

The mine is concurrently undertaking exploration, development and operations. Exploration is ongoing near the mine and is supported predominantly by drilling and exploration drifting. The mine is also producing several types of metal concentrates from the underground mine areas.

1.4 Mineral Processing and Metallurgical Testing

Yauricocha is consistently producing commercial quality copper concentrate, zinc concentrate, and lead concentrate. The lead concentrate produced in the oxide plant, because of its small tonnage and/or lower grades, is blended in the plant with the concentrate produced from the polymetallic circuit to generate a lead concentrate of commercial quality.

The plant has been subject to continuous improvements in recent years to improve recovery and deportment of metals. Recent improvements to the processing facilities include:

- Addition of one OK-50 flotation cell to increase Cu-Pb bulk flotation stage;
- Installation of x-ray slurry analyzer for six streams: flotation feed, middling Zn feed, copper final concentrate, lead final concentrate, zinc final concentrate and final tailings;
- Mechanical rod feeder for primary rod mill grinding for improved safety and production;
- Installation of five DR-180 cells in the Second Zn Cleaning Flotation Stage; four DR-180 cells in the Third Zn Cleaning Flotation Stage in order to improve the Zn concentrate grade and to increase the nominal plant capacity up to 4000 tpd; and

- Installation of 10 DR-180 cells in the Bulk Cleaning Flotation Stage arranged in three banks, with which the flotation retention time is increased from 9 minutes to 17 minutes:
  - First Cleaning Flotation Stage (comprising 5 cells);
  - Second Cleaning Flotation Stage (comprising 3 cells); and
  - Third Cleaning Flotation Stage (comprising 2 cells).

Table 1-2 shows the mill's feed tonnages and head grades for the period of January 2019 to June 2020. In this period, there was no treatment of any oxide mineralized material. Table 1-3 shows the mill's performance from 2013 to 2020.

Table 1-2: Mill Tonnage and Head Grades, January 2019 to June 2020

Period	Mineralized Material (tonnes)	Head Grade					
		Au (g/t)	Ag (g/t)	Pb (%)	Cu (%)	Zn (%)	As (%)
2020 Jun	78,080	0.63	61.1	1.49	1.02	3.72	0.13
2020 May	64,364	0.68	69.65	1.99	1.1	3.89	0.14
2020 Apr	60,090	0.53	69.69	1.43	1.57	2.74	0.14
2020 Mar	78,553	0.63	70.85	1.59	1.22	3.87	0.14
2020 Feb	103,764	0.66	66.01	1.6	1.09	3.81	0.14
2020 Jan	102,908	0.75	61.89	1.49	1.11	4.05	0.14
2019 Dec	110,939	0.7	59.33	1.47	1.22	3.99	0.13
2019 Nov	101,862	0.55	58.74	1.66	0.93	4.09	0.15
2019 Oct	108,900	0.56	62.27	1.52	1.01	4.07	0.13
2019 Sep	100,030	0.51	63.02	1.54	1.11	3.57	0.15
2019 Aug	106,988	0.59	66.77	1.82	1.14	3.94	0.14
2019 Jul	100,221	0.64	69.25	1.69	1.11	3.86	0.15
2019 Jun	99,588	0.55	68.84	1.8	1.09	3.58	0.13
2019 May	101,502	0.65	59.55	1.5	0.94	3.33	0.14
2019 Apr*	53,075	0.61	59.25	1.29	1.12	3.02	0.14
2019 Mar*	51,707	0.59	64.91	1.48	1.17	3.29	0
2019 Feb	88,010	0.59	63.08	1.28	1.06	3.57	0
2019 Jan	94,097	0.5	63.15	1.61	0.85	3.7	0
Averages	**89,149**	**0.61**	**64.1**	**1.58**	**1.09**	**3.72**	**0.12**

Source: Sierra Metals, 2020
* production in March and April 2019 was affected by a strike at the mine.

Table 1-3: Yauricocha Metallurgical Performance, 2013 to 2020*

Period	Stream	Tonne	Tonnes/day (@ 365 d/y)	Concentrate Grade					Metal Recovery				
				Au (g/t)	Ag (g/t)	Pb (%)	Cu (%)	Zn (%)	Au (%)	Ag (%)	Pb (%)	Cu (%)	Zn (%)
2013	Mineralized Material	641,268	1,757		83	1.5	0.7	4.1		100	100	100	100
	Cu Con.	12,728	35		1,058	2.8	23.2	6.4		25.2	3.7	70.6	3.1
	Pb Con.	14,258	39		1,300	53.4	1.8	5.9		34.7	80	6.3	3.2
	Zn Con.	45,412	124.4		122	0.6	1	50.8		10.4	3	10.8	88.7
2014	Mineralized Material	703,713	1,928		84	1.8	0.7	4		100	100	100	100
	Cu Con.	12,782	35		1,115	2.1	26.4	6.8		24.2	2.1	68	3.1
	Pb Con.	18,055	49		1,398	58.6	1.5	4.9		42.8	83.9	5.3	3.2
	Zn Con.	48,657	133		115	0.8	1.4	50.6		9.5	3.1	13.2	88.5
2015	Mineralized Material	618,460	1,694		79	1.6	0.6	3.4		100	100	100	100
	Cu Con.	8,145	22		1,278	2.3	27.8	4.1		21.4	1.8	65.3	1.6
	Pb Con.	14,463	40		1,656	59.5	1.1	4.3		49.3	85.7	4.7	2.9
	Zn Con.	37,587	103		91	0.6	1.2	50.7		7.1	2.1	13.4	90.1
2016	Mineralized Material	698,872	1,915	0.5	80.3	1.8	0.6	3.9	100	100	100	100	100
	Cu Con.	9,068	25	3.1	1362.6	2.1	26.3	6.8	8.1	22	1.5	61.3	2.3
	Pb Con.	18,014	49	1.7	1470.8	59	1.2	4.8	9.1	47.2	86.3	5.6	3.1
	Zn Con.	47,573	130	0.4	95.2	0.7	1.2	51.5	4.9	8.1	2.6	14.2	88.9
2017	Mineralized Material	966,138	2,647	0.6	66	1.5	0.7	3.9	100	100	100	100	100
	Cu Con.	16,412	45	2.7	920.5	2.4	26.9	7.6	8.4	23.7	2.8	67.3	3.3
	Pb Con.	21,731	60	1.8	1242.3	56.8	2.5	5.5	7.4	42.3	86.9	8.4	3.2
	Zn Con.	65,671	180	0.4	110.8	0.9	1.4	51.4	5.3	11.4	4	14.2	89.4
2018	Mineralized Material	985,679	2,700	0.6	58.4	1.3	0.9	3.8	100	100	100	100	100
	Cu Con.	21,940	60	2.2	677.4	2.3	28.1	7.5	8.4	25.8	3.8	70.1	4.4
	Pb Con.	20,146	55	2.2	1087.5	56.1	3.3	5.7	7.6	38.1	85.8	7.5	3
	Zn Con.	65,823	180	0.5	101.4	0.8	1.8	50.9	5.2	11.6	4.1	13.4	88.7
2019	Mineralized Material	1,092,410	2,993	0.6	63.9	1.6	1.1	3.7	100	100	100	100	100
	Cu Con.	30,931	85	2.3	593.9	1.8	29.4	6	11	26.3	3.2	76.9	4.6
	Pb Con.	26,574	73	2.1	1131.6	57.6	2.4	5.5	8.4	43.1	88.8	5.4	3.6
	Zn Con.	69,863	191	0.5	90.6	0.6	1.7	51	4.9	9.1	2.6	10.1	88
2020*	Mineralized Material	483,509	2,657	0.7	66.3	1.6	1.2	3.7	100	100	100	100	100
	Cu Con.	17,127	94	1.9	531.5	1.9	25.4	5.9	10.4	28.4	4.3	76.4	5.6
	Pb Con.	13,972	77	2.2	996.4	47.9	2.1	4	9.5	43.4	87.2	5.1	3.1
	Zn Con.	38,925	214	0.4	76.9	0.6	1.5	40.5	5.1	9.3	3	10.6	87.5

Source: Sierra Metals, 2020
* January to June 2020

In 2020, silver is preferably recovered with the lead sulfide concentrate and accounts for approximately 43% of the total silver recovered at Yauricocha. Copper concentrate recovers approximately 28% of the silver, and zinc concentrate recovers 9%. The overall silver recovery at Yauricocha totaled 81% during the first six months of 2020.

Yauricocha's metallurgical laboratory has been testing samples from multiple sources, including polymetallic material from Esperanza, Cuerpo Contacto Occidental, from Mina Mario among others. In most of the cases the metallurgical test results show good amenability to conventional processing and potential to achieve commercial quality concentrates. Some samples show arsenic presence, while others achieve lower concentrate grades because of their higher oxides content. In all cases, laboratory personnel are continuously investigating improved process conditions for treating the new sources of mineralized material.

1.5 Mineral Resource Estimate

CIM Definition Standards for Mineral Resources and Mineral Reserves (May 2014) defines a Mineral Resource as follows:

"A Mineral Resource is a concentration or occurrence of solid material of economic interest in or on the Earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling".

The "reasonable prospects for economic extraction" requirement generally implies that the quantity and grade estimates meet certain economic thresholds and that the Mineral Resources are reported at an appropriate cut-off grade (CoG) taking into account extraction scenarios and processing recoveries. To assess this at Yauricocha, SRK has calculated an economic value for each block in terms of US dollars based on the grade of contained metal in the block, multiplied by the assumed recovery for each metal, multiplied by pricing established by Sierra Metals for each commodity. Costs for mining and processing are taken from data provided by Sierra for their current underground mining operation.

SRK is of the opinion that the resource estimations are suitable for public reporting and are a fair representation of the in-situ contained metal for the Yauricocha deposit.

The June 30, 2020 consolidated Mineral Resource statement for the Yauricocha Mine is presented in Table 1-4. The detailed, individual tables for the various Yauricocha mining areas are presented in Section 14 of this report.

Table 1-4: Consolidated Yauricocha Mine Mineral Resource Statement as of June 30, 2020 – SRK Consulting (Canada), Inc. (1) (2) (3) (4) (5) (6) (7) (8) (9)

Classification	Volume (m^3) '000	Tonnes (K t)	Density (kg/m^3)	Ag (g/t)	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	As (%)	Fe (%)	NSR (USD/t)	Ag (M oz)	Au (K oz)	Cu (M lb)	Pb (M lb)	Zn (M lb)
Measured	1,458	4,904	3.36	55.81	0.59	1.13	0.83	2.59	0.18	24.47	113	8.8	93.5	122.2	89.4	280.1
Indicated	3,226	11,020	3.42	38.39	0.50	1.20	0.52	2.05	0.14	25.41	98	13.6	178.0	291.1	126.7	498.9
Measured + Indicated	4,684	15,924	3.40	43.75	0.53	1.18	0.62	2.22	0.15	25.12	103	22.4	271.5	413.3	216.2	779.0
Inferred	3,346	11,633	3.48	27.54	0.45	1.40	0.31	0.95	0.07	26.65	84	10.3	167.4	357.9	79.3	242.5

Notes

(1) Mineral Resources have been classified in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum ("CIM") Definition Standards on Mineral Resources and Mineral Reserves, whose definitions are incorporated by reference into NI 43-101.

(2) Mineral Resources are reported inclusive of Mineral Reserves. Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability. All figures are rounded to reflect the relative accuracy of the estimates. Silver, gold, copper, lead, zinc, arsenic (deleterious) and iron assays were capped / cut where appropriate.

(3) The consolidated Yauricocha Mineral Resource estimate is comprised of Measured, Indicated and Inferred Resources in the Mina Central, Cuerpos Pequeños, Cuye, Mascota, Esperanza and Cachi-Cachi mining areas.

(4) Polymetallic Mineral Resources are reported at Cut-Off Values (COVs) based on 2020 actual metallurgical recoveries and 2020 smelter contracts.

(5) Metal price assumptions used for polymetallic feed considered CIBC, August 2020 long-term consensus pricing (Gold (US$1,502/oz), Silver (US$18.24/oz), Copper (US$3.05/lb), Lead (US$0.91/lb), and Zinc (US$1.06/lb).

(6) Lead Oxide Mineral Resources are reported at COVs based on 2020 actual metallurgical recoveries and 2020 smelter contracts.

(7) Metal price assumptions used for lead oxide feed considered CIBC, August 2020 long-term consensus pricing (Gold (US$1,502/oz), Silver (US$18.24/oz) and Lead (US$0.91/lb).

(8) The mining costs are based on 2020 actual costs and are variable by mining method.

(9) The unit value COVs are variable by mining area and proposed mining method. The marginal COV ranges from US$25 to US$36.

1.6 Mineral Reserve Estimate

A Mineral Reserve is the economically mineable part of a Measured and/or Indicated Resource. It includes diluting material and allowances for losses, which may occur when the material is mined or extracted and is defined by studies at Prefeasibility or Feasibility level as appropriate that include the application of Modifying Factors.

A Mineral Reserve has not been estimated for the Project as part of this PEA.

The PEA includes Inferred Mineral Resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as Mineral Reserves.

1.7 Mining Methods

1.7.1 Mining

The Yauricocha Mine is a producing operation with a long production history. The majority of mining is executed through mechanized sub-level caving with a relatively small portion of the mining using overhand cut and fill. The mine uses well-established, proven mining methods and is anticipated to continue to maintain an approximate 3,800 tpd (1.4 Mt/y) production rate for the remainder of 2020.

Polymetallic sulfide mineralized material accounts for more than 99% of the material mined at Yauricocha. Material classified as lead oxide can also be encountered, but it is a minor component of the overall tonnage in the mineralized zones currently being mined.

The mine is accessed by two shafts, Central shaft and Mascota shaft, and the Klepetko and Yauricocha tunnels. Mineralized material and waste are transported via the Klepetko tunnel at the 720 level (elevation 4,165 masl) which runs east-northeast from the mine towards the mill and concentrator, and the 4.7 km Yauricocha tunnel, commissioned in 2018, that also accesses the mine at the 720 level. The Yauricocha tunnel was added to increase haulage capacity and serves as a ventilation conduit. The Yauricocha shaft, currently under construction, will provide access down to 1370 level and is expected to be in production in 2021.

1.7.2 Geotechnical

Geotechnical investigations have been conducted at the Yauricocha Mine to prepare a geotechnical model of ground conditions. The investigations involved preparing a major fault model, rock mass model, rock mass strength model, rock mass characterization, granular material (mineralized material) classifications; underground traverse mapping, core logging, laboratory tests, shafts inspections, subsidence studies, preparation of a geotechnical database, and the implementation of a data collection process. In 2017, SRK confirmed that these activities complied with international standards and industry best practices.

Mudflows, also known as mud rushes, are encountered at Yauricocha. At present, lower mined levels where mudflows are occurring are at the 820 level (elevation of 4,040 masl to 4,057 masl in the Antacaca and Catas mineralized material bodies) and the 870 level (elevation of 4,010 masl to

4,093 masl in the Rosaura and Antacaca Sur mineralized material bodies). All of the recorded mudflows have been located within mineralized material bodies near the contact with the Jumasha limestone and the adjacent granodiorite and Celendín formation. The current understanding of mudflow conditions is sufficient to support the drawpoint design adjustments implemented by Yauricocha, mucking operations, and dewatering programs.

The ground control management level plans reviewed present a rock mass quality regime that is consistent with the conceptual geotechnical rock mass model, as well as the description of the domains and sub-domains from the 2015 technical report. The level plans, and accompanying development profile and installation procedures are well developed and appropriate for operational application. The ground support designs were not reviewed in detail as part of this study, but an observation was made that the ground support type for good ground did not include any surface support. Unless there is a thorough and regimented check-scaling procedure ensured, industry standard is to have surface support of mesh and/or shotcrete even in good ground.

SRK is of the opinion that the current understanding of subsidence and its effects is reasonable. The current understanding of in-situ and induced stress for the current mining areas is satisfactory, but for the deeper planned mining areas, site specific stress measurements and stress modelling are needed. The current understanding of the conditions leading to mudflow and the mitigation measures put in place are reasonable; however, the potential occurrence of a mud rush event is an ever-present risk, particularly when entering new mining areas. Dewatering practices need to be maintained, existing drawpoints monitored, and new areas investigated prior to being developed.

1.7.3 Hydrogeology

Hydrogeological and hydrological information is available from multiple sources, including mine records and a large number of investigations and data compilations by external consultants. Mine operations have compiled significant information on flow rates and field water quality parameters (e.g., color, pH, conductivity, temperature) across much of the mine and developed maps summarizing locations and data. The numerous hydrogeological and hydrological studies completed by external consultants (Geologic, 2014, 2015; Hydro-Geo Consultores, 2010, 2012, 2016; Geoservice Ingenieria 2008, 2014, 2016; Helium, 2018) involved the collection of data from underground observations, pump tests, tracer tests, and surface water features.

Current observations and analyses suggest that inflow to both the subsidence (caving) zone and the mine will increase as the mine expands. Mitigation and management efforts should continue to understand the distribution of water and value in efforts to control or reduce inflow. Mud rushes pose a risk, as described in Section 16.

1.8 Project Infrastructure

The Project is a mature producing mine and mill and all required infrastructure is fully functional. The Project has highway access with two routes to support the Project’s needs, and the regional capital Huancayo (population 340,000) is within 100 km. Personnel travel by bus to the site and are accommodated in four camps. There are currently approximately 1,700 personnel on-site with 500 employees and 1,200 contractors.

The on-site facilities include the processing plant, mine surface facilities, underground mine facilities, tailings storage facility (TSF), and support facilities. The processing facility includes crushing, grinding, flotation, dewatering and concentrate separation, concentrate storage, and thickening and tailings discharge lines to the TSF.

The underground mine and surface facilities include headframes, hoist houses, shafts and winzes, ventilation structures, mine access tunnels, waste storage facilities, high explosives and detonator magazines, underground shops, and diesel and lubrications storage. The support facilities include four camps where personnel live while on-site, a laboratory, change houses and showers, cafeterias, school, medical facility, engineering and administrative buildings, and miscellaneous equipment and electrical shops to support the operations.

The site has existing water systems to manage water needs on-site. Water is sourced from the Ococha Lagoon, the Cachi-Cachi underground mine, and recycle/overflow water from the TSF, depending on end use. Water treatment systems treat the raw water for use as potable water or for service water in the plant. Additional systems treat the wastewater for further consumption or discharge.

Energy for the site is available through electric power, compressed air, and diesel. The electric power is supplied by contract over an existing 69 kV line to the site substation. The power is distributed for use in the underground or at the processing facility. The current power load is 10.5 MVA with approximately 70% of this being used at the mine and the remainder at the mill and other facilities. The power system is planned to be expanded to approximately 14 MVA in 2020/2021. A compressed air system is used underground with an additional 149 kW compressor system being added, and diesel fuel is used in the mobile equipment and in the 895-kW backup electrical generator.

The site has permitted systems for the handling of waste including a TSF, waste rock storage facility, and systems to handle other miscellaneous wastes. The TSF has a capacity for 12 months at the current production levels. The TSF is being expanded with another lift in 2019/2020 to provide three more years of capacity. The three additional lift stages in total will provide the Project with approximately nine years of additional capacity. An on-site industrial landfill is used to dispose of the Project's solid and domestic waste. The Project collects waste oil, scrap metal, plastic, and paper which are recycled at off-site licensed facilities.

The site has an existing communications system that includes a fiber optic backbone with internet, telephone, and paging systems. The security on-site is managed through checkpoints at the main access road, processing plant, and at the camp entrances.

Logistics to the site are primarily by truck with the five primary concentrate products being shipped by 30 t to 40 t trucks to other customer locations in Peru. Materials and supplies needed for Project operation are procured in Lima and delivered by truck.

The infrastructure is well developed and functioning as would be expected for a mature operation. The TSF continues to develop and will require ongoing monitoring to assure the construction of the next lift is timely to support the operation. Ongoing monitoring of the stability of the embankment and operations practices is recommended to conform to industry best practices.

1.9 Environmental Studies and Permitting

Sierra has all relevant permits required for the current mining and metallurgical operations. Sierra also has a Community Relations Plan that includes annual assessment, records, minutes, contracts and agreements. An Environmental Impact Assessment (EIA) was obtained on February 11, 2019.

1.10 Capital and Operating Costs

The capital and operating costs presented here are for the base case production rate of 3,780 tpd. Capital and operating cost estimates for the higher production rates of 5,500 tpd, 6,500 tpd and 7,500 tpd are in Section 21. Capital and operating costs are based upon forward-looking information. This forward-looking information includes forecasts with material uncertainty which could cause actual results to differ materially from those presented herein.

Table 1-5 and Table 1-6 show the capital and growth capital cost (capex) summaries for the base case of 3,780 tpd respectively. Table 1-7 shows the operating cost (opex) summary for the base case of 3,780 tpd.

Table 1-5: Capital Cost Forecast (US$000's) – Base Case 3,780 tpd

Sustaining Capex	Total (US$ 000s)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Exploration & Development															
Development	79,869	5,922	6,141	6,134	6,106	6,270	6,162	6,175	6,164	6,160	6,110	6,203	6,104	6,218	-
Equipment	10,320	1,080	1,080	2,040	1,500	720	720	720	720	720	720	300	-	-	
Projects															
Central Shaft Rehab	1,800	1,000	800	-	-	-	-	-	-	-	-	-	-	-	-
Personnel transportation	4,550	350	-	770	-	770	-	770	-	770	-	770	-	350	-
Concentrator Plant	5,450	1,270	380	800	300	300	300	300	300	300	300	300	300	300	-
Tunnel (Cx 5000 + Shotcrete Plant)	2,300	2,300	-	-	-	-	-	-	-	-	-	-	-	-	-
Drainage System + Study	2,200	1,000	600	600	-	-	-	-	-	-	-	-	-	-	-
Ventilation	10,002	879	869	868	864	888	872	874	873	872	865	878	400		
Ramp Lv 1592 and Mascota	3,240	3,240	-	-	-	-	-	-	-	-	-	-	-	-	-
Environmental	1,165	82	82	83	83	83	83	83	83	83	83	83	83	83	83
Seismograph Study and Instrumentation	250	150	50	50	-	-	-	-	-	-	-	-	-	-	-
Geomechanical Model Study	500	-	250	-	-	250	-	-	-	-	-	-	-	-	-
Fuel Distribution System	300	300	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**121,945**	**17,573**	**10,252**	**11,345**	**8,854**	**9,281**	**8,138**	**8,922**	**8,140**	**8,906**	**8,078**	**8,535**	**6,887**	**6,951**	**83**

Source: Sierra Metals, 2020

Table 1-6: Growth Capex Forecast 3,780 Tonnes/Day

Growth Capex	Total (US$ 000s)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Projects															
Yauricocha Shaft	19,400	7,000	7,500	4,900	-	-	-	-	-	-	-	-	-	-	-
Access to Yauricocha Shaft	5,500	3,000	2,500	-	-	-	-	-	-	-	-	-	-	-	-
Tailing Dam	32,340	3,234	3,234	3,234	3,234	3,234	3,234	3,234	3,234	3,234	3,234				-
Ramp Lv 720 to Ramp Tatiana	600	600	-	-	-	-	-	-	-	-	-	-	-	-	-
Mine Camp	4,650	150	3,000	1,500	-	-	-	-	-	-	-	-	-	-	-
Studies (Increase production)	500	250	250	-	-	-	-	-	-	-	-	-	-	-	-
Studies (geometallurgical)	300	150	-	150	-	-	-	-	-	-	-	-	-	-	-
Closure	9,450	1,000	650	650	650	650	650	650	650	650	650	650	650	650	650
Total	**72,740**	**15,384**	**17,134**	**10,434**	**3,884**	**3,884**	**3,884**	**3,884**	**3,884**	**3,884**	**3,884**	**650**	**650**	**650**	**650**

Source: Sierra Metals, Redco, 2020

Table 1-7: Opex Forecast 3,780 Tonnes/Day

Opex Total	Total (US$ 000s)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Mine	**639,839**	47,467	47,144	47,108	46,970	47,794	47,252	47,314	47,262	47,242	46,572	47,039	46,542	47,115	27,016
Plant	**198,865**	14,712	14,607	14,596	14,551	14,818	14,642	14,662	14,646	14,639	14,556	14,709	14,546	14,734	8,446
G&A	**93,800**	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700
Total	**932,504**	**68,879**	**68,451**	**68,403**	**68,221**	**69,312**	**68,595**	**68,677**	**68,608**	**68,581**	**67,829**	**68,448**	**67,789**	**68,549**	**42,163**

Source: Sierra Metals, Redco, 2020

1.11 Economic Analysis

The PEA considered four different production rates for the Yauricocha Mine:

1. 3,780 tpd (base case);
2. 5,500 tpd (in 2024);
3. 6,500 tpd (in 2024); and
4. 7,500 tpd (in 2024).

As detailed in Section 22, the four production rate options were evaluated financially, and the 7,500 tpd production rate had the highest post tax NPV. Sierra observes that there are some mineralized material and waste haulage issues due to mineralized zone geometry and distribution. As such, Sierra has decided that the 5,500 tpd production rate option is the recommended case for a future pre-feasibility study. Increased production rates beyond 5,500 tpd may be possible once Yauricocha has resolved the mineralized material and waste haulage issues.

The 5,500 tpd (2024) proposed mine plan has a capital requirement (initial and sustaining) of US$ 235 M over the 12-year LOM; efficiencies associated with higher throughputs are expected drive a reduction in operating costs on a per tonne basis. This PEA indicates an after-tax NPV (8%) at 5,500 tpd (in 2024) of US$ 359 M. Total operating cost for the LOM is US$ 915 M, equating to a total operating cost of US$ 45.25 per tonne milled and US$ 1.19 per pound copper equivalent. Economic estimates are based upon forward-looking information. This forward-looking information includes forecasts with material uncertainty which could cause actual results to differ materially from those presented herein.

A sensitivity analysis was performed for each mining plan to analyze the impact of the change on the main drivers: metal grades, operating and capital costs, and gross income. The analysis shows that the NPV is most sensitive to changes in gross income and operating costs, moderately sensitive to changes in capex and the grade of copper, and least sensitive to changes in the grades of silver, gold, lead and zinc.

The proposed mine plan is conceptual in nature and would benefit from further investigation.

1.12 Conclusions and Recommendations

1.12.1 Geology and Mineral Resources Estimation

SRK has the following recommendations for the geology and Mineral Resources at Yauricocha:

- Construct and compile a single reliable secure drilling and sampling database for the entire mine area, which can be easily verified, audited, and shared internally. This can be accomplished through commercially available SQL database management tools.
- Exploration should continue in the Esperanza area, which is locally open along strike and at depth.

- Long-term exploration should be focused on areas such as the possible intersection of the Yauricocha fault and the Cachi-Cachi structural trend, where recent geophysical data are currently being generated to assist in targeting.

- Given the use of channel samples in the Mineral Resource estimations, SRK recommends ensuring that the channel samples are collected on a representative basis, and that they are collected across the entire exposed thickness of a mineralized zone. In addition, they should be weighed for each sample to ensure that appropriate quantities of material are sampled from both the harder, more difficult material and the higher-grade, softer material.

- SRK recommends reviewing the performance of the QA/QC program as soon as batches of results are returned. If any failures occur investigation and re-analysis of these samples and +/- five adjacent samples on either side of the respective failure should be completed as soon as possible to prevent any sample preparation or laboratory issues.

- No umpire laboratory checks of the Chumpe laboratory were completed in the period November 2019 to June 2020. SRK recommends that umpire duplicates be implemented on a regular basis for both coarse and pulp reject material.

- SRK recommends that density measurements of drillhole core be implemented as a regular practice to improve density relationships in mineralized and non-mineralized rock.

- Minera Corona should produce detailed internal documentation summarizing the procedures and methods similar to those described in this report.

  - Of note, SRK recommends developing internal standards and procedures for estimation and reporting of Mineral Resources. Although this is somewhat new for the mine personnel, SRK is of the opinion that sufficient talent and technology support exists to continue to develop this expertise.

- Exploration should be supported by a reasonably detailed litho-stratigraphic and structural model for the area to aid in exploration targeting. At present, this model does not exist and should be generated by mine and exploration personnel to produce fit for purpose models.

- SRK recommends that a standardized workflow is applied to the geological modelling to prevent significant changes in mineralized shape forms with minor additions of drillhole information. The integration of structure, stratigraphy and mineralized zone into a global model is essential in developing a comprehensive exploration and mining model. This will prevent inconsistencies and overlap between mineralized zones modelled.

- Classification of certain areas should be reviewed to determine if opportunities exist to refine the scripted classification scheme, or that based on estimation pass (in the case of Minera Corona models) to a hybrid approach taking into account the confidence in the estimation and the reasonableness of the classification distribution.

- Modelling variogram anisotropy for each of the mineralized domains can be improved by considering relevant transformation e.g. gaussian or log transforms of the composites before producing the experimental variograms. Ideally, modelled variograms should be back-transformed before the estimation. Certain commercially available software can complete this process seamlessly.

- Local and global grade anisotropy occur within the larger mineralized bodies. The sensitivity of utilizing a local anisotropy in highly informed data areas, whereas utilizing a global trend in poorly informed areas should be investigated.
- The models estimated internally by the mine should endeavor to regularize certain estimation parameters (such as sample selection criteria) so that these do not vary significantly between metals.
- SRK recommends that Minera Corona implement short term grade control models to track and reconcile with production.

1.12.2 Mineral Processing and Metallurgical Testing

SRK is of the opinion that Yauricocha's processing facility is reasonably well operated and shows flexibility to treat multiple mineralized material sources. The metallurgical performance, i.e., metal recovery and concentrate grade has been consistent throughout the period evaluated allowing the mine to produce commercial quality copper concentrate, lead concentrate, and zinc concentrate.

The spare capacity in their oxide circuit is an opportunity to source material from third-party mines located in the vicinity. The presence of arsenic is being well managed by blending mineralized material in order to control arsenic concentration in the final concentrates. Gold deportment seems an opportunity that Yauricocha may want to investigate, particularly by evaluating gravity concentration in the grinding stage, or alternatively in the final tails, or both.

1.12.3 Mining

SRK has the following recommendations for the mining at Yauricocha:

- The Yauricocha shaft project should be monitored closely in order to ensure timely access to mineralized zones below 1070 level.
- A consolidated 3D LOM design should be completed to improve communication of the LOM plan, infill drilling requirements, and general mine planning and execution.
- Further technical-economic evaluations of the production rate expansion options should be undertaken via pre-feasibility and feasibility studies.

1.12.4 Geotechnical and Hydrogeological

SRK's geotechnical and hydrogeological recommendations are as follows:

- Continue collecting geotechnical characterization data from mined drifts and exploration drillholes;
- Maintain a central geotechnical database;
- Develop and maintain geotechnical models, including structures and rock mass wireframes;

- Conduct a program of stress measurement in the deeper planned mining areas;
- Conduct numerical stress analyses of mining-induced stress effects on planned mining;
- Continue short-term to long-term dewatering programs with drainage systems;
- Examine the current mine sequence and simulate the optimal mine sequence to reduce safety risks and the risk of sterilizing mineralized material due to unexpected ground problems; and
- Revisit the current ground control management plans to check that they are appropriate for the deeper mining areas.
- Continue to actively dewater ahead of production mining and monitor for conditions that could lead to mud rushes.

1.12.5 Infrastructure

Ongoing monitoring of the stability of the TSF embankment and operations practices is recommended to conform to industry best practices.

1.12.6 Recovery Methods

SRK recommends that Yauricocha improve its control of plant operations by installing more instrumentation and an automation control system. Doing so could lead to more consistent plant operation, reduced electrical energy and reagent consumption, and ultimately initiate a continuous improvement of the plant's unit operations and overall performance.

1.12.7 Environmental Studies and Permitting

Social and environmental activities are currently of high importance in Peru; therefore, SRK recommends that the company's commitments and agreements be fulfilled in detail and in a timely manner. Reputational and legal risks can arise due to this issue.

1.13 Recommended Work Program Costs

Table 1-8 lists the estimated costs for the recommended work that is not considered to be covered by on-going operating expenditures.

Table 1-8: Summary of Costs for Recommended Work

Category	Work	Units	Cost US$
Geology and Resources	Infill Drilling [1]	25,000 m	2,500,000
	Exploration Drilling - Yauricocha Expansion [1]	25,000 m	2,500,000
	Structural and litho-stratigraphic model	1	100,000
	Training	1	10,000
	QA/QC and Re-analysis	500	12,500
Geotechnical	Annual data and analysis review and data collection	N/A	100,000
	Stress measurements	1	30,000
Production Rate Increases	Prefeasibility study	1	500,000
Total			**5,752,500**

Source: SRK, 2020

[1] Drilling costs assume US$100/m drilling costs.

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2 Introduction and Terms of Reference

2.1 Terms of Reference and Purpose of the Report

This report presents a Preliminary Economic Assessment (PEA) designed to give an indication of the economic viability of the Yauricocha property. The assessment is based on Indicated and Inferred Resources estimated by SRK and effective as of June 30, 2020. The mine plan presented in this PEA considers the Mineral Resources depleted to June 30, 2020.

Sierra prepared LOM production and development plans based on four production rate options ranging from the base case of 3,780 tpd to 7,500 tpd (Table 2-1). The specific details for these production options are described in Section 16, operating and capital cost information is provided in Section 21, and an economic analysis of each production rate option is provided in Section 22.

Table 2-1: LOM Production Rates

Tonnes/Day	Tonnes/Year	Comments
3,780 tpd (base case)	1.3 M	Constant production rate through LOM *
5,500 tpd	2.0 M	Increases from 3,780 tpd to 5,500 tpd in 2024
6,500 tpd	2.4 M	Reaches 6,500 tpd in 2024
7,500 tpd	2.8 M	Reaches 7,500 tpd in 2024

Source: Sierra Metals, Redco, 2020
Note: *3780 tpd used as the base case assumes that permit will be received to reach that level, which is in the initial process.

The reader is reminded that PEA studies are indicative and not definitive and that the Mineral Resources used in the proposed mine plan include Inferred Resources as allowed for by the CSA NI 43-101 in PEA studies. The PEA is preliminary in nature; it includes Inferred Mineral Resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as Mineral Reserves, and there is no certainty that the results of the PEA will be realized.

2.2 Qualifications of Consultants (SRK)

The consultants preparing this Technical Report are specialists in the fields of geology, exploration, Mineral Resource estimation and classification, underground mining, geotechnical, environmental, permitting, metallurgical testing, mineral processing, processing design, capital and operating cost estimation, and mineral economics.

None of the SRK consultants and associate consultants employed in the preparation of this report has any beneficial interest in Sierra Metals or its subsidiaries. The consultants are not insiders, associates, or affiliates of Sierra Metals or its subsidiaries. The results of this Technical Report are not dependent upon any prior agreements concerning the conclusions to be reached, nor are there any undisclosed understandings concerning any future business dealings between Sierra Metals and the consultants. The consultants are being paid a fee for their work in accordance with normal professional consulting practice.

The following individuals, by virtue of their education, experience and professional association, are considered Qualified Persons (QPs) as defined in the NI 43-101 standard, for this report, and are members in good standing of appropriate professional institutions. QP certificates of authors are provided in Appendix A. The QPs are responsible for specific sections as follows:

- Andre Deiss, B.Sc. (Hons), Pr.Sci.Nat., MSAIMM, SRK Principal Consultant (Resource Geology), is the QP responsible for geology and Mineral Resources, Sections 7 through 12, 14 and portions of Sections 1, 25 and 26 summarized therefrom, of this Technical Report.
- Carl Kottmeier, B.A.Sc., P. Eng., MBA, SRK Principal Consultant (Mining), is the QP responsible for Sections 2 through 6, 27, 28 and portions of Sections 1, 25 and 26 summarized therefrom, of this Technical Report.
- Daniel H. Sepulveda, BSc, SME-RM, SRK Associate Consultant (Metallurgy), is the QP responsible for mineral processing, metallurgical testing and recovery methods Sections 13, 17, and portions of Sections 1, 25 and 26 summarized therefrom, of this Technical Report.

2.3 Qualifications of Consultants (Sierra Metals)

The following individuals from Sierra Metals, by virtue of their education, experience and professional association, are considered QPs as defined in the NI 43-101 standard, for this report, and are members in good standing of appropriate professional institutions. QP certificates of authors are provided in Appendix A. The QPs are responsible for specific sections as follows:

Américo Zuzunaga, Mining Engineer, MBA, FAusIMM, Vice-President Corporate Planning, is the QP responsible for Sections 15, 16, 18, 19, 20, 21, 22, 23 and 24, and portions of Sections 1, 25 and 26 summarized therefrom, of this Technical Report.

2.4 Details of Inspection

Table 2-2 shows recent site visit participants.

Table 2-2: Site Visit Participants

Personnel	Expertise	Date(s) of Visit	Details of Inspection
Andre Deiss	Resource Geology, Mineral Resources	April 28 – May 23, 2019	Reviewed geology, resource estimation methodology, sampling and drilling practices, and examined drill core.
Daniel Sepulveda	Metallurgy and Process	April 28 – May 23, 2019	Reviewed metallurgical test work, tailings storage, and process plant.

2.5 Sources of Information

The sources of information used in the preparation of this report include data and reports supplied by Sierra Metals personnel as well as documents cited throughout the report and referenced in Section 27.

2.6 Effective Date

The effective date of this report is June 30, 2020.

2.7 Units of Measure

The metric system has been used throughout this report. Tonnes (t) are metric, comprising of 1,000 kg, or 2,204.6 lb. All currency is in U.S. dollars (US$ or USD) unless otherwise stated.

3 Reliance on Other Experts

The consultants' opinions contained herein are based on information provided to the consultants by Sierra Metals throughout the course of the investigations.

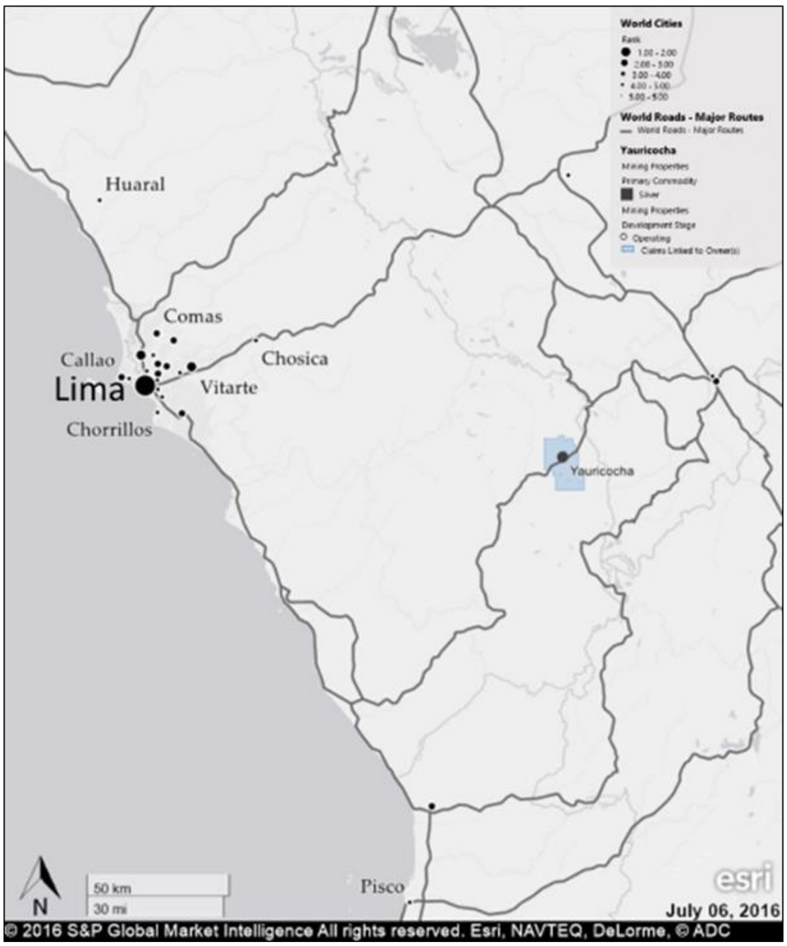
The consultants used their experience to determine if the information from previous reports was suitable for inclusion in this Technical Report and adjusted information that required amending. This report includes technical information that required subsequent calculations to derive subtotals, totals and weighted averages. Such calculations inherently involve a degree of rounding and consequently introduce a margin of error. Where these occur, the consultants do not consider them to be material.

SRK received statements of validity for mineral titles, surface ownership and permitting for various areas and aspects of the Yauricocha Mine and reproduced them for this report. Sierra has assured SRK that the mineral titles, surface ownership and permitting are all valid and in good order. As such, these items have not been independently reviewed by SRK and SRK did not seek an independent legal opinion of these items.

4 Property Description and Location

4.1 Property Location

The Yauricocha Mine is in the Alis district, Yauyos province, Department of Lima, approximately 12 km west of the Continental Divide and 60 km south of the Pachacayo railway station. The active mining area within the mineral concessions is located at coordinates 421,500 m east by 8,638,300 m north on UTM Zone 18L on the South American 1969 Datum, or latitude and longitude of 12.3105º S and 75.7219º W. It is geographically in the high zone of the eastern Andean Cordillera and within one of the major sources of the River Cañete, which discharges into the Pacific Ocean. The mine is at an average altitude of 4,600 masl. Figure 4-1 shows the project location.



Source: Sierra Metals, 2020

Figure 4-1: Yauricocha Location Map

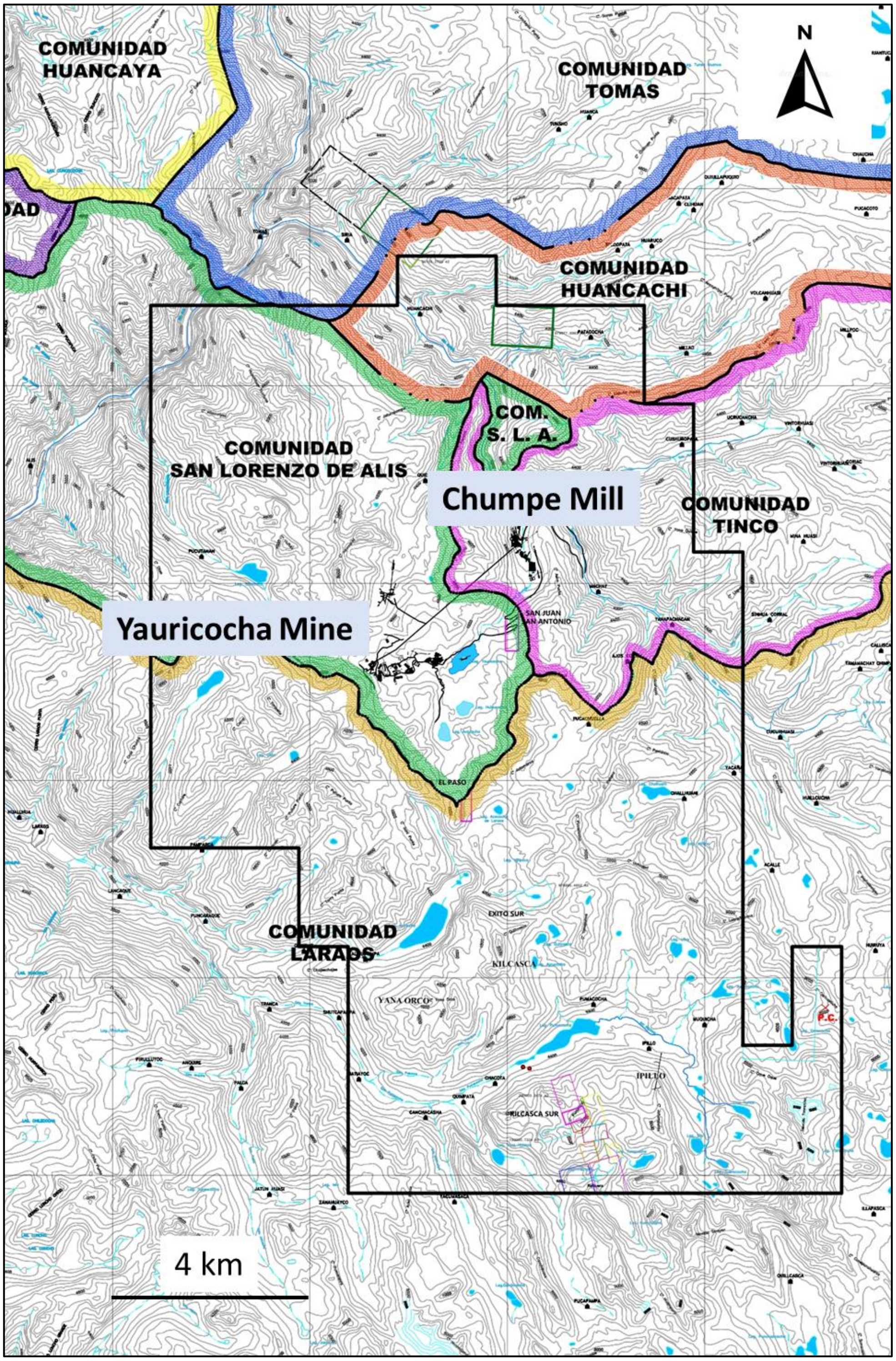
4.2 Mineral Titles

The mining concession Acumulación Yauricocha (Figure 4-2) was transferred from Empresa Minera del Centro del Peru, the Peruvian state-owned mining entity, to Minera Corona in 2002 (Empresa Minera, 2002) for the sum of US$4,010,000, plus an agreement to invest US$3,000,000 to project development or to the community, which has been completed. The Accumulation Yauricocha includes the mineral rights on 18,685 ha. It includes areas in the communities of San Lorenzo de Alis, Laraos, Tinco, Huancachi, and Tomas. Dia Bras purchased 82% of Minera Corona in May 2011. On December 5, 2012, Dia Bras Exploration changed its name to Sierra Metals Inc. According to information provided by Sierra, the mineral concessions are not subject to an expiration date and remain in effect as long as these two conditions are met:

1. Renewal payment is made to the Peruvian federal government in the amount of US$3 per hectare (ha); and

2. Annual minimum production amount of US$100 per year, per hectare.

Included within the above area is a processing site concession with an area of 148.5 ha with a permitted capacity of 3,000 dry tpd. This has been authorized by Resolution No. 279- 2010-MEM-DGM/V on July 14, 2010.



Source: Sierra Metals, 2019

Figure 4-2: Yauricocha Mineral Title Map

4.2.1 Nature and Extent of Issuer's Interest

As part of the mineral concessions transfer from Empresa Minera del Centro del Peru in 2002 (see Section 4.2), Minera Corona acquired approximately 677 ha of land and associated surface rights. A portion of the San Lorenzo Alis community is located within the 677 ha.

In 2007, Minera Corona entered into an additional agreement with the San Lorenzo Alis community (Villaran, 2009). Under this agreement, Minera Corona owns the surface rights and may conduct mining operations in the subject 677 ha through August 2, 2037, or until mine closure, whichever comes first. In exchange, Minera Corona is obligated to pay the San Lorenzo Alis community an annual fee. This fee is paid by Minera Corona every two years beginning on January 1, 2009, and surface rights remain in good standing. However, in February 2013 an addendum was signed which establishes that the payments must be made every year. This right of usufruct (beneficial use) has been registered before the Public Registry of Lima, Office of Cañete (Public Registry of Lima et al, 2013).

Minera Corona has in place several land surface agreements by means of which the title holders of the land surfaces within the area of the Acumulación Yauricocha mining concession, grants Minera Corona the right to use the superficial surface and execute mining activities. The agreements entered by Minera Corona in this regard, are the following:

Lease Agreement: Huacuypacha

Minera Corona has entered into a lease agreement with Mr. Abdon Vilchez Melo, regarding the surface land within the real property named Huacuypacha, located in Tinco, district of Alis, province of Yauyos, Department of Lima. This land is not registered in the Public Registry. By means of this agreement, Minera Corona acquired the right to use said land, including access to water boreholes.

This agreement has been renewed in four opportunities. The term of the agreement expires on December 31, 2021.

Lease Agreement: Queka and Cachi-Cachi

Minera Corona has entered into a lease agreement with the Family Varillas, in relation to land containing 56 ha located in district of Alis, province of Yauyos, Department of Lima. This land is not registered in the Public Registry. By means of this agreement, the landowner granted the use of the referred land in favor of Minera Corona for a total payment of S/.31,500. In addition to the payment obligation, Minera Corona has assumed the obligation to take care of all the environmental liabilities that its activities could generate.

This agreement has been amended in two opportunities. The term of the agreement expired on March 7, 2012. However, Minera Corona has signed a new agreement extending the term of the lease until March 7, 2022 in exchange for a one-time payment of S/.210,000.

4.3 Royalties, Agreements and Encumbrances

4.3.1 Debt

On March 11, 2019, the Company entered into a new six-year senior secured corporate credit facility ("Corporate Facility") with Banco de Credito de Peru that provides funding of up to $100 million effective March 8, 2019. The Corporate Facility provides the Company with additional liquidity and will provide the financial flexibility to fund future capital projects as well as corporate working capital requirements. The Company will also use the proceeds of the new facility to repay existing debt balances. The most significant terms of the agreement are:

- Term: 6-year term maturing March 2025;
- Principal Repayment Grace Period: 2 years;
- Principal Repayment Period: 4 years; and
- Interest Rate: 3.15% + 3-Month London Interbank Offered (LIBOR).

The Corporate Facility is subject to customary covenants, including consolidated net leverage and interest coverage ratios and customary events of default. The Company is in compliance with all covenants as of March 31, 2019. On March 11, 2019, Dia Bras Peru drew down $21.4 million from this facility. Interest is payable quarterly and interest payments will begin on the drawn and undrawn portions of the facility starting in June 2019.

Principal payments on the amount drawn from the facility will begin in March 2021. The Company repaid the amount owed on the Corona Acquisition Facility on May 11, 2019 using funds drawn from the new facility. The loan is recorded at amortized cost and is being accreted to face value over 6 years using an effective interest rate of 5.75%.

4.3.2 Royalties and Special Taxes

In 2011, the Peruvian Congress passed a new Mining Law effective in 2012. Under this law, a Special Tax and Royalty is introduced which applies to the operating margin of producing mining companies. The margin rates for a given interval of Earnings Before Interest and Tax (EBIT) are shown in Table 4-1. The total royalty is the summation of the special mining tax and the mining royalty.

Table 4-1: Royalty and Special Tax Scale

EBIT Margin	Special Mining Tax – Margin Rate	Mining Royalty – Margin Raw
0.00% 5.00%	0.00%	0.00%
5.00% 10.00%	2.00%	1.00%
10.00% 15.00%	2.40%	1.75%
15.00% 20.00%	2.80%	2.50%
20.00% 25.00%	3.20%	3.25%
25.00% 30.00%	3.60%	4.00%
30.00% 35.00%	4.00%	4.75%
35.00% 40.00%	4.40%	5.50%
40.00% 45.00%	4.80%	6.25%
45.00% 50.00%	5.20%	7.00%
50.00% 55.00%	5.60%	7.75%
55.00% 60.00%	6.00%	8.50%
60.00% 65.00%	6.40%	9.25%
65.00% 70.00%	6.80%	10.00%
70.00% 75.00%	7.20%	10.75%
75.00% 80.00%	7.60%	11.50%
80.00% 85.00%	8.00%	12.00%
85.00% 90.00%	8.40%	

Source: Gustavson, 2015

4.4 Environmental Liabilities and Permitting

The mine known as “Acumulación Yauricocha Unit” is located on the property of the San Lorenzo de Alis and Laraos Communities and in the buffer zone of the Nor Yauyos-Cochas landscape reserve. It was established by the Supreme Decree N° 033-2001-AG (06/03/2001) which has a Master Plan 2006-2011 by the National Institute of Natural Resources and Natural Protected Area Office (INRENA, Instituto Nacional de Recursos Naturales, and IANP, Intendencia de Áreas Naturales Protegidas).

Sierra has managed its operations in Acumulación Yauricocha based on:

- The Environmental Adjustment and Management Plan (PAMA, Plan de Adecuación y Manejo Ambiental) presented by CENTROMIN (approved by Directorial resolution N° 015-97-EM/DGM, 01/03/1997);
- The modification of the implementation nine projects of the PAMA of the Yauricocha Production Unit presented by CENTROMIN (approved by Directorial resolution N° 159-2002-EM-DGAA, 05/23/2002);
- The implementation of the PAMA “Yauricocha" Administrative Economic Unit by Sierra (approved by Directorial resolution N° 031-2007-MINEM-DGM, 02/08/2007);

- The Mine Closure Plan (PCM) at feasibility level of the Yauricocha Mining Unit, presented by Sierra (approved by Directorial resolution N° 258-2009-MINEM-AAM, 08/24/2009);
- Authorization to operate the Mill N° 4 (8'x10') and the amendment of the "Yauricocha Chumpe" Benefit Concession to the expanded capacity of 2500 TMD, presented by Sierra (approved by Resolution N° 279-2010-MINEM-DGM-V, 07/14/2010);
- The Yauricocha Mining Unit Mine Closure Plan Update, presented by Sierra (approved by Directorial resolution N° 495-2013-MINEM-AAM, 12/17/2013);
- Supporting Technical Reports to the PAMA (ITS, Informe Técnico Sustentatorio) "Expanding the capacity of the Processing Plant Chumpe of the Accumulated Yauricocha Unit from 2500 to 3000 TMD" (approved by Directorial resolution N° 242-2015-MINEM-DGAAM, 06/09/2015);
- Supporting Technical Report to the PAMA (ITS) "Technological improvement of the domestic waste water treatment system" (approved by Directorial resolution N° 486-2015-MINEM-DGAAM, 11/12/2015); and
- Approval of the amendment of the Closure Plan of the Yauricocha Mining Unit (approved by Directorial resolution N° 002-2016-MINEM-DGAAM, 01/08/2016).

The Supporting Technical Reports are prepared in compliance with the Supreme Decree N° 054-2013-PCM (article Art. 4) and R.M. N° 120-2014-MEM/DM, and refer to the modification of mining components, or extensions and upgrades in the mining unit, in exploration and exploitation projects when the environmental impacts are insignificant.

Environmental liabilities and permitting are discussed in further detail in Section 20. A list of approved environmental and closure permits is included in Section 20.1 Required Permits and Status.

4.5 Other Significant Factors and Risks

SRK is not aware of any additional significant factors or risks that affect access, title, right, or ability to perform work on the property.

5 Accessibility, Climate, Local Resources, Infrastructure and Physiography

Sections 5.1, 5.2, 5.3 and 5.4 of this Report have been excerpted from NI 43-101 Technical Report on the Yauricocha Mine, prepared by Gustavson Associates, report date May 11, 2015 and are shown in italics. Standardizations have been made to suit the format of this report; any changes to the text have been indicated using [brackets].

5.1 Topography, Elevation and Vegetation

The topography of the Yauricocha mining district is abrupt, typical alpine terrain. Pliocene erosion is clearly recognizable in the undulating, open fields to the northeast of the Continental Divide while to the southeast the terrain is cut by deep valleys and canyons. The extent of this erosion is evidenced by mountain peaks with an average elevation of 5,000 masl.

To the southeast of the Continental Divide, the high valleys are related to the Chacra Uplift. Below 3,400 m elevation, this grand period of uplift is clearly illustrated by deep canyons that in some cases are thousands of meters deep. Valleys above 4,000 masl clearly demonstrate the effects of Pliocene glaciations, with well-developed lateral and terminal moraines, U-shaped valleys, hanging valleys and glacial lakes.

Vegetation in the Yauricocha area is principally tropical alpine – rain tundra. The flora is varied with species of grasses, bushes, and some trees. The biological diversity is typical of Andean alpine communities.

5.2 Accessibility and Transportation to the Property

The principal access to the Mine is the main Lima – Huancayo – Yauricocha highway. The highway is paved (asphalt) for the first 420 km, along the Lima – Huancayo – Chupaca interval. From Chupaca to the Mine the road is unpaved.

Another important access route is along the southern Pan-American Highway from Lima through Cañete to Yauricocha, through the valley of the Rio Cañete, for a distance of 370 km. The road is paved (asphalt) from Lima to Pacarán, and from Pacarán to the mine it is unpaved.

5.3 Climate and Length of Operating Season

The climate in the region is cool, with two well-demarcated seasons with daytime temperatures above 20º C; the nights are cool with temperatures below 10º C. Operations are carried out year-round. The wet season extends from November to April, and during April and May there is broad vegetative cover. The dry season covers the remainder of the year.

During the wet season, snow and hail feed the glaciers, which subsequently feed streams that descend the mountainsides and feed the lakes below.

The climate factors do not affect the length of the operating season, and the mine operates continuously year-round.

5.4 Sufficiency of Surface Rights

Overall, the property position including mineral concessions and surface rights are expected to be sufficient for foreseeable mine activities. The project infrastructure is located within the area where Sierra Metals has surface rights. The Cachi-Cachi mine is located within the area of mineral rights, but outside of the area of surface rights. Cachi-Cachi is an underground mine, and surface access to Cachi-Cachi is located within the area of surface rights.

Of the 20 km length of the property along strike, approximately 4 km have been developed near the center of the property.

5.5 Infrastructure Availability and Sources

5.5.1 Power

The primary power is provided through the existing power system, Sistema Interconectado Nacional (SINAC) to the Oroya Substation. A three phase, 60 hertz, 69 kV power line owned and operated by Statkraft (SN Power Peru S.A.) through its subsidiary, Electroandes S.A. delivers electricity from the Oroya Substation to the Project substation at Chumpe. Power is transformed to 69 kV line voltage and approximately 9 MVA is supplied to the mine and 3.75 MVA is supplied to the processing plant.

5.5.2 Water

Water is sourced from Ococha Lagoon, Cachi-Cachi underground mine, and recycle/overflow water from the TSF depending on end use.

5.5.3 Mining Personnel

The largest community in the area is Huancayo located approximately 100 km to the east-northeast. Huancayo and the surrounding communities have a combined population of approximately 340,000. Huancayo is the capital of the Junin Region of Peru.

The employees live on-site at four camps and a hotel with capacity to house approximately 2,000 people. The camps include the supervisory camp, the mill camp, and the mining camp that also houses mining contractors. There are approximately 1,700 people (500 employees and 1,200 contractors) currently working on the site.

5.5.4 Potential Tailings Storage Areas

Tailings from the Chumpe Mill are stored in the TSF. The tailings undergo flocculation and settling and are then processed through a thickener and piped to the existing permitted TSF. The dam up to Stage 7 has a capacity of 7,773 km^3. Currently, the construction of Stage 5 Phase 1 (4531 masl) has been completed for a capacity of 1,003 km^3. The construction of Phase 2 of Stage 5

(4533 masl) is to be restarted in November 2020, continuing with Stage 6 in 2021 and Stage 7 in 2022.

5.5.5 Potential Waste Rock Disposal Areas

The Project site has existing permitted waste disposal areas as well as systems to handle miscellaneous wastes.

5.5.6 Potential Processing Plant Sites

The site has an existing mineral processing site that has been in use for several years.

6 History

6.1 Prior Ownership and Ownership Changes

The silver of Yauricocha was initially documented by Alexander von Humboldt in the early 1800s. In 1905, the Valladares family filed the claims of what is today the Yauricocha Mine. The Valladares family mined high grade silver mineralized material for 22 years and in 1927, Cerro de Pasco Corporation acquired the Yauricocha claims. In 1948, Cerro de Pasco commenced mining operations at Yauricocha until the Peruvian Military Government nationalized Cerro de Pasco Corporation and Yauricocha became a production unit of State-owned Centromin Peru S.A. for 30 years. In 2002, the Yauricocha unit was privatized and purchased by Sociedad Minera Corona S.A. (Minera Corona). Dia Bras (renamed Sierra Metals Inc. in 2012) acquired 82% of the total equity of Minera Corona in May 2011.

Sierra Metals retains a controlling ownership status in the Yauricocha Mine, through their subsidiary Minera Corona. An unnamed private interest holds 18.16% equity ownership in Yauricocha, with Sierra Metals holding the remaining 81.84%.

6.2 Exploration and Development Results of Previous Owners

Prior to the 1970s detailed production records are unavailable. Since 1973, Company records indicate that Yauricocha has produced 13.6 Mt of mineralized material containing 63 Moz of silver as well as 378 kt of lead, 117 kt of copper and nearly 618 kt of zinc. Since 1979, Yauricocha has averaged 413,000 t of production per year. The historical estimates presented below predate CIM and NI 43-101 reporting standards and therefore cannot be relied upon. These estimates were not used as a basis for the current Resource as the material has already been mined and processed.

Table 6-1 summarizes exploration and mining statistics under Minera Corona ownership. Mineral inventory is derived from Company reports to Peruvian regulatory authorities and are not CIM compliant. Mine production is derived from actual mine production records.

Table 6-1: Prior Exploration and Development Results [1]

Year	Exploration (m)	Development and Infill (m)	Exploration & Development	Drilling (DM) By Company (m)	Drilling (DDH) Contractor (m)	Mine Production (t)	Mineral Inventory (t)
2002	2,726	1,160	3,886	1,887	NA	124,377	34,463
2003	3,307	1,648	4,955	3,415	NA	212,677	571,520
2004	1,778	2,245	4,023	2,970	NA	233,486	1,001,350
2005	2,004	2,030	4,034	3,160	8,043	373,546	702,524
2006	788	1,998	2,786	2,999	10,195	487,909	6,371,845
2007	826	1,640	2,466	4,751	6,196	546,652	4,773,198
2008	796	1,584	2,380	5,379	13,445	690,222	4,720,606
2009	872	1,040	1,912	4,955	13,579	802,737	4,974,593
2010	454	632	1,086	4,615	3,527	837,389	5,379,526
2011	684	927	1,611	5,195	9,071	816,289	4,943,770
2012	921	609	1,530	11,532	31,257	872,869	5,246,000
2013	1,730	839	2,569	10,653	16,781	840,711	6,394,000
2014	680	331	1,011	9,357	30,455	89,091	NA
2015	120	220	342	9,735	33,214	802,251	5,337,000 [2]
2016	920	5,319	6,239	9,145	4,202	847,467	NA
2017	865	7,655	8,520	7,384	49,715	1,009,635	8,917,000 [3]
2018	1,120	5,073	6,193	5,103	36,771	1,074,475	NA
2019	956	3,226	4,182	4,653	45,983	1,127,480	8,439,000 [4]
2020*	35	1,863	1,898	1,076	10,212	457,029	NA

Source: Sierra Metals, 2020
* January to June 30, 2020

(1) Except as noted below, Mineral Inventory included Proven and Probable Reserves and Indicated Resources as reported to the Peruvian Exchange and is not CIM compliant. These numbers are for historic information purposes only.
(2) Proven and Probable Reserves estimated by Gustavson on May 11, 2015 (excludes Resources)
(3) Proven and Probable Reserves estimated by SRK, as of July 31, 2017 (excludes Resources)
(4) Proven and Probable Reserves estimated by SRK as of October 31, 2019 (excludes Resources)

6.3 Historic Production

Historic production is shown in Table 6-2 and is based on Yauricocha Mine production reports.

Table 6-2: Historic Yauricocha Production (From Mine Production Reports)

Fiscal Year	Data Source	Date Ended	Mineralized Material Processed (t)	Ag (oz)	Cu (t)	Zn (t)	Pb (t)
2001	Reported Actual	12/31/2001	235,000	1,124,086	530	15,136	8,402
2002	Reported Actual	12/31/2002	124,000	592,538	356	7,736	4,965
2003	Reported Actual	12/31/2003	213,000	898,066	803	11,389	6,540
2004	Reported Actual	12/31/2004	356,800	643,000	1,046	14,952	996
2005	Reported Actual	12/31/2005	374,642	868,000	2,491	22,657	6,883
2006	SNL Standardized Estimate	12/31/2006	269,333	915,717	3,902	20,620	7,070
2007	Reported Actual	12/31/2007	NA	NA	5,330	NA	NA
2008	Reported Actual	12/31/2008	NA	1,832,550	5,456	20,466	11,560
2009	Reported Actual	12/31/2009	790,743	NA	NA	NA	NA
2010	Reported Actual	12/31/2010	837,839	NA	NA	NA	NA
2011	Reported Actual	12/31/2011	816,289	1,230,000	3,348	9,946	8,723
2012	Reported Actual	12/31/2012	872,869	2,143,971	4,110	22,628	15,966
2013	Reported Actual	12/31/2013	837,496	1,866,769	2,955	23,050	16,808
2014	Reported Actual	12/31/2014	890,910	2,121,565	3,491	24,610	21,189
2015	Reported Actual	12/31/2015	829,805	1,791,056	2,525	19,086	17,885
2016	Reported Actual	12/31/2016	897,169	1,688,183	2,849	24,859	16,529
2017	Reported Actual	12/31/2017	1,023,491	1,414,087	5,316	34,088	12,685
2018	Reported Actual	12/31/2018	1,106,648	1,315,101	7,553	34,713	11,938
2019	Reported Actual	12/31/2019	1,092,410	2,244,354	11,809	40,456	17,225
2020*	Reported Actual	6/30/2020	483,509	1,030,944	5,685	18,022	7,685

Source: Sierra Metals, 2020
* January to June 30, 2020

7 Geological Setting and Mineralization

Sections 7.1, 7.2 and 7.3 of this Report has been excerpted from NI 43-101 Technical Report on the Yauricocha Mine, prepared by Gustavson Associates, report date May 11, 2015 and are shown in italics. Some new information has also been provided by Sierra Metals. Standardizations have been made to suit the format of this report; any changes to the text have been indicated by the use of [brackets].

7.1 Regional Geology

Most of the stratigraphy, structure, magmatism, volcanism and mineralization in Peru are spatially- and genetically-related to the tectonic evolution of the Andean Cordillera that is situated along a major convergent subduction zone where a segment of the oceanic crust, the Nazca Plate, slips beneath the overriding South American continental plate. The Andean Cordillera has a metamorphic rock basement of Proterozoic age on which Hercynian Paleozoic sedimentary rocks accumulated and were, in turn, deformed by plutonism and volcanism to Upper Paleozoic time. Beginning in the Late Triassic time, following Atlantic Ocean rifting, two periods of subduction along the western margins of South America resulted in the formation of the present Andes: the Mariana-type subduction from the Late Triassic to Late Cretaceous and Andean-style subduction from the Late Cretaceous to the present. Late Triassic to late Cretaceous Mariana-type subduction resulted in an environment of extension and crustal attenuation producing an oceanic trench, island arcs, and back arc basin from west to east. The back-arc basin reportedly has two basinal components, the Western Basin and Eastern Basin, which are separated by the Cusco – Puno high, probably part of the Maranon Arch. The basins are largely comprised of marine clastic and minor carbonate lithologies of the Yura and Mara Groups overlain by carbonates of the Ferrobamba Formation. The western back-arc basin, called the 'Arequipa Basin', is the present Western Andean Cordillera of Peru; the site of a Holocene magmatic belt that spans the Andes and was emplaced from Late Oligocene to 25 Ma.

The Western Andean Cordillera is recognized for its world class base- and precious-metal deposits, many of which have been intermittently mined since Incan time. Most of the metal deposits in Peru are spatially and genetically associated with metal-rich hydrothermal fluids generated along magmatic belts that were emplaced along convergent plate tectonic lineaments. Furthermore, many of these primary base-metal deposits have undergone significant supergene enrichment due to uplift and weathering over the last 30 Ma.

Radiometric studies have correlated the igneous host rocks and attendant hydrothermal alteration for some of the largest and richest porphyry copper deposits in the world along the Western Andean Cordillera from 6° to 32° south, including the Chalcobamba – Tintaya iron-gold-copper skarn and porphyry belt (30 to 35 Ma) in the main magmatic arc, southward through the Santa Lucia district (25 to 30 Ma) and into Chile. The Andahuaylas-Yauri Porphyry Copper Belt, a well-known 300 km long porphyry copper belt related to middle Eocene to early Oligocene calc-alkaline plutonism, is situated along the northeastern edge of the Western Andean Cordillera.

7.2 Local Geology

The local geology of the Yauricocha Mine has been well understood by Minera Corona personnel for a number of years and is summarized as follows. Figure 7-1 and Figure 7-2 show the local surface geology of the Yauricocha area.

Goyllarisquizga Formation

The oldest rocks exposed in the area are the lower Cretaceous Goyllarisquizga arenites. This formation is approximately 300 m thick and comprises thick gray and white arenites, locally banded with carbonaceous lutites as well as small mantos of low-quality coal beds and clay. In the vicinity of Chaucha, these arenites have near their base interbedded, red lutite. The arenites crop out in the cores of the anticlines southwest of Yauricocha, as beds dispersed along the Chacras uplift, and isolated outcrops in the Éxito zone.

Jumasha Formation

The mid-Cretaceous Jumasha Formation consists of massive gray limestone, averages 700 m thick, and concordantly overlies the Goyllarisquizga Formation. Intercalations of carbonaceous lutites occur at its base near the contact with the arenites. These layers are succeeded by discontinuous lenses of maroon and grey limestone, occasionally with horizons of lutite and chert about 6 m thick. Also present are pseudo-breccias of probable sedimentary origin and a basaltic sill.

Celendín Formation

The Celendín Formation concordantly overlies the Jumasha Formation and contains finely stratified silicic lutites with intercalations of recrystallized limestone of Santoniana age as well as the France Chert. The average thickness in the Yauricocha area is 400 m.

Casapalca Red Beds

The Casapalca red beds lay concordantly on the Celendín Formation with a gradational contact. It has been assigned an age between upper Cretaceous and lower Tertiary, but because of the absence of fossils its age cannot be precisely determined. It is composed primarily of calcareous red lutites, pure limestones, and reddish arenaceous limestone. Lava flows and tuffaceous beds have been occasionally reported.

Intrusions

Major intrusive activity occurred during the Miocene period. Radiometric K-Ar ages derived from biotite samples taken in the Yauricocha and Éxito areas yield an average age of 6.9 Ma. The intrusives cut the sediments at a steep angle and exhibit sharp contacts, as well as a tendency to follow the regional strike and dip of the structure. The intrusions vary in size from bodies of several hundred square meters to large masses that cover several square kilometers. Small intrusive compositions vary from granodiorite to quartz monzonite at margins and are typically porphyritic *with phenocrysts of plagioclase, orthoclase, biotite, hornblende and quartz. The plagioclases vary from orthoclase to andesine.*

Metamorphism

All of the intrusions have produced metamorphic aureoles in the surrounding rocks. The extent, type, and grade of metamorphism vary greatly with the type of rock intruded. The rocks have been altered to quartzites, hornfelsed lutites, and recrystallized limestones. Locally, the intrusions have produced narrow zones of skarn of variable width. These skarn zones contain epidote, zoisite, tremolite, wollastonite, phlogopite, garnet, chlorite and diopside.

Structure

The Andean Cordillera uplift has dominated the structural evolution of the Yauricocha area through episodes of folding, fracturing, and brecciation associated with the local structure having a general NW-SE strike principally expressed as follows:

Folds

Various folds make up the principal structures of the Yauricocha area. The Purísima Concepcíon anticline and the France Chert syncline occur in the Mina Central area, while the Cachi-Cachi anticline and Huamanrripa al Norte syncline and the Quimpara syncline occur immediately to the south of Lake Pumacocha, north of Mina San Valentíne.

The Purísima Concepcíon anticline, located southwest of the Yauricocha Mine in the Mina Central area, is well defined by a tightly folded basaltic sill 17 m thick. The axial trace trends approximately N50W with a gentle SE plunge of 20°. In the axis of this anticline and towards Flanco East, the basaltic sill contains occurrences of disseminated gold in horizontal, silicic breccias.

The France Chert syncline is a tight fold, also in the Mina Central area, but located northeast of the mine. Its axial trace changes trend from N35W in the south to N65W in the north and has a SE40 plunge. The Yauricocha mineral deposit is found in the west flank of this fold and in banded limestones without subsidiary folding.

In the Mina Central area, the NW strike of the folded sediments was rotated about 30° clockwise horizontally. This distortion can be attributed to a basement shear fault that strikes NE-SW. The axial trace of the Cachi-Cachi-Prometida anticline strikes approximately N80W to N70W and its flanks dip to the north (Prometida) and south (Cachi-Cachi) with a plunge to the east. Mineralization in the vicinity of the major North Intrusive located 2 km north of Mina Central is associated with this fold.

The Quimpara syncline, located 1 km south of the discharge stream of Pumacocha Lake, has an axial trace that strikes N45W. Its east flank is in contact with the intrusive at an angle dipping 70° to 75°W. Its west flank dips about 80°E conformably with beds of dark gray limestone that are recrystallized in the vicinity of the contact. Garnets, magnetite and copper oxides occur in the same contact.

Fractures

Diverse systems of fractures were developed during episodes of strong deformation.

Folding occurred before and/or contemporaneous with intrusive emplacement. Primary fractures developed during folding along with longitudinal faults parallel to the regional strike of the stratigraphy. These faults combined to form the Yauricocha Fault along the Jumasha limestone-Celendín lutite contact. The Yauricocha Fault extends a great distance from the SE of the Ipillo mine continuing to the north behind Huamanrripa hill, parallel to and along Silacocha Lake.

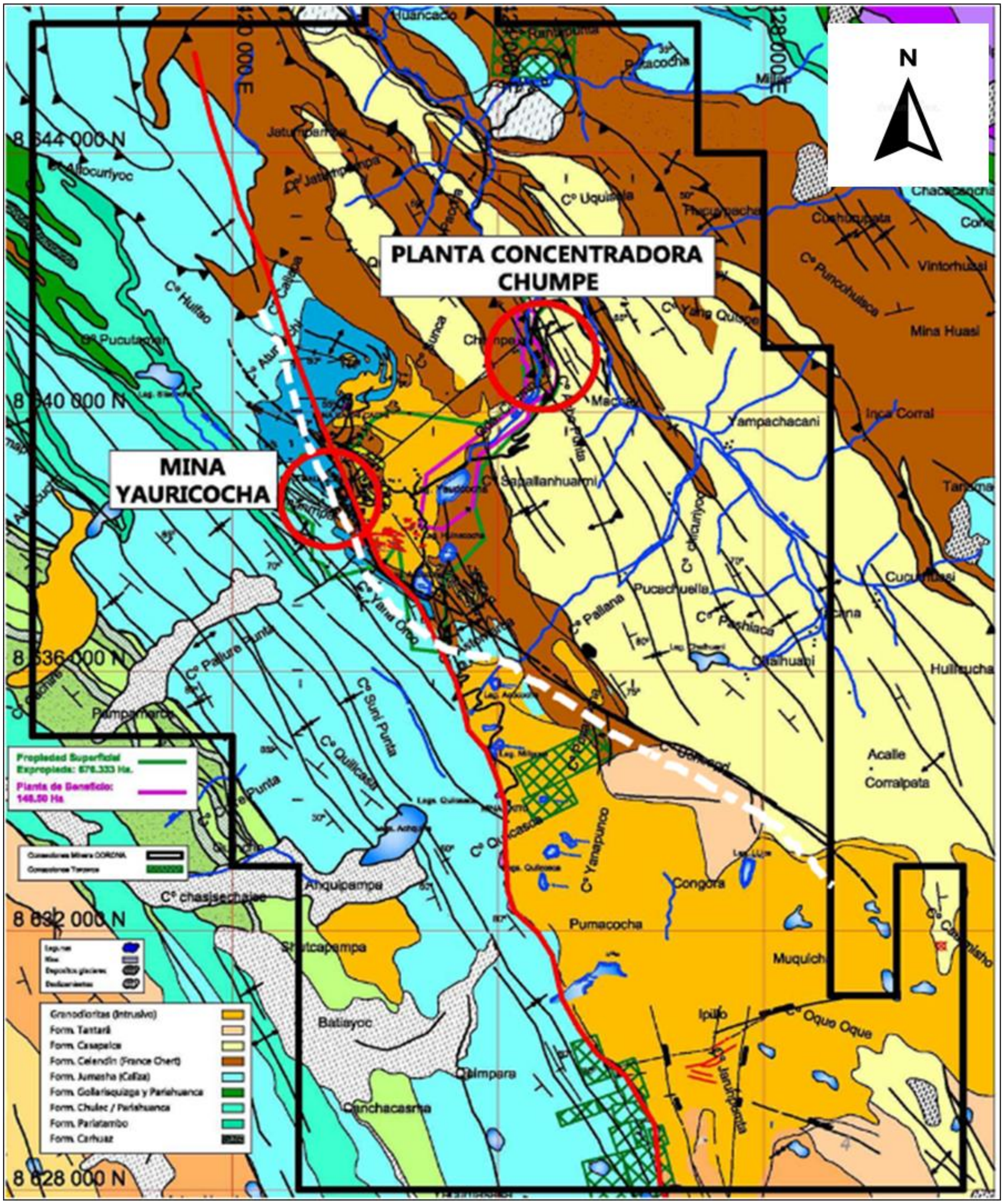
After the intrusions were emplaced, the strike of the folds NW of the mine was rotated by strong horizontal forces some 30°. As a result of this rotation, three sets of shears and joints were developed: NW-SE, NE-SW and E-W with dips of 50-80° NE or SW first, then 60-85° SE or NW, and finally N or S with nearly vertical dips. This set of fractures forms fault blocks that cut the dominant lithologies of the area and join with the Yauricocha Fault. The Yauricocha Fault is the most significant fault in the mining district and is a strong control on mineralization.

Contacts

The contacts of the Jumasha limestone-Celendín lutite, the Jumasha limestone-intrusions, and Celendín lutite-intrusions had major influence on the development of folds, fractures and ascension of mineralizing fluids.

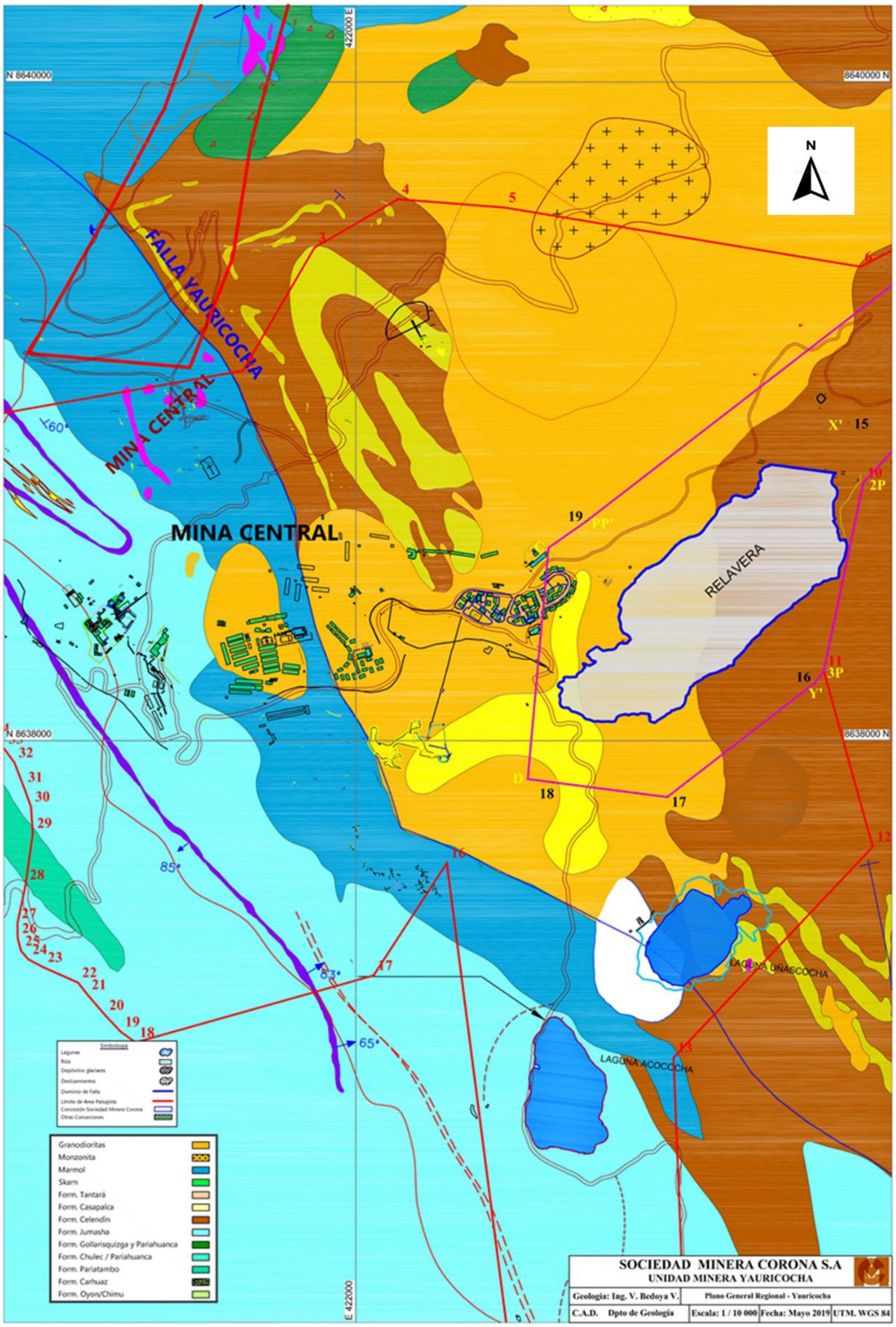
Breccias

The breccias that occur in the Yauricocha area typically follow structural lineaments and occur predominantly in the limestones associated with contacts and intersections of fractures. They form tabular and chimney-like bodies. Tectonic breccias, forming near intrusions or contacts, constitute some of the principal receptive structures for mineralization.



Source: Sierra Metals, 2020

Figure 7-1: Local Geology Map (grid lines are 4 km x 4 km)



Source: Sierra Metals, 2020

Figure 7-2: Geologic Map of Yauricocha Mine Area

7.3 Significant Mineralized Zones

Mineralization at the Yauricocha Mine is represented by variably oxidized portions of a multiple-phase polymetallic system with at least two stages of mineralization, demonstrated by sulfide veins cutting brecciated polymetallic sulfide mineralized bodies. The mineralized bodies and quartz-sulfide veins appear to be intimately related and form a very important structural/mineralogical assemblage in the Yauricocha mineral deposit. Comments made herein regarding the characteristics of the Yauricocha district apply directly to the Yauricocha Mine.

All parts of the property with historic exploration or current production activity are in the current area of operations. This area is nearly centered within the concession boundary and there is both space and potential to expand the resources and the operation both directions along the strike of the Yauricocha Fault.

Minera Corona has developed local classifications describing milling and metallurgical characteristics of mineralization at Yauricocha: polymetallic, oxide, and copper. "Polymetallic" mineralization is represented by Pb-Zn sulfides, often with significant Ag values, "oxide" refers to mineralization that predominantly comprises oxidized sulfides and resulting supergene oxides, hydroxides and/or carbonates (often with anomalous Au), and the "copper" classification is represented by high values of Cu with little attendant Pb-Zn.

More details on the mineralized zones are provided in Section 14.

8 Deposit Types

Section 8.1 of this Report has been excerpted from NI 43-101 Technical Report on the Yauricocha Mine, prepared by Gustavson Associates, report date May 11, 2015, and is shown in italics. Some new information has also been provided by Sierra Metals. Standardizations have been made to suit the format of this report; any changes to the text have been indicated by the use of [brackets].

8.1 Mineral Deposit

Mineralization in the Yauricocha district is spatially and genetically related to the Yauricocha stock, a composite intrusive body of granodioritic to quartz monzonitic composition that has been radiometrically dated at late Miocene (approximately 7.5 million years old) (Giletti and Day, 1968). The stock intrudes tightly folded beds of the late Cretaceous Jumasha and Celendín Formations and the overlying Casapalca Formation (latest Cretaceous and Paleocene?). Mineralized bodies are dominantly high-temperature polymetallic sulfide bodies that replaced limestone. Metal-bearing solutions of the Yauricocha magmatic-hydrothermal system were highly reactive and intensely attacked the carbonate wall rock of the Jumasha and Celendín Formations, producing the channels in which sulfides were deposited.

Base and precious metals were largely precipitated within several hundred meters of the stock (Lacy, 1949; Thompson, 1960). Skarn is developed adjacent to the stock but does not host appreciable amounts of economic mineralization (Alverez and Noble, 1988). Mineralization typically exhibits both vertical and radial zoning and there is a pronounced district zoning, with an inner core of enargite (the principal copper mineral) giving way outward to an enargite-chalcopyrite-bornite zone, which in turn is succeeded to the west by zones characterized by sphalerite, galena and silver (Lacy, 1949; Thompson, 1960).

The mineralized zones at Yauricocha are partially to completely oxidized and extend from the surface to below level 1220. Supergene enrichment is closely related to oxidation distribution. Supergene covellite, chalcocite and digenite are found where the sulfide minerals are in contact with oxidized areas.

Mineralization at Yauricocha very closely resembles that typified by polymetallic Ag-Au deposits, which comprise quartz-sulfide-carbonate fissure vein equivalents of quartz-sulfide and carbonate-base metal deposits. These deposits are best developed in Central and South America, where they have been mined since Inca times as important Ag sources. Quartz and pyrite of the quartz-sulfide Au +/- Cu mineralization suite typically occur early in the paragenetic sequence; carbonate-hosted mineralization and some polymetallic Ag-Au veins evolved at a later stage. Predominant controls on mineralization are structural, where dilatational structures, voids resulting from wall rock dissolution, and/or rheologic dissimilarities at contacts between units serve as enhanced fluid pathways for mineralizing solutions.

8.2 Geological Model

The geological model used for the Yauricocha deposit has been developed and verified through extensive exploration and mining activities during more than 50 years of mining. SRK is of the opinion that the geological model is appropriate and will continue to serve the company going forward.

9 Exploration

Since 2016, surface exploration has focused more on areas surrounding the Central Mine, mainly to the south of the mine in the areas of Doña Leone, El Paso, Success, Kilcaska and the South Yauricocha Fault. The work has consisted of detailed geological mapping, sampling for geochemical interpretation and focusing on areas with strong anomalies. During 2017, the Canadian company, Quantec Geoscience Ltd., was contracted to perform a surface geophysical study using the TITAN 24 DC resistivity induced polarization (DCIP) and Magnetotelluric (MT) methods.

The Yauricocha mining district contains multiple polymetallic deposits represented by skarn and replacement bodies and intrusion-hosted veins related to Miocene-era magmatism. Mineralization is strongly structurally controlled with the dominant features being the Yauricocha Fault and the contact between the Jumasha limestones and the Celendín Formation (especially the France Chert). Exploration is being conducted to expand the mineralized zones currently being exploited as well as on prospects in the vicinity of the operations.

Exploration in or close to the mining operations is of higher priority since it is performed under existing governmental and community permits. Any exploration success can be quickly incorporated into defined resources and reserves and thus the business plan.

9.1 Relevant Exploration Work

Exploration in the district has been ongoing and work has been successful in delineating several targets (described above) for future drilling or exploration development. This work has included detailed geological mapping of the areas, surface rock chip sampling, and limited trench / channel sampling.

The 2020 planned underground and surface drilling programs have been revised due to the impact of the Covid pandemic. As a direct consequence of the 2019 underground exploration drilling mineralization discoveries in the Esperanza (lead and zinc dominant mineralization) and Cuye (copper dominant mineralization) areas, approximately 5,600 m of diamond drilling is planned for further exploration of these areas in 2020.

During the period of June 3, 2017 to September 6, 2017, a geophysical survey was carried out with the TITAN 24 DCIP and MT survey methods. A total of 20 DCIP-MT profiles (23 differentials) were carried out, ranging from 400 to 500 m covering 54.2 kilometers. Based on this work, several anomalous areas were identified, and priority has been given to diamond drilling these areas from surface. The most relevant geophysical targets in order of priority are Doña Leona, El Paso-Éxito Victoria and Alida.

Doña Leona is located 2.5 km southeast of the Yauricocha Mine. There are historical workings in the area which have been sampled. Kilcaska is situated 7.5 km southeast of the Yauricocha Mine. Historically, the polymetallic Francolina and Felicidad mineralized bodies were exploited. El Paso-Éxito is located 3.5 km southeast of the Yauricocha Mine, in the vicinity of the Éxito and Antonia Mines. The Éxito and Antonia Mines are historical Pb, Zn, Cu and Ag producers. Victoria is situated

1.5 km southeast of the Yauricocha Mine in an area where narrow polymetallic veins have been mined historically.

The Doña Leona and Kilcaska targets are scheduled to be evaluated with a revised initial stage of approximately 9,000 m of diamond drilling at a budgeted cost of US$ 1.2 M during 2020. The exploration at Doña Leona is focused on replacement metasomatic mineralization.

9.2 Sampling Methods and Sample Quality

Sampling of exploration targets generally features rock chip or hand samples taken by geologists from surface outcrops using rock hammers and chisels. These samples are point samples and should be considered indicative of mineralization rather than representative of any volume or tonnage.

In cases where channel or trench samples are collected, these are done so using pickaxes, shovels, chisels, hammers, and other hand tools, and are likely more representative of the mineralization as they are taken across the strike of mineralization observed at surface.

Regardless, the results of exploration related sampling in this context are used as guides for future drilling programs, rather than resource estimation.

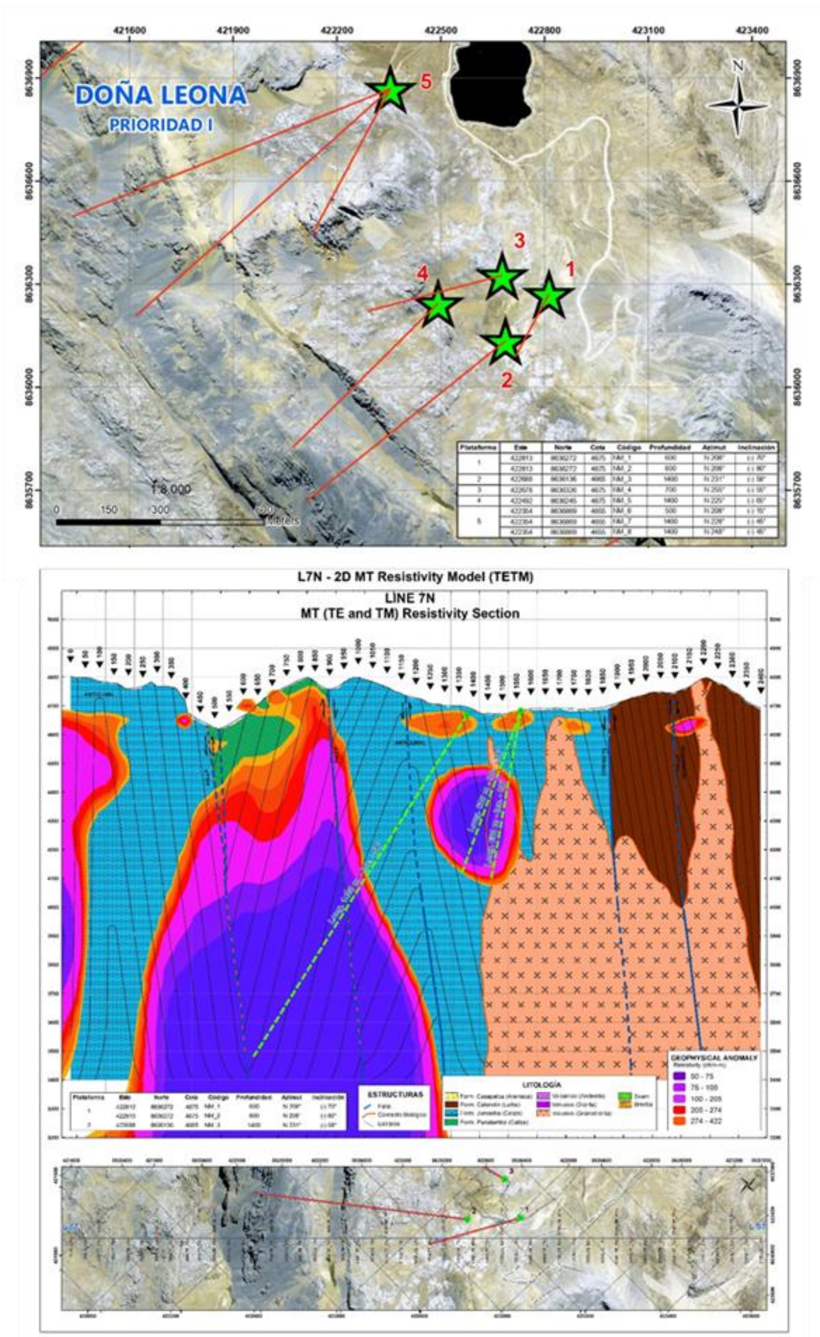
9.3 Significant Results and Interpretation

There have been satisfactory results with exploration diamond drilling in the Cuye mineralized area where additional mineralization has been identified and designated as Cuye iii and Cuye Sur respectively. Similarly, in the Esperanza area additional polymetallic mineralization was identified and designated as Esperanza ii. Neither of these zones have been included in the 2020 Mineral Resources as they require additional drilling to define the morphologies and grade distribution of the mineralized zones.

The 2017 surface geophysical survey interpretation has identified several resistivity anomalies in the Doña Leona, El Paso-Éxito, and Victoria areas located within less than 10 km of the current Yauricocha Mine area.

Replacement-type alteration within the Jumasha limestones, intense brecciation, silicification and localized skarns have been observed during surface mapping of the Doña Leona area. Doña Leona's interpreted low resistivity geophysical anomalies (less than 205 ohm/p) are the focus of exploration drilling (Figure 9-1). A low resistivity anomaly can be indicative of metallic mineralization, whereas a narrow high resistivity zone surrounding a very low resistivity zone can be an indication of alteration such as silicification. Surface geochemical sampling of the structures of non-mined areas has yielded results as high as 22.36% zinc, 11.45% lead, 0.19% copper and 43.5 ppm silver. Re-sampling of historically mined areas has yielded values as high as 10.78% zinc, 5.36% lead, 0.01% copper and 58.8 ppm silver.

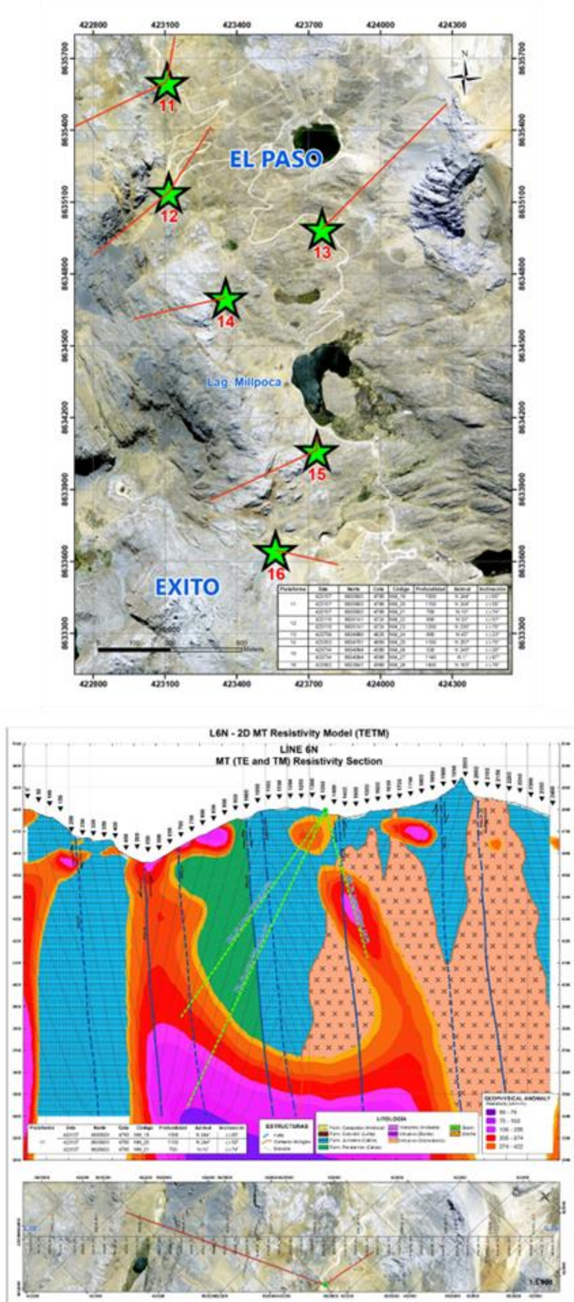
In the El Paso-Éxito target area, granodiorite and diorite intrusives were observed during geological mapping within the limestones and marbles of the Jumasha and Pariatambo Formations. The Chonta Fault lies to the extreme west of the area. Contact metasomatism and skarn development have been observed at contacts between the intrusives and the limestones. Therefore, these contacts are the focus of the current exploration drilling. The geophysical resistivity anomalies are not as prominent as those interpreted at Doña Leona (Figure 9-2). Furthermore, the most prominent anomaly is significantly deeper below surface. The historical Éxito Mine yielded grades of 14.00% zinc, 3.00% lead, 0.60% copper and 37.3 ppm silver. In the surrounding area, geochemical sampling has yielded results of 95 to 10,000 ppm lead, 76 to 10,000 ppm zinc and 50 to 490 ppm copper. These geochemical results are lower than the results at other exploration targets and the largest geophysical anomaly is significantly deeper than the other exploration target areas. Hence, the El Paso-Éxito exploration target is of a lower priority for exploration purposes and is not considered as part of the 2020 revised exploration drilling program.



srk consulting	Sierra Metals Inc.	Doña Leona low resistivity exploration target
	Yauricocha Mine	Date:24/07/2020

Source: Sierra Metals, 2020

Figure 9-1: Doña Leona Exploration Target Area



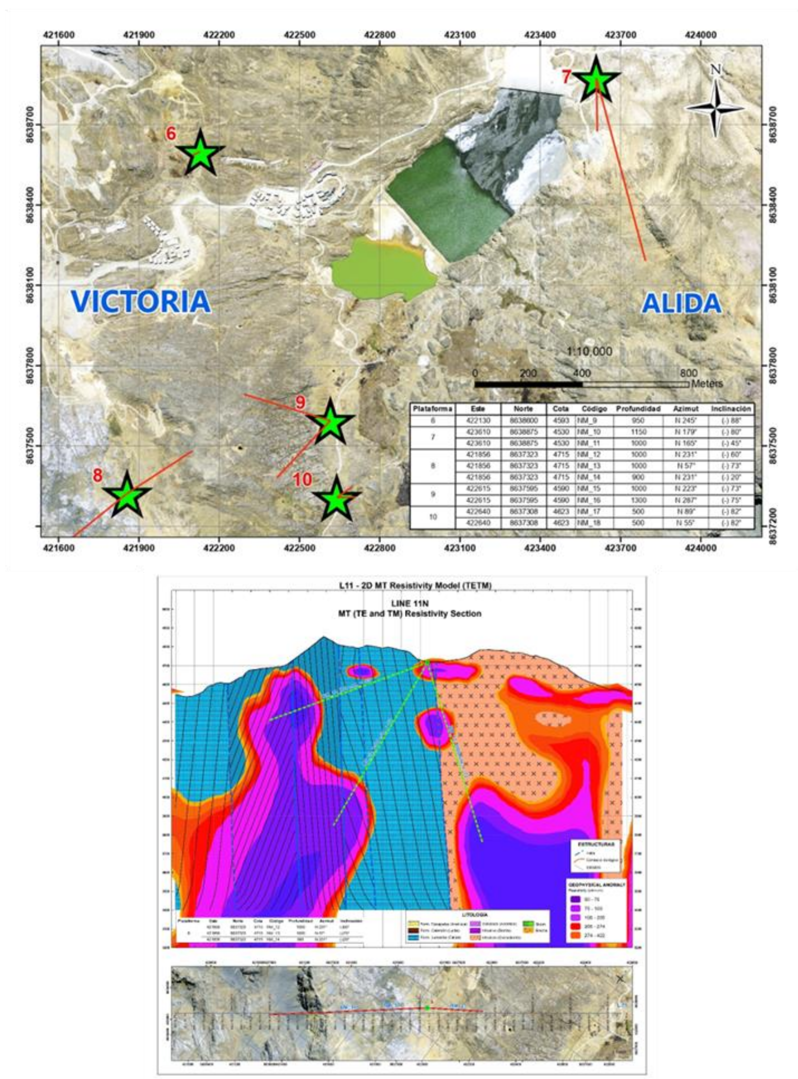
srk consulting	Sierra Metals Inc.	El Paso-Éxito low resistivity exploration target
	Yauricocha Mine	Date:24/07/2020

Source: Sierra Metals, 2020

Figure 9-2: El Paso-Éxito Exploration Target Area

The Victoria and Alida exploration areas are in proximity to the northwest – southeast trending Yauricocha Fault. Extensive outcrops of granodiorites have been observed in contact with the

Jumasha Formation limestones. Argillic and phyllic alteration occur at these contacts. Historically, narrow veins were mined in the area, yielding grades in the region of 2.80% copper, 0.70% zinc, 0.60% lead and 6.00% arsenic. The arsenic values could pose a future mining issue as arsenic is a deleterious element. Surface quartz veins and stockwork have been geochemically sampled, producing grades as high as 3.00% zinc, 1.00% lead and 0.60% copper. Marble and skarn outcrop geochemical sampling have yielded values as high as 8.30% lead, 6.80% zinc, 0.80% copper and 93.3 ppm silver. A large low resistivity geophysical anomaly is a future exploration drilling target area in the future (Figure 9-3) and therefore not part of the revised exploration drilling for 2020.

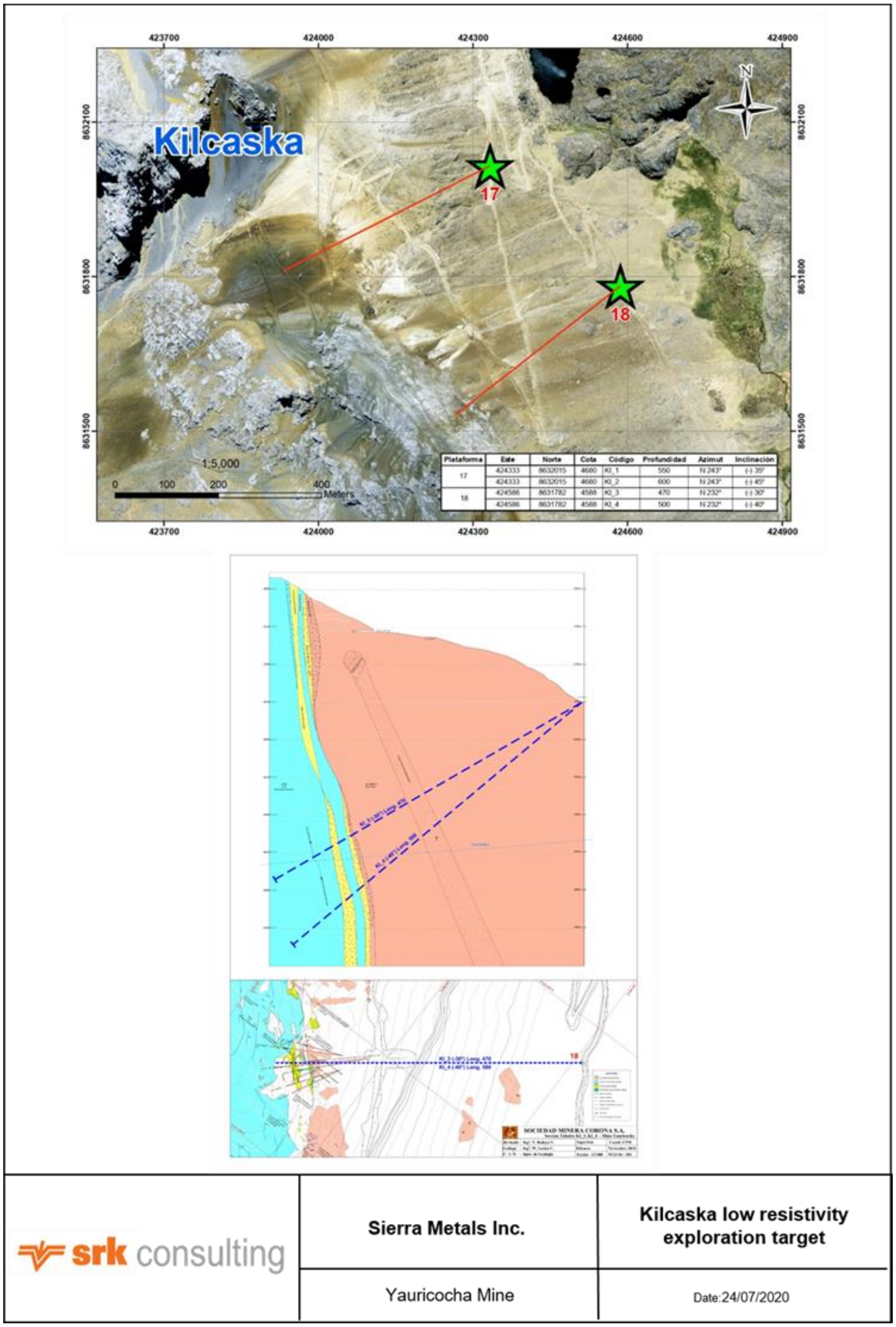


srk consulting	Sierra Metals Inc.	Victoria low resistivity exploration target
	Yauricocha Mine	Date:24/07/2020

Source: Sierra Metals, 2020

Figure 9-3: Victoria and Alida Exploration Target Areas

Additional mapping and sampling have been conducted in the South Yauricocha Fault and South Kilcaska areas (Figure 9-4). The Éxito granodiorite intrusives are in contact with the calcareous rocks of the Jumasha Formation.



Source: Sierra Metals, 2020

Figure 9-4: Kilcaska Exploration Target Area

Hydrothermal breccias in conjunction with the development of marbles and skarns within the limestones have been observed in the area. Argillic and phyllic alteration occurs along vein contacts. The hydrothermal breccias outcrop and are intensely oxidized and leached. Historically, the mineralized bodies of Francolina and Felicidad have been mined at average grades of 4.27% zinc, 2.15% lead, 0.30% copper and 23.30 ppm silver. Recent surface geochemical sampling results yielded values as high as 0.99% lead, 0.97% zinc, 1.00% copper and 97.0 ppm silver. Polymetallic mineralization similar to the Éxito Mine is the focus of the exploration drilling at Kalcaska and has been included in the 2020 revised surface exploration drilling program.

10 Drilling

10.1 Type and Extent

Minera Corona's Geology Department owns and operates two electro-hydraulic drills, the reach of which varies between 80 m and 150 m with a core diameter of 3.5 cm. The company also utilizes, or has previously utilized, the services of drilling contractors (MDH and REDRILSA) for deeper drillholes reaching up to 900 m in length. Core diameters are generally HQ and NQ, although selected infill drilling within the mine is drilled using a TT-46 (46 mm) diameter.

Exploration (establishing continuity of mineralization) and development (reserve and production definition) drilling conducted by Minera Corona from 2002 to 2020 is detailed in Table 10-1.

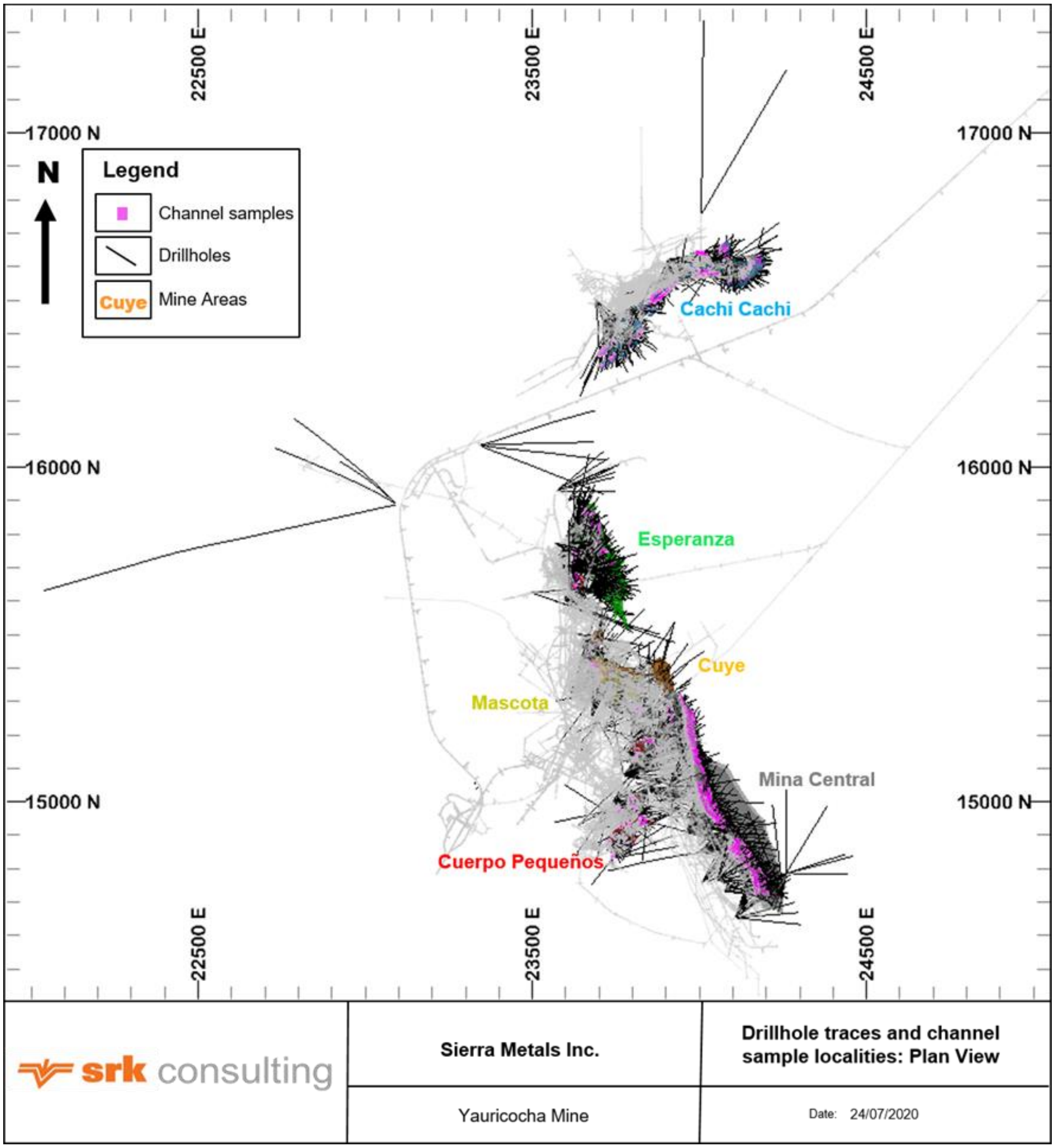
Table 10-1: Yauricocha Exploration and Development Drilling

Year	Exploration and Development (m)	Drilling (DDH) by Company (m)	Drilling (DDH) by Contractor (m)
2002	3,886	1,887	-
2003	4,955	3,415	-
2004	4,023	2,970	-
2005	4,034	3,160	8,043
2006	2,786	2,999	10,195
2007	2,466	4,751	6,196
2008	2,380	5,379	13,445
2009	1,912	4,955	13,579
2010	1,086	4,615	3,527
2011	1,611	5,195	9,071
2012	1,530	11,532	31,257
2013	2,569	10,653	16,781
2014	1,011	9,357	30,455
2015	342	9,735	33,214
2016	6,239	9,145	42,020
2017	8,520	7,384	49,715
2018	6,193	5,103	36,771
2019	4,182	4,653	45,983
2020	1,898	1,076	10,212

Source: Sierra Metals, 2020

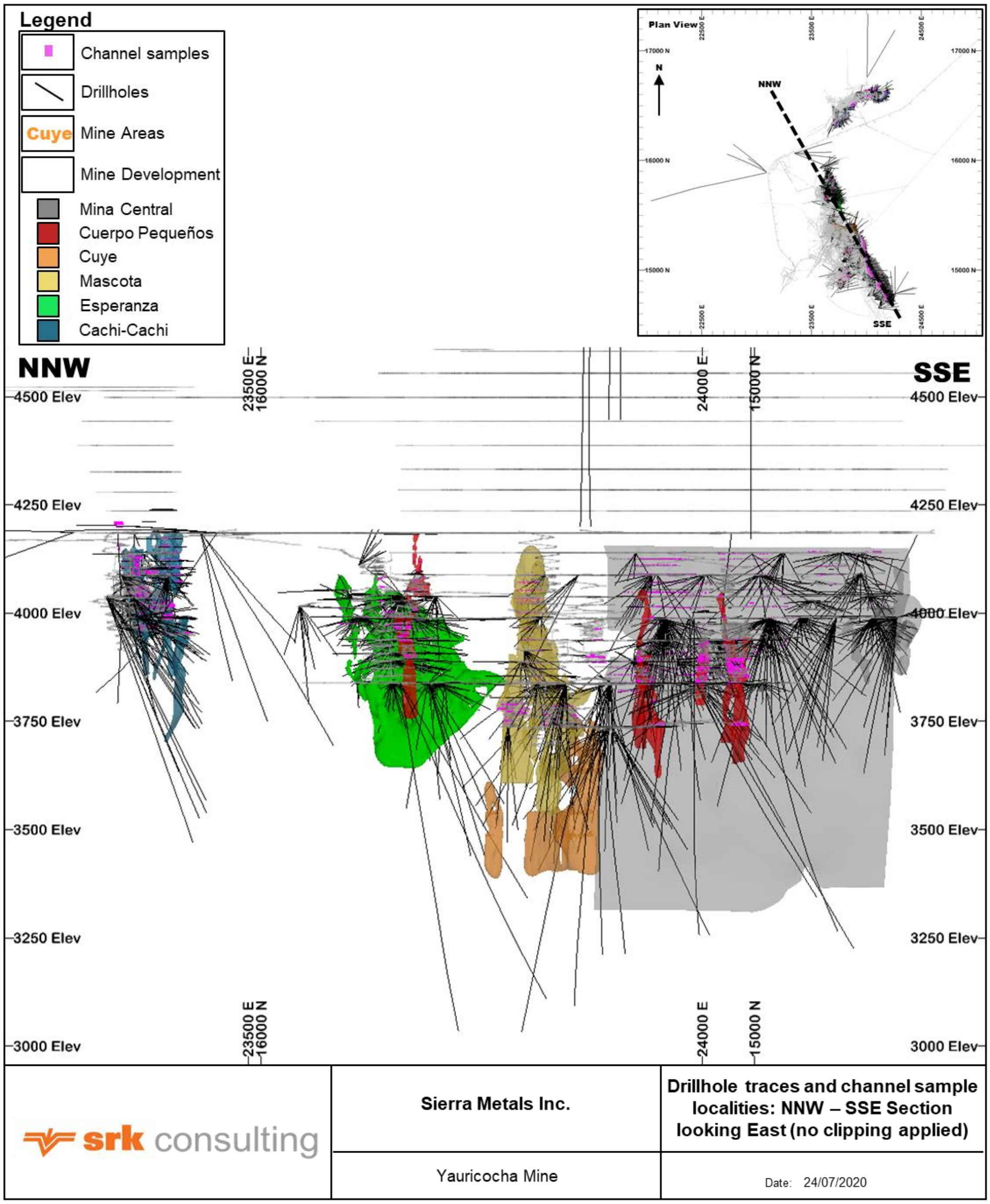
Approximately 13,000 m of infill diamond drilling is planned for 2020 reserve and production definition purposes.

In addition to the drilling at Yauricocha, extensive channel sampling of the mineralized bodies is completed for grade control and development purposes. Channel sampling is conducted on perpendicular lines crossing the various mineralized bodies. Spacing between samples is variable, but generally the spacing is 2 m to 4 m. Material is collected on tarps across the channel sampling intervals and is then transferred to bags marked with the relevant interval. These data points are utilized in the Mineral Resource estimation. The general distribution of drilling and channel samples is shown in Figure 10-1 and Figure 10-2.



Source: SRK, 2020

Figure 10-1: Extent of Drilling and Sampling Plan View



Source: SRK, 2020

Figure 10-2: Extent of Drilling and Sampling Sectional View

10.2 Procedures

10.2.1 Drilling

Modern drill collar locations are surveyed underground by the mine survey team. Where these types of surveys have been completed, collar locations are assumed to be accurate to less than 0.1 m. Historic drilling was not surveyed to the same level of detail, potentially decreasing the accuracy of the collar positions in space compared to modern holes. This effect would potentially decrease the accuracy of the geological model and resource estimation in these areas, but SRK notes that the majority of the areas supported by this historic drilling have already been mined.

While drillholes are currently surveyed down-hole for all new exploration drilling, this has not always been the case. Historic drill holes, as well as selected more recent holes that were not deemed to be long enough or otherwise designated non-critical for surveying, were not surveyed down-hole and the collar azimuth and dip are the only points of reference for the drillhole. SRK notes that all new holes now have down-hole surveys, and that most of these are in areas which are incorporated in the current update to the Mineral Resource estimation. While the nominal spacing of the survey has been 50 m, several newer holes have been surveyed every 5 m to discern any potential risk of deviation affecting the accuracy of the interpretation.

An SRK 2019 study conducted of the deviation for the drillholes which had been downhole surveyed highlighted that the average deviations (of more than 3,500 measurements) down-hole are only -0.06° bearing and 0.09° inclination. This would indicate that the lack of down-hole survey information is not necessarily a risk at Yauricocha, although SRK recommends continuing the practice of surveys at nominal intervals of 25 to 50 m to ensure quality of information.

SRK visited the core logging and sampling facilities at the mine site in early 2015, mid-2017, and in April 2019, and notes that the logging facility is clean and sufficiently equipped. Logging is conducted on paper and transferred to Excel™ worksheets. Details recorded include geotechnical information such as recovery and RQD, geologic information (lithology, alteration, mineralization, etc.), sampling information, as well as other parameters, which may not get incorporated into the digital database. Samples are selected by the geologist and placed in numbered plastic bags, along with a bar-coded sample ticket for tracking. Bags are tied tightly to prevent contamination during handling and transport.

Drill recovery is generally over 97%, and there appears to be no relationship between grade distribution and recovery.

Drill cores are split by hydraulic or manual methods where core is broken or poorly indurated and is sawn by rotary diamond saw blade when the core is competent. In both scenarios, care is taken to ensure that the sample is collected in a consistent and representative manner. SRK notes that sampling is only conducted in segments of core that are noted as having obvious mineralization during logging. This results in several occurrences where the first sample in a drillhole may be a very high grade one, or that there may be multiple high-grade samples with un-sampled intervals in between. These intervals have been considered as un-mineralized based on the assumptions made for the sampling or lack thereof and are flagged with a lowest-limit-of-detection value. For arsenic (As), which is regarded as a deleterious element the intervals were left blank as well as for iron (Fe), which is utilized to establish polymetallic mineralized zones in-situ density.

10.2.2 Channel Sampling

Channel samples are collected underground by the geology staff. Samples are collected via hammer and chisel, with rock chips collected on a tarp for each sample and transferred to sample bags. Typical sample intervals are 1 m along the ribs of crosscuts within stopes for the large mineralized zones, and 2 m across the back of the stopes for the small mineralized zones. Ideal weights are between 2.5 kg and 3 kg. The samples are placed in a plastic bag labeled with a permanent marker on the outside. A sample ticket displaying the number and bar code is inserted in the bag. The bags are tied to prevent outside contamination during their handling and transportation to the assay lab.

SRK notes that samples are not weighed to ensure representativeness, but geologists are involved in the channel sampling efforts to direct the samplers to collect samples, which visually are representative of the mineralization.

10.3 Interpretation and Relevant Results

Drilling and sampling results are interpreted by Minera Corona site geologists and are reviewed in cross sections and plan / level maps. The relevant results are those featuring significant intervals of geologic or economic interest, which are then followed-up by further drilling or exploration development.

SRK notes that other sampling types are described in the documentation at Yauricocha, such as point samples, muck samples, and others. These sampling types are used for specialized purposes only and are not used in the resource estimation.

11 Sample Preparation, Analyses, and Security

11.1 Security Measures

Core and channel sample material is stored at the mine site in a secure building and the boxes are well labeled and organized. The entire mine site is securely access-controlled. Samples submitted to third-party laboratories are transported by mine staff to the preparation laboratory in Lima. The channel samples are processed at Minera Corona's Chumpe laboratory located in the processing plant under the supervision of company personnel.

The on-site laboratory currently is not independently certified. Channel sample locations are surveyed underground by mine survey staff. Sample start and end-point locations are assumed to be accurate to centimeter accuracy.

11.2 Sample Preparation for Analysis

Samples are generally prepared by a primary and secondary laboratory:

- Primary: Chumpe Laboratory –Yauricocha Mine Site; Non-ISO Certified; and
- Secondary: ALS Minerals (ALS) – Lima; ISO 9001:2008 Certified.

The majority of the sample preparation is completed at the Chumpe laboratory, except in cases where checks on the method of preparation are desired and ALS conducts sample preparation on duplicate check assays.

11.2.1 Chumpe Laboratory

Most historical core samples, and effectively all channel samples, have been prepared and analyzed by the Chumpe laboratory. Detailed procedures have been documented by Minera Corona and are summarized below (in italics).

Sample Reception

Channel samples and selected mine infill drilling are collected in the field by the geology staff and transported by Yauricocha personnel from the Yauricocha Mine or Klepetko Adit and are received at the reception counter at the Chumpe laboratory entrance. A log entry is made to record the number of samples being received. These samples are generally between 1.5 and 3.0 kg; are damp and received in plastic bags.

Preparation

Equipment used in sample preparation includes:

- *1 – Primary Jaw Crusher (Denver), Jaw capacity – 5" x 6", Output – 70%, passing ¼ inch;*
- *1 – Secondary Jaw Crusher (FIMA), Jaw capacity – 5" x 6", Output –80%, passing No. 10 mesh;*

- *1 – Pneumatic Pulverizer, Make – Tmandina;*
- *2 – Sample Dryers, with temperature regulator;*
- *1 – ½" Stainless steel splitter, Make – Jones;*
- *Five compressed air nozzles;*
- *Stainless steel trays, 225 x 135 x 65 mm;*
- *Stainless steel trays, 300 x 240 x 60 mm;*
- *Plastic or impermeable cloth; and*
- *2" brushes.*

Preparation Procedure

Prior to beginning sample preparation, workers verify that:

- *The equipment is clean and free from contamination;*
- *The crushers and pulverizers are functioning correctly; and*
- *The numbering of the sample bags is such that all bags are unique and identifiable.*

The procedure at Chumpe to reduce the sample to a pulp of 150 g, at 85% passing 200 mesh is:

- *Transfer the sample to the appropriate tray, depending on the volume of the sample, noting the tray number on the sample ticket;*
- *Insert a blank sample (silica or quartz) in each batch;*
- *Place in the Sample Dryer at a temperature of 115ºC;*
- *Code the sample envelopes with the information from the sampling ticket noting the sample code, the tray number, date and the quantity of samples requested on the sample ticket;*
- *Once dry, remove and place the tray on the worktable to cool;*
- *Pass 100% of the sample through the Primary Jaw Crusher when particle sizes exceed 1 inch, the resulting product is 70% passing ¼ inch;*
- *Pass the sample through the Secondary Crusher, the resulting product is 80% passing -10 mesh;*
- *Clean all equipment after crushing of each sample using compressed air;*
- *Weigh the -10-mesh coarse material and record;*
- *Dump the complete sample into the Jones Splitter and split/homogenize to obtain an approximate 150 g split. Clean the splitter after each sample with compressed air;*

- *Put the 150 g sample in numbered envelopes in the tray for the corresponding sample sequence;*
- *Pulverize sample using the cleaned ring pulverizer until achieving a size fraction of 85% - 200 mesh. Clean the ring apparatus after each sample with the compressed air hose;*
- *Transfer the pulverized sample to the impermeable sample mat, homogenize and pour into the respective coded envelope; and*
- *Clean all materials and the work area thoroughly.*

11.2.2 ALS Minerals

For core samples, bagged split samples are transported by the internal transport service from the core logging facility. Samples are transported by truck to Lima for submission to the ALS Minerals laboratory in Lima. ALS records samples received and weights for comparison to the Yauricocha geologist's records for sampling.

Samples prepared at ALS Minerals exclusively include the 2016 to present exploration diamond drilling. SRK has not visited the ALS Minerals lab in Lima but notes that ALS Minerals-Lima is an ISO-Certified preparation and analysis facility and adheres to the most stringent standards in the industry. The PREP-31 method of sample preparation was used for all samples processed through ALS Minerals. This includes jaw crushing to 70% less than 2 mm, with a riffle split of 250 g, then pulverized using ring pulverizers to >85% passing 75 μm. Samples are tracked in barcoded envelopes throughout the process using internal software tracking and control measures. ALS is an industry leader in sample preparation and analysis and uses equipment that meets or exceeds industry standards.

11.3 Sample Analysis

Samples are generally analyzed by a primary and secondary laboratory:

- Primary: Chumpe Laboratory –Yauricocha Mine Site; Non-ISO Certified;
- Secondary: ALS Minerals – Lima; ISO 9001:2008 Certified; and
- Note: ALS is the primary laboratory for all diamond exploration drilling samples.

The Chumpe laboratory provides all analyses used in the drilling/sampling database supporting the Mineral Resource estimation, whereas the ALS Laboratory is used exclusively as an independent check on the Chumpe laboratory for these samples.

11.3.1 Chumpe Laboratory

Core and channel samples from the mine are assayed utilizing two procedures. Silver, lead, zinc, and copper are assayed by atomic absorption (AA) on an aqua-regia digest. Gold is assayed by fire assay (FA) with an AA finish. Lower limits of detection (LLOD) are shown in Table 11-1, and are higher than those for ALS Minerals as Chumpe does not run the same multi-element analysis.

Table 11-1: Chumpe LLOD

Element	LLOD	Unit
Ag	3.43	ppm
Au	0.03	ppm
Cu	0.01	%
Pb	0.01	%
Zn	0.01	%

Source: Sierra Metals, 2020

11.3.2 ALS Minerals Laboratory

The core samples analyzed at ALS are analyzed for a suite of 35 elements using inductively coupled plasma atomic emission spectroscopy (ICP-AES) on an aqua-regia digest, generally used to discern trace levels of multiple elements. Samples are also analyzed using an AA method on an aqua-regia digest for accuracy at higher mineralized grade ranges. Au is analyzed using FA (gravimetric finish) with an AA finish. Lower limits of detection for the critical elements are shown in Table 11-2.

Table 11-2: ALS Minerals LLOD

Element	LLOD	Unit
Ag	0.2000	ppm
Au	0.0050	ppm
Cu	0.0001	%
Pb	0.0001	%
Zn	0.0001	%

Source: Sierra Metals, 2020

11.4 Quality Assurance/Quality Control Procedures

Part of this section has been excerpted from NI 43-101 Technical Report on the Yauricocha Mine, prepared by Gustavson Associates, report date May 11, 2015 and is shown in italics. Standardizations have been made to suit the format of this report; any changes to the text have been indicated by the use of [brackets].

Prior to 2012, Minera Corona did not utilize the services of an independent lab for data verification. The company used an internal QA/QC procedure at its assay lab (Chumpe) located in the processing plant. Historically, the results have compared well with the metal contained in concentrates and further work on a formal external QA/QC procedure had not been pursued. Beginning in 2012, Minera Corona began to use external check assays as part of the validation system for the Chumpe lab data stream.

The current procedure includes certified standards, blanks, pulp duplicates, and sample preparation size review. These are processed at approximately one per 20 samples. External labs receive approximately one sample for each 15 processed internally. Gustavson did not have the opportunity to fully observe the laboratory operation; however, Gustavson has examined QA/QC records of certified standards for 2011 through 2014.

The results of the historical QA/QC show that the Chumpe laboratory generally performed well with respect to the standard blanks and duplicates submitted from the exploration department, but SRK notes that this has not been the case over the entire project history, with the Chumpe lab consistently missing targets for certain types of QA/QC. This resulted in a limited program of pulverized duplicate samples for every sample interval being submitted to ALS Minerals in Lima as a check on the Chumpe lab, where the results showed a consistent bias. Historically, Chumpe lab appeared to under-report Ag compared to ALS duplicates, although other metals appeared to be relatively consistent. For this reason, the mine abandoned the use of the Chumpe lab for the new exploration drilling, with all samples being sent to ALS Minerals in Lima prior to 2018.

Several improvements were implemented since 2018 at the Chumpe laboratory to improve the historical poor performance and to increase its sample throughput and there is a noticeable improvement in the Chumpe laboratory performance since 2018. Samples were last sent to ALS in late 2019 and no samples were analyzed by ALS in 2020. Yauricocha has not completed any umpire laboratory QA/QC checks of the Chumpe laboratory samples for 2020.

Currently, Minera Corona uses a very aggressive program of QA/QC for new exploration areas to mitigate uncertainty in analytical results. The QA/QC applied to new exploration efforts focused on underground Esperanza and Cuye areas, as well as Doña Leona and Kilcaska surface exploration target areas is discussed in Sections 11.4.1 through 11.4.3.

11.4.1 Standards

Minera Corona currently inserts standards or certified reference materials (CRM) into the sample stream at a rate of about 1:20 samples, although the insertion rate is adjusted locally to account for particular mineralogical observations in the core. Five standards have been generated by Minera Corona and certified via round robin analysis for the current exploration programs. These standards have been procured from Yauricocha material, and homogenized and analyzed by Target Rocks Peru S.A., a commercial laboratory specializing in provision of CRM to clients in the mining industry.

Each CRM undergoes a rigorous process of homogenization and analysis using aqua-regia digestion and AA or ICP finish, from a random selection of 10 packets of blended pulverized material. The six laboratories participating in the round robin for the Yauricocha CRM are:

- ALS Minerals, Lima;
- Inspectorate, Lima;
- Acme, Santiago;
- Certimin, Lima;
- SGS, Lima; and
- LAS, Peru.

The mean and between-lab standard deviations (SD) are calculated from the received results of the round robin analysis, and the certified means and tolerances are provided in certificates from Target Rocks. The certified means and expected tolerances are shown in Table 11-3.

Table 11-3: CRM Certified Means and Expected Tolerances

CRM	Certified Mean				Two Standard Deviations (between lab)			
Element	Ag (g/t)	Pb (%)	Cu (%)	Zn (%)	Ag (g/t)	Pb (%)	Cu (%)	Zn (%)
MAT-04	29.1	0.70	0.16	0.28	2.1	0.03	0.01	0.01
MAT-05	128.2	2.37	0.58	2.50	7.7	0.06	0.02	0.12
MAT-06	469.0	7.75	2.53	7.98	13.0	0.20	0.12	0.23
MCL-02	40.8	0.65	1.58	2.49	3.4	0.05	0.08	0.09
PLSUL-03	192.0	3.09	1.03	3.15	4.0	0.08	0.04	0.13
PLSUL-04	6.7	0.09	0.24	0.23	0.5	0.01	0.01	0.01
PLSUL-05	13.6	NA	0.49	0.47	1.0	NA	0.03	0.02
PLSUL-06	30.3	1.94	0.21	1.60	2.9	0.04	0.01	0.11
PLSUL-07	79.2	5.94	0.45	4.67	4.5	0.27	0.02	0.20
PLSUL-08	248.0	12.46	0.98	12.54	14.0	0.39	0.04	0.55

Source: Sierra Metals, 2020

During the 2017, 2018 and 2019 drilling campaigns an additional 11 CRMs were inserted into the sample stream at the Chumpe laboratory, one of which was designed specifically for Au inspection (MRISi81). The additional CRMs and their expected tolerances are shown in Table 11-4. No additional CRMs were added during the 2020 drilling campaign.

SRK notes that the CRMs are adequate for QA/QC monitoring and that in 2018 a rigorous QA/QC program was set in place and maintained, including a recently included CRM for Au. Minera Corona has submitted 177 CRMs to ALS Minerals in 2015-2017 for new drilling with an average insertion rate of about 5%. Between 2018 and 2019, a total of 435 CRMs was sent to ALS for independent checking and the Chumpe laboratory analyzed a total of 6,319 during that same timeframe. These two sets of CRMs were reviewed independently by SRK in 2019.

Table 11-4: 2017-2019 CRM Means and Tolerances

CRM	Certified Mean					Two Standard Deviations (between lab)				
Element	Au (g/t)	Ag (g/t)	Pb (%)	Cu (%)	Zn (%)	Ag (g/t)	Pb (%)	Cu (%)	Zn (%)	Au (g/t)
MRISi81	1.79									0.048
PLSUL-10		85	5.7	0.608	5.39	6	0.13	0.032	0.22	
PLSUL-14		25.5	0.857	0.032	5.17	0.9	0.06	0.000 3	0.16	
PLSUL-15		22.7	0.6	0.041	0.97	1.7	0.02	0.002	0.04	
PLSUL-22		83	1.22	0.147	3.13	4.8	0.08	0.01	0.16	
PLSUL-24		114	3.69	0.272	7.72	4	0.19	0.016	0.26	
PLSUL-32		42.5	0.53	0.429	1.04	3.6	0.04	0.02	0.03	
PLSUL-33		51.1	0.65	0.738	2.35	3.7	0.03	0.038	0.1	
PLSUL-34		109	1.6	1.454	5.19	5.3	0.06	0.07	0.3	
ST1700013 (Oz/Tc)		0.799	0.167	0.226	0.467	0.052	0.008	0.012	0.028	
ST1700014 (Ox/Tc)		3.478	2.664	0.803	5.178	0.074	0.042	0.024	0.206	

Source: SRK, 2020

Performance: ALS Minerals

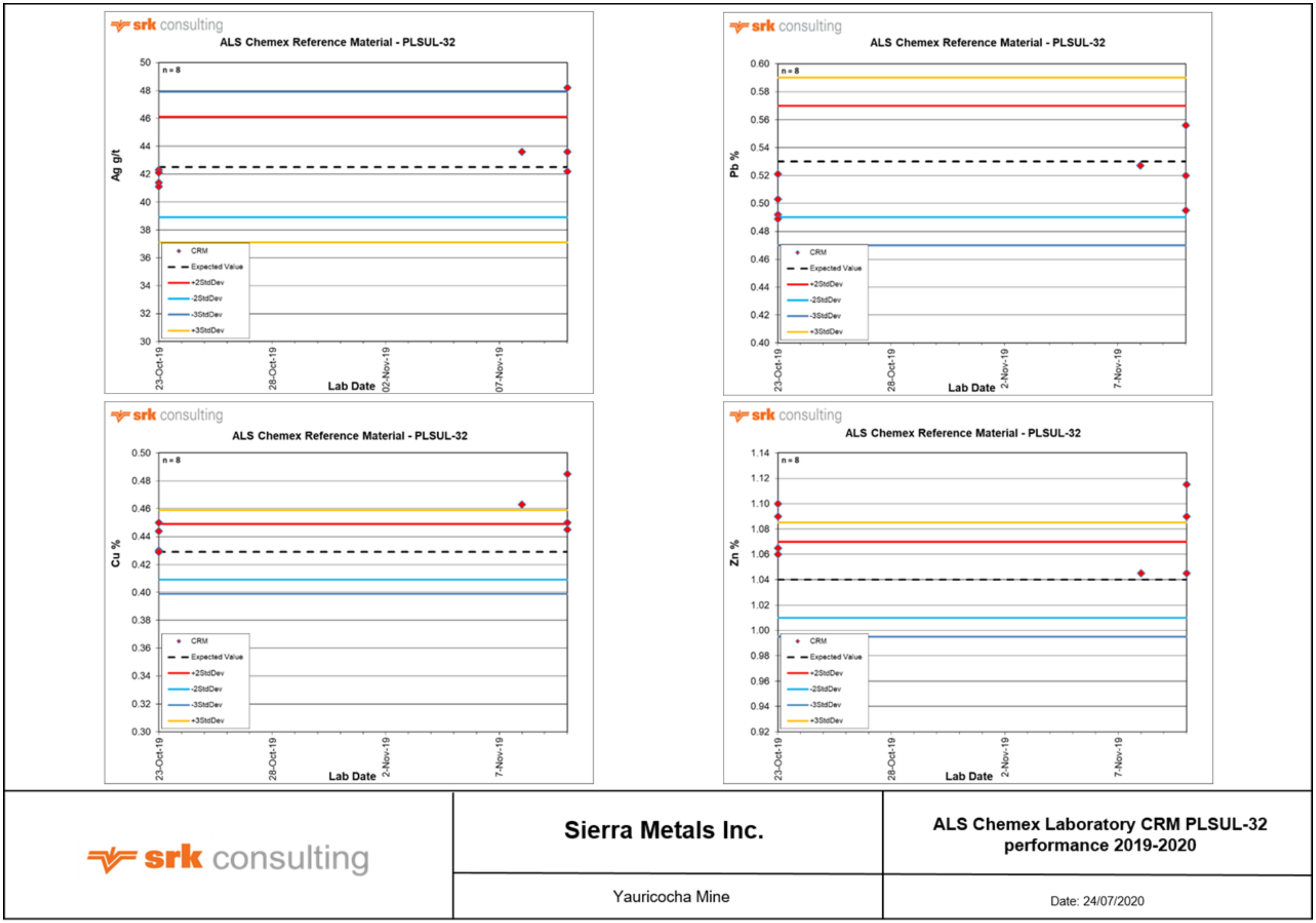
SRK generally uses a nominal +/-3 SD criteria for evaluating failures of the CRMs. The SD used is the between lab SD, as provided in the certificates from Target Rocks. SRK notes that failure rates for the CRMs as provided are very high for Cu, which are due to rounding differences between lab certificates and CRM values. All other elements have minimal failure results, although CRM PLSUL-10 reports low results for Pb, which will need to be monitored in future.

The tabulated QA/QC results for the 2018 drilling campaign using ALS as the testing laboratory are shown in Table 11-5. In 2018, Minera Corona submitted a total of 435 samples to ALS for independent checking. As is evident in Figure 11-1, PLSUL-32 (8 samples) shows an increasing positive bias for Ag, Pb and Cu over time. Zn generally is positively biased throughout with four samples lying above the upper 3rd standard deviation limit. Additional CRMs utilized during the specified period include; PLSUL-33 (7 samples) and PLSUL-34 (6 samples). Limited samples were sent to ALS in 2019, with the bulk of samples analyzed and tested at the Chumpe laboratory. No samples were sent to ALS in 2020.

Table 11-5: 2018 CRM Performance Summary – ALS Minerals

STD	Total	Low 3SD	High 3SD	Failure % Low	Failure % High
Ag					
PLSUL-22	99	0	0	0.00%	0.00%
PLSUL-24	109	2	0	1.83%	0.00%
PLSUL-10	13	0	0	0.00%	0.00%
PLSUL-14	36	0	34	0.00%	94.44%
PLSUL-15	12	0	0	0.00%	0.00%
All Ag	**269**	**2**	**34**	**0.74%**	**12.64%**
Pb					
PLSUL-22	99	0	0	0.00%	0.00%
PLSUL-24	109	2	0	0.00%	0.00%
PLSUL-10	13	9	1	69.23%	7.69%
PLSUL-14	36	0	0	0.00%	0.00%
PLSUL-15	12	1	0	8.33%	0.00%
All Pb	**269**	**12**	**1**	**3.72%**	**5.77%**
Cu					
PLSUL-22	99	0	6	0.00%	6.06%
PLSUL-24	109	1	19	0.00%	17.43%
PLSUL-10	13	0	1	0.00%	7.69%
PLSUL-14	36	36	0	100.00%	0.00%
PLSUL-15	12	0	1	0.00%	8.33%
All Cu	**269**	**37**	**27**	**13.38%**	**10.04%**
Zn					
PLSUL-22	99	1	2	1.01%	2.02%
PLSUL-24	109	4	1	3.67%	0.92%
PLSUL-10	13	1	0	7.69%	0.00%
PLSUL-14	36	2	1	5.56%	2.78%
PLSUL-15	12	2	0	16.67%	0.00%
All Zn	**269**	**10**	**4**	**3.72%**	**1.49%**

Source: SRK, 2020



Source: SRK, 2020

Figure 11-1: ALS Minerals Laboratory CRM (PLSUL-32) Performance

Performance: Chumpe Laboratory

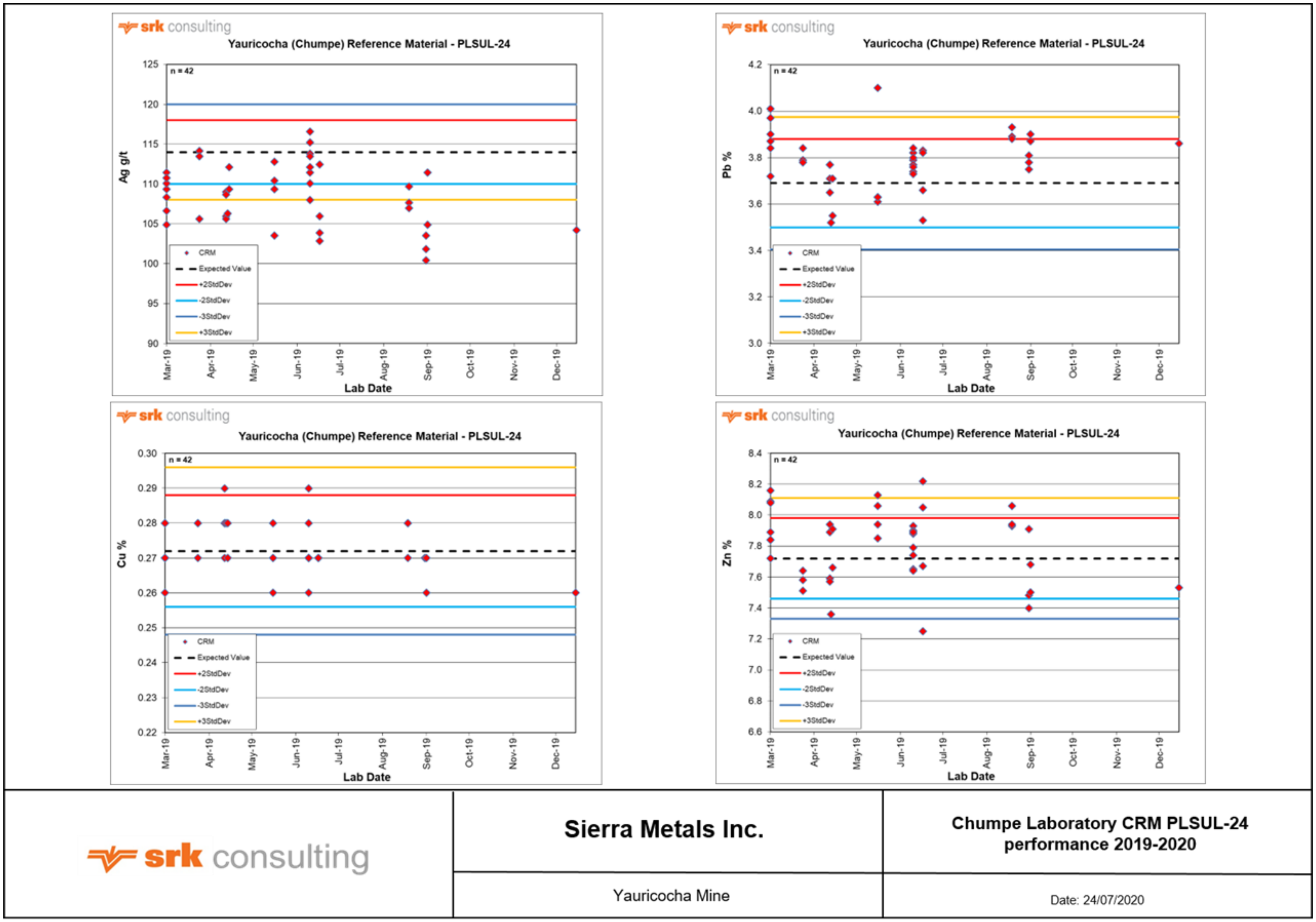
In 2018, Minera Corona instigated a rigorous QA/QC program whereby Standards, Duplicates (Core and Pulp) and Blanks were routinely inserted into the assay sample stream. Monthly QA/QC reports were generated on-site and the results confirm the improved performance of the Chumpe laboratory in more recent years, whereby CRM failure rates have been significantly reduced. The performance of the 2019 and 2020 CRMs at the Chumpe laboratory are summarized in Table 11-6. Significant under-reporting of Pb, Cu and Zn were, however, still a problem for certain CRMs in 2018. CRM results in 2019 - 2020 appear to be significantly improved. However, Ag continues to return negative bias results for three of the four CRMs in use at Yauricocha. Laboratory reporting limits account for most of the Cu discrepancies, whereas CRM sample mix-ups also accounted for several of the failures.

Figure 11-2 tracks the performance of PLSUL-24 (42 samples), a polymetallic CRM, which was a CRM utilized during the 2019 and 2020 underground definition and exploration drilling campaigns. Silver results indicate a slight negative bias, with the negative bias increasing over time. This indicates that the instrumentation may require additional calibration for the determination of the Ag analyte. The remaining sample batches are unbiased and distributed evenly about the Expected value. Two Pb and three Zn values lie slightly above the upper 3rd standard deviation limit. However, this is not deemed to be material. Additional CRMs utilized during the specified period include; PLSUL-22 (39 samples), PLSUL-32 (10 samples), PLSUL-33 (8 samples) and PLSUL-34 (3 samples). These CRMs performed in a similar manner to PLSUL-24. CRM samples that repeatedly occur above or below the 3 standard deviations limit (+/-3SD) should be repeated along with +/- five samples above and below the erroneous CRM interval.

Table 11-6: 2018 and 2019 CRM Performance Summary – Chumpe Lab

STD	Total	Low 3SD	High 3SD	% Low	% High
2018					
Ag					
PLSUL-10	97	1	0	1.03%	0.00%
PLSUL-14	77	0	58	0.00%	75.32%
PLSUL-15	94	0	3	0.00%	3.19%
All Ag	**268**	**1**	**61**	**0.37%**	**22.76%**
Pb					
PLSUL-10	97	87	0	89.69%	0.00%
PLSUL-14	77	0	0	0.00%	0.00%
PLSUL-15	94	0	1	0.00%	1.06%
All Pb	**268**	**87**	**1**	**32.46%**	**0.37%**
Cu					
PLSUL-10	97	30	0	30.93%	0.00%
PLSUL-14	77	76	1	98.70%	1.30%
PLSUL-15	94	3	48	3.19%	51.06%
All Cu	**268**	**109**	**49**	**40.67%**	**18.28%**
Zn					
PLSUL-10	97	1	1	1.03%	1.03%
PLSUL-14	77	0	2	0.00%	2.60%
PLSUL-15	94	85	4	90.43%	4.26%
All Zn	**268**	**86**	**7**	**32.09%**	**2.61%**
2019 - 2020					
Ag					
PLSUL-22	39	4	0	10.26%	0.00%
PLSUL-24	41	16	2	37.50%	5.00%
PLSUL-32	10	0	0	0.00%	0.00%
PLSUL-33	8	1	0	33.33%	0.00%
PLSUL-34	5	4	0	100.00%	0.00%
All Ag	**103**	**25**	**2**	**25.00%**	**2.27%**
Pb					
PLSUL-22	39	0	0	0.00%	0.00%
PLSUL-24	41	2	3	5.00%	7.50%
PLSUL-32	10	0	0	0.00%	0.00%
PLSUL-33	8	0	0	0.00%	0.00%
PLSUL-34	5	0	0	0.00%	0.00%
All Pb	**103**	**2**	**3**	**2.27%**	**3.41%**
Cu					
PLSUL-22	39	0	3	0.00%	7.69%
PLSUL-24	41	0	2	0.00%	5.00%
PLSUL-32	10	0	1	0.00%	0.00%
PLSUL-33	8	1	0	33.33%	0.00%
PLSUL-34	5	0	1	0.00%	50.00%
All Cu	**103**	**1**	**7**	**1.14%**	**6.82%**
Zn					
PLSUL-22	39	0	7	0.00%	17.95%
PLSUL-24	41	3	3	7.50%	7.50%
PLSUL-32	10	1	5	0.00%	50.00%
PLSUL-33	8	1	0	0.00%	0.00%
PLSUL-34	5	0	0	0.00%	0.00%
All Zn	**103**	**5**	**15**	**3.41%**	**13.64**

Source: SRK, 2020



Source: SRK, 2020

Figure 11-2: Yauricocha Mine Chumpe Laboratory CRM (PLSUL-24) Performance

11.4.2 Blanks

Minera Corona currently inserts unmineralized quartz sand blanks into the sample stream at a rate of 1:20 samples, or adjusted as necessary, to ensure smearing of grade is not occurring immediately after higher grade intervals. Blanks are generally about 0.5 kg of silica sand, bagged and submitted in the sample stream along with the normal core samples. The results of the Blank analysis in 2019 and 2020, show that based on a failure criterion of 5 times the LLOD, there are only two gold systematic failures for the Chumpe diamond drilling samples (Table 11-7). LLOD data for the Chumpe laboratory are presented in Table 11-1.

Between 2017 and 2020, a total of 6,897 Blanks were inserted into the sample stream at the Chumpe laboratory. Figure 11-3 tracks the performance of 93 blank samples utilized during exploration and definition drilling completed within lead, zinc and copper dominant mineralization, all of which are well below the five times LLOD failure criteria, except Au which has two failures, indicating possible contamination. This contamination is not evident in the primary metals.

Table 11-7: 2019 - 2020 Chumpe Blank Failures

Lab	Count	Failures				
		Ag	Pb	Cu	Zn	Au
Chumpe	93	0	0	0	0	2

Source: SRK, 2020
Failures assessed on a 5X LLOD basis.

Source: SRK, 2020

Figure 11-3: Yauricocha Mine Chumpe Laboratory Blank (TR-18137) Performance

11.4.3 Duplicates (Check Samples)

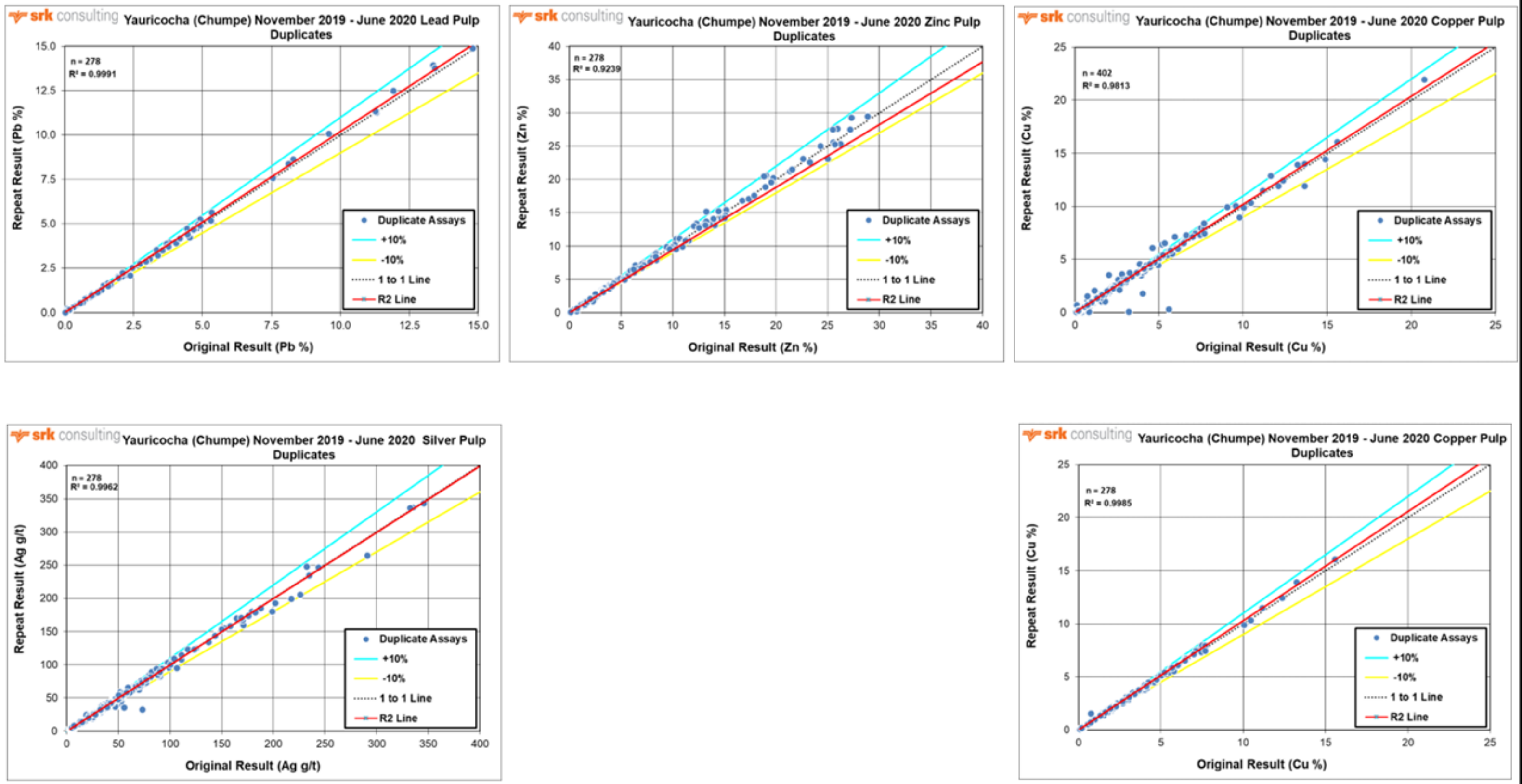
SRK was provided duplicate sample data for 2019 and 2020.

True duplicate samples such as the other half of split core or a crushed/pulverized sample resubmitted to the same laboratory are common practice for normal QA/QC programs but become less critical once development and mining continues. These samples are designed to check the primary assay laboratory's ability to repeat sample values or to check the nugget effect of the deposit very early on, but the inherent variability of the deposit is typically known at the production stage.

While Minera Corona did not submit true duplicate samples for the years preceding 2017, these intra-lab repeatability checks were instigated for the 2018 and 2019 drilling campaigns, for a combined total of 2,652 samples.

Minera Corona uses three types of check samples in the QA/QC program. These include twin (core) duplicates, coarse duplicates (crushed), and pulp duplicates (pulverized) to assess repeatability at the different phases of preparation between the site lab and third-party ALS lab.

In 2018 and 2019, pulp and core duplicate samples were routinely performed on all assay batches submitted to both ALS and Chumpe laboratory. Agreement between original samples and duplicate samples was found to be within acceptable limits for Ag, Pb and Zn. For the period November 2019 to June 2020, 278 pulp (Figure 11-4) and 125 core duplicates were processed. Agreement between original samples and duplicate samples was found to be within acceptable limits for Ag, Pb, Zn and Au for both types of duplicates.



srk consulting	Sierra Metals Inc.	Chumpe Laboratory Pulp Duplicates performances 2019-2020
	Yauricocha Mine	Date: 24/07/2020

Source: SRK, 2020

Figure 11-4: Yauricocha Mine Chumpe Duplicate Analyses' Performances

11.4.4 Actions

SRK notes that the actions taken by the exploration team at Yauricocha are documented in the QA/QC procedures for the mine. In the event that a failure is noted, the laboratory is contacted, and the source of the failure is investigated. There is no formal documentation for procedures involving re-runs of batches at this time, but SRK understands that this is the process being used. SRK notes that the QA/QC reports are not amended to reflect the new passing QA/QC and batch, and only reflect the initial failure and batch to track laboratory performance rather than the performance of reruns.

SRK is of the opinion that these actions are not consistent with industry best practice, which generally features a program of reanalysis upon failure of a CRM in a batch of samples. Subsequent to this are the incorporation of the revised samples into both the database and QA/QC analysis. SRK notes that this program is implemented at other Sierra Metals sites but is not well documented at Yauricocha.

11.4.5 Results

The results of the recent QA/QC program described above show relatively high incidence of failures for CRM samples. SRK notes that the CRM failures are potentially due to ongoing sample mix-ups, but that this inherently represents a failure in the process that must be reviewed.

SRK evaluated the CRM performance using more lenient tolerances than the CRMs themselves recommend (+/-3SD vs +/-2SD) as the recommended certified performance ranges result in extreme failure rates.

If the SD and performance criteria for the CRMs as calculated by Target Rocks are considered to be reasonable, and it is determined that the laboratories should be able to meet the performance criteria, then this is a more serious matter. The laboratories are not capable of analyzing to the precision needed for these CRMs, and the laboratory practices should be reviewed. Uncertainty in the accuracy and precision of the analyses would be introduced through this process, requiring some action in terms of the classification of the Mineral Resources.

SRK is aware that the bias of the Chumpe laboratory compared to ALS has been noted and that changes in procedures and hardware are still being implemented at Chumpe to better approximate the preparation and analysis methodology employed by ALS. QA/QC methods have been adjusted in recent years and the results from 2018 to 2020 reflect the positive change.

11.5 Opinion on Adequacy

SRK is of the opinion that the database is supported by adequate QA/QC to have reasonable confidence to estimate Mineral Resources. The Chumpe laboratory results have had a consistent negative bias relative to ALS. However, SRK notes that these biases are conservative given that Chumpe is the source for the historical drilling database and current channel samples, and that the nature of the bias is not such that the entire resource would be under or over-stated.

SRK did not observe any consistent performance issues over time (2015-2020) at either lab, but rather noted isolated and apparently random failures for the CRMs and blanks. As noted, many of these can be attributed to sample mix-ups during QA/QC submittal or potential issues with the CRMs, both problems in and of themselves. Any sample mix-ups where corrected before the QA/QC analysis reporting and the Resource estimation process. Actual QA/QC sample failures initiate a re-assay protocol of the affected sample batch and those samples are not included in the estimation process. SRK continues to recommend that more attention is given to sampling and QA/QC in the future to continue to mitigate potential uncertainty in the analyses supporting the Mineral Resource. SRK also notes that any bias from the Chumpe analyses will likely be conservative due to the significant under-reporting of Ag for Chumpe compared to ALS.

Although the performance and monitoring of the QA/QC samples is not consistent with industry best practices, SRK notes that the lack of precision in certain analyses (Ag, Zn, Pb, Cu) is less critical due to the nature of the mineralization and mining criteria at Yauricocha. Precision issues between 0.1% to 0.2% in the base metals is likely not enough to cause material issues in deciding whether material is mined or not, and these decisions are generally made with ongoing development samples and grade control entirely unsupported by detailed QA/QC. Thus, much of the risk associated with the analyses has already be borne by the active mining of multiple areas at Yauricocha and mitigated by ongoing profitable production. SRK is of the opinion that while these issues should be addressed going forward; they represent little risk to the statement of Mineral Resources at this time.

12 Data Verification

Independent consultants such as Gustavson and Associates, and SRK have verified the data supporting Mineral Resource estimation at Yauricocha since 2012. SRK verified the data supporting the 2019 Mineral Resource estimation on site by observing and verifying geologically related procedures and data chain of custody, comparing several physical drillhole cores in the core yard to logged values recorded in the mine Excel spreadsheet, inspecting drillhole collar sites and comparing locations to recorded locations, cut-off values and assumptions, comparing laboratory result spreadsheets to the values utilized for the Mineral Resource estimation process. The drillholes, channel samples, mine development and the respective geological models were visually inspected in Studio RM™ version 1.6.87 (Datamine) by SRK to determine whether there were any material issues with respect to interpretation, data location or grade values. SRK found no material differences, except as outlined in Section 12.1 and corrected for the 2019 Resource estimation.

In 2020, SRK completed a desktop verification of the data utilized to support the Mineral Resource estimate as reported in this Report. This included the verification of the interpretation, data location and grade values related to drillholes, channel samples, cut-off values and assumptions, mine development and the respective geological models in Datamine.

SRK notes that the data verification process is made difficult due to the lack of a compiled and well-ordered database for the overall mine area.

12.1 Procedures

For data prior to 2016, Gustavson reviewed the drillhole and underground channel sample databases for the Yauricocha project and compared the assay database with a separately maintained database of assay data which is described as 'laboratory data'. Chumpe lab does not provide a separately maintained database, nor are there assay certificates with which to compare the database.

For the 2019 drillhole and channel sample database, SRK compared approximately 5% of the Chumpe laboratory results for the period 2018 to 2019 back to the Chumpe laboratory supplied Excel spreadsheets. No errors were noted between the two sources of results for silver, gold, lead, zinc and copper analytes. However, there were instances where arsenic and iron analytes where not available in the geological drillhole database. The entire analytical database was checked for further such instances and this information was sourced and updated where it was analyzed and available. For the period November 2019 to June 2020 SRK compared approximately 4% of the Chumpe laboratory results back to the Chumpe laboratory supplied Excel spreadsheets and no errors or omittances were noted.

12.2 Limitations

SRK has not reviewed 100% of the analyses at Yauricocha against certified, independent assay certificates.

12.3 Opinion on Data Adequacy

SRK has relied upon the verification conducted by others previously and has conducted independent verification of assays to analytical certificates from ALS Minerals for the recent project history. SRK also notes that much of the risk associated with potential version control issues, database contamination or transposition, is borne-out through daily production in the currently operating underground mine.

SRK recommends the installation of a dedicated database management platform that will compile and validate the database used in Mineral Resource estimation against the actual certificates received from Chumpe, as well as make QA/QC management and database export more flexible and reliable. The ability to process QA/QC in real time will allow the identification of laboratory or sampling issues long before the Mineral Resource estimation process.

13 Mineral Processing and Metallurgical Testing

13.1 Testing and Procedures

Yauricocha's facilities include a metallurgical laboratory at site. Sampling and testing of samples are executed on an as needed basis. Information available from site shows that Yauricocha has been testing various samples from the mineralized zones as follows:

- Samples from Mina Central – Cuerpo Esperanza: a polymetallic Ag-Cu-Pb-Zn material that at laboratory scale achieved comparable results to those achieved in the industrial scale plant. Three products resulted from the tests: copper concentrate, lead concentrate, and zinc concentrate. Silver is preferably deported to copper and lead concentrates. No deleterious elements were reported in the flotation concentrates.
- Samples from a polymetallic material: test results are comparable to those of the industrial scale plant. Three products resulted from the tests: copper concentrate, lead concentrate, and zinc concentrate. Silver is preferably deported to copper and lead concentrates. Yauricocha continues testing alternative flotation conditions and reagents to reduce arsenic and antimony presence in copper concentrate and lead concentrate.
- Samples from Mina Mario (Pb-Zn): successfully produced a good quality lead sulfide concentrate and found difficulties in achieving commercial quality zinc grades.
- Samples from Cuerpo Contacto Occidental: correspond to an oxide Ag-Pb material that successfully achieved good quality lead sulfide concentrate and lead oxide concentrate. Approximately 70% of the silver was deported to concentrates, with approximately 47% of the total being deported to lead oxide concentrate.
- Additionally, samples identified as sourced from: Angelita, Antacaca, Catas, Celia, Cuye Cobre, Cuye Polimetalico, Gallito, Karlita have been subject to mineralogy analysis and flotation testing.
- Samples from an oxide copper material: this sample achieved poor metallurgical performance that laboratory personnel attributed to high presence of copper carbonates. Additional tests are planned for these samples.
- Samples from Esperanza Norte: a copper bearing material that achieved reasonable copper recovery and concentrate grade but with high presence of arsenic. The laboratory personnel's recommendation is to blend this material in the mill feed.
- Samples from copper sulfide materials: achieved high recovery and concentrate grade but with significant arsenic presence in the copper concentrate. The laboratory personnel's recommendation is to batch process this material in the plant.

13.2 Metallurgical Performance

Yauricocha's metallurgical performance is presented in Table 13-1, Table 13-2, Figure 13-1 and Figure 13-2 for the period of January 2019 to June 2020. There was no oxide concentrate produced during this period. All concentrate products reached typical commercial grades.

In the polymetallic circuit, the fresh feed assaying 1.58% Pb, 1.11% Cu, 3.71% Zn, 0.62 g/t Au, and 64.64 g/t Ag produced three final concentrates with the following specifications:

- Copper recovery of 76.9% to produce a copper concentrate assaying 29.7% Cu, including grades of 6.3% Zn, and 1.9% Pb; because of their grades, both metals may trigger penalties from buyers. Silver recovery to copper concentrate reached 27.2%, equivalent to 606.52 g/t Ag in concentrate. Arsenic reached a likely penalty grade level of 2.1% in the copper concentrate after a recovery of 45.3%. Gold deportment was minor at 10.9% which translated to 2.32 g/t Au.
- Lead concentrate assaying 57.7% Pb after 88.4% Pb recovery. Zinc and copper may trigger penalties at 5.3% Zn and 2.5% Cu. Gold recovery of 8.8% translated to 2.23 g/t Au in concentrate which is unlikely to add value to the lead concentrate. Silver recovery reached 43.5% to produce a 1,152.70 g/t Ag grade well within payable levels. Arsenic was marginally deported to the lead concentrate reflecting a 0.1% As grade, well below penalty levels.
- Zinc concentrate that recovered 87.9% Zn and assayed 50.7% Zn which is within typical commercial values. Pb, Cu, and As are unlikely to trigger penalties when grading 0.7%, 1.8%, and 0.1% respectively. Gold recovery reached 5.0% translating to 0.48 g/t Au which is below payable levels. Silver recovery reached 9.2% translating to 92.07 g/t Ag and therefore within payable levels.

Table 13-1: Yauricocha Metallurgical Performance, January 2019 to June 2020

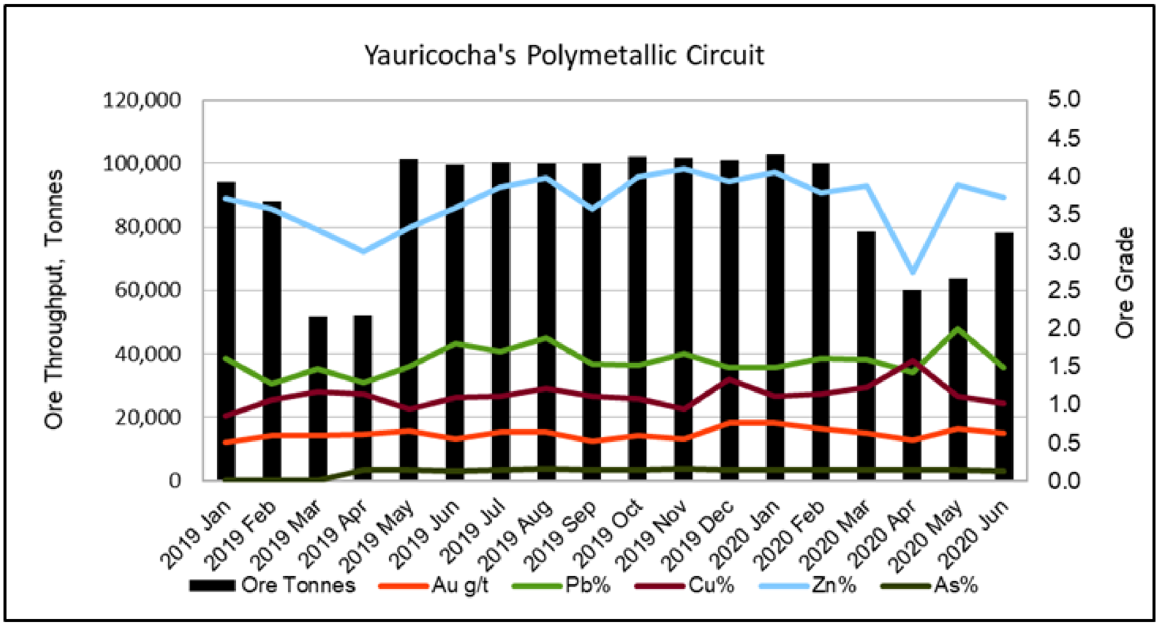
Stream	Tonnes	Au (g/t)	Ag (g/t)	Pb (%)	Cu (%)	Zn (%)	As (%)
Fresh Mineralized Material	1,575,919	0.62	64.64	1.6	1.1	3.7	0.1
Cu Concentrate	45,285	2.32	606.52	1.9	29.7	6.3	2.1
Pb Concentrate	38,169	2.23	1,152.70	57.7	2.5	5.3	0.1
Zn Concentrate	101,230	0.48	92.07	0.7	1.8	50.7	0.1

Source: Sierra Metals, 2020

Table 13-2: Concentrate Metal Recoveries, January 2019 to June 2020

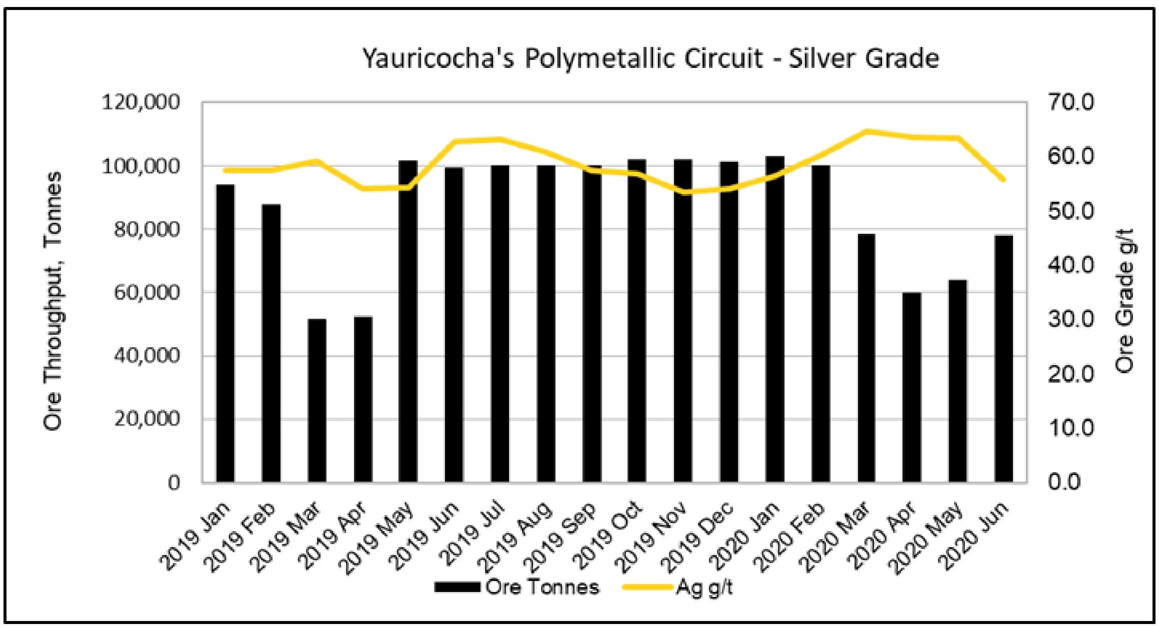
Concentrate	Au (%)	Ag (%)	Pb (%)	Cu (%)	Zn (%)	As (%)
Cu	10.9	27.2	3.7	76.9	5.1	45.3
Pb	8.8	43.5	88.4	5.5	3.5	1.7
Zn	5.0	9.2	2.8	10.4	87.9	0.0

Source: Sierra Metals, 2020



Source: Sierra Metals, 2020

Figure 13-1: Mineralized Material Tonnes Processed and Metal Grades (Excluding Silver)



Source: Sierra Metals, 2020

Figure 13-2: Mineralized Material Tonnes Processed and Silver Grade (g/t)

Current gold deportment results suggest that gold is not associated with any of the major metals (silver, lead, copper, zinc), therefore suggesting that it could be present as free gold. Additionally, the overall recovery of gold is very low at 24.7% (across the Cu, Pb and Zn concentrate streams), and opportunities for improving gold recovery should be evaluated. Potential ways to improve gold recovery that should be evaluated include:

(a) Gravity concentration at the grinding stage;

(b) Promoting gold deportment to a concentrate using gold-specific collectors; and

(c) Gravity concentrating final flotation tails.

Gravity concentration technologies are numerous and cover a wide range of capital and operating costs. Yauricocha should evaluate these options and determine the economic viability of each.

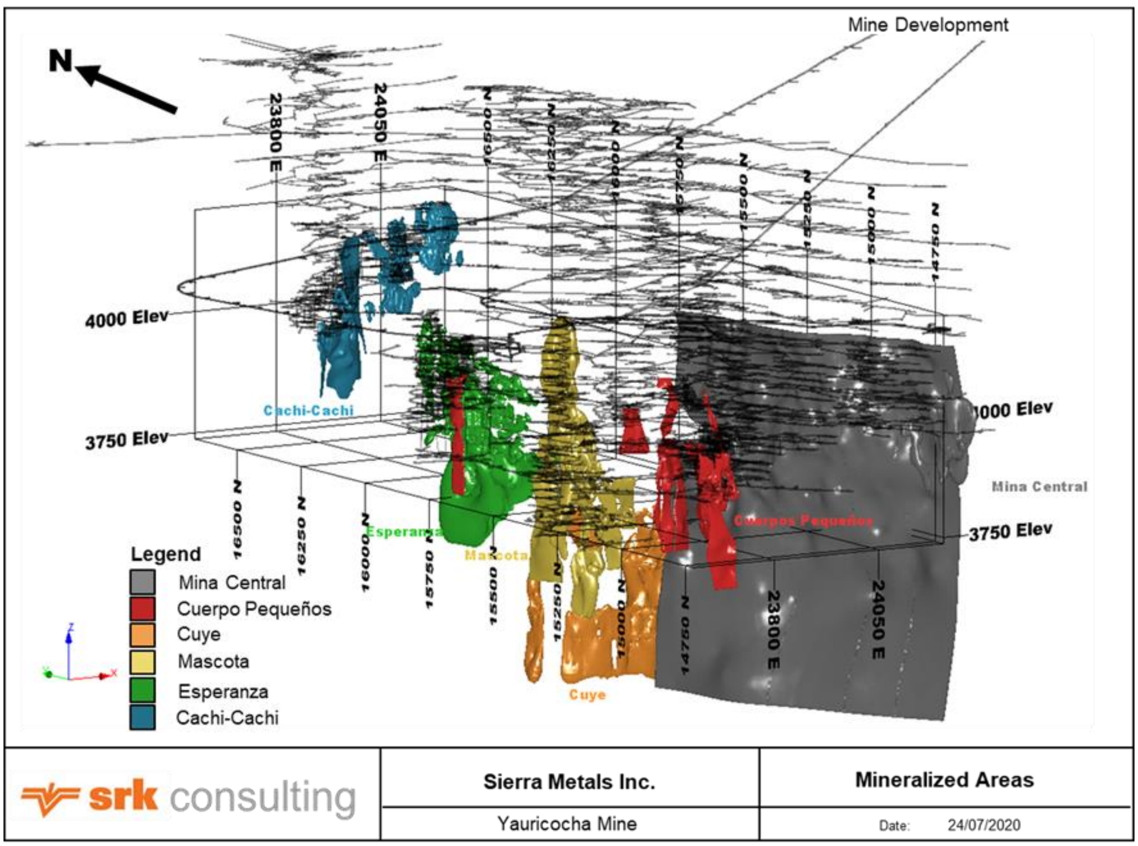
14 Mineral Resource Estimates

Mineral Resource estimations have been conducted by the following Qualified Person using various industry-standard mining software:

- Andre Deiss, Principal Resource Geologist of SRK Consulting (Canada) Inc., Datamine Studio RM™ version 1.6.87.

SRK completed Mineral Resource estimations for the following mineralized areas (Figure 14-1):

- Mina Central;
- Esperanza;
- Mascota;
- Cuye;
- Cuerpos Pequeños; and
- Cachi-Cachi.



Source: Sierra Metals, 2020

Figure 14-1: Modeled Mineralized Areas Estimated at Yauricocha Mine

14.1 Drillhole/Channel Database

SRK received a drillhole database in digital Microsoft Excel™ (Excel) format. SRK notes that Minera Corona maintains their own database in an individual unprotected spreadsheet, without a clear chain of custody record. However, the use of a single repository Excel sheet is an improvement on the historical practice of utilizing individual Excel files for each mineralized zone respectively. No record is kept of the original source information as edits are made directly in the current spreadsheet tabs.

SRK is of the opinion that one of the largest and most critical deficiencies at Yauricocha is the lack of a well-maintained and protected geological relational database, which has the capability to track changes. This type of database would facilitate multi-faceted interrogations of the original and interpreted drillhole information available. Furthermore, it would permit flexibility and speed in manipulation and extraction of data for use in any Mineral Resource estimation. QA/QC results would be seamlessly available to allow for timeous interrogation and intervention on assay result failures.

14.2 Geological Model

The geological model was developed by Minera Corona geologists, primarily using Seequent Leapfrog® Geo software (Leapfrog). Three dimensional (3D) models were derived from both drilling and channel samples, as well as incorporating mapping from mine levels and structural observations. Significant expansion and infill drilling between the end of 2017 and the effective date of the resource statement (June 30, 2020), has resulted in net changes in many areas of the Yauricocha deposit, improving the definition of the mineralized zones. Minera Corona geologists are responsible for the generation of the mineralized solids, allowing for the incorporation of detailed local geological information and hence producing more accurate representations of the mineralized zones as they are exposed in the mine. SRK has reviewed the geological model wireframes collaboratively with Minera Corona personnel and noted that they appear to be reasonable representations of the polymetallic oxide and sulfide mineralization as logged and sampled in each of the respective areas detailed in Sections 14.2.1 to 14.2.6.

SRK notes that the mineralized zones at depth have a closer morphology to the actual mined areas, which was not the case prior to 2018. Historically, the less informed areas of the models tended to be extremely optimistic for the respective mineralization style. This issue has been addressed since 2018 with additional infill drilling and the modification of the implicit modelling parameters utilized in Leapfrog. This has reduced the volumes of the respective mineralized bodies significantly in areas with a lower density of drilling intercepts.

There is currently no detailed structural or litho-stratigraphic model available for the mine. A regional structural model was commissioned by the mine. However, the results were not readily available for SRK to evaluate or comment on the validity thereof. A litho-stratigraphic model would facilitate the mine planning process with regards to the ability to apply a litho-stratigraphic waste density for dilution purposes.

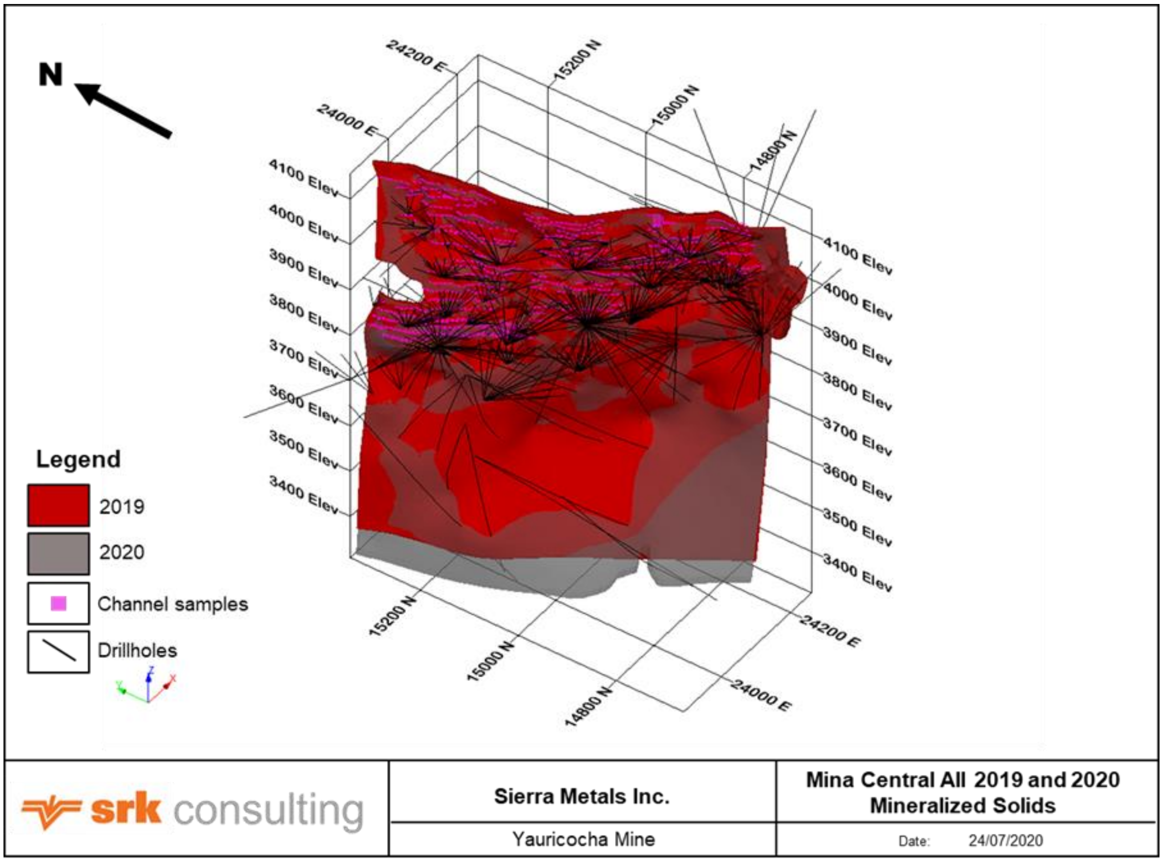
Mineralization at Yauricocha encompasses two main styles, differentiated by scale, continuity, and exploration and development style, namely:

- Cuerpos Massivos (large bodies) are bodies formed along major structures of significant (several hundreds of meters) vertical extent, consistent geometry, and significant strike length. The majority of the tonnage mined at Yauricocha is from these bodies, as they are easily intersected by targeted drilling and are mined by bulk mining methods; and
- Cuerpos Chicos (small bodies) are smaller mineralized bodies of high grades. They are often skarn bodies, are less continuous and less regular in form than the Cuerpos Massivos and are difficult to intersect except with carefully targeted drilling. They are typically mined by overhand cut and fill or similar high-selectivity mining methods. The mine has historically drifted into these zones and delineated them using localized channel sample data.

14.2.1 Mina Central

The geological model for Mina Central has been constructed by Minera Corona site geologists. This model is based on implicit modeling of drilling and channel sampling, and encompasses the Antacaca, Catas, Rosaura, and Antacaca Sur areas, which are broken on geographic and infrastructure boundaries, rather than any mineralogic or geologic boundaries. The model is effectively continuous through all areas. The mineralization is domained using a steeply dipping, NW-trending, tabular wireframe constructed in Leapfrog. Both channel sampling and drilling have been used to develop this model. SRK reviewed the wireframes collaboratively with Minera Corona personnel and noted that it appears to be a reasonable representation of the polymetallic sulfide mineralization as logged and sampled in this area. SRK noted overlaps between the Antacaca Sur Oxidos Cuye mineralized zones with the Mina Central mineralized zones. These were corrected for the 2020 estimation. The mineralized zone has been adapted at depth from the previous 2019 model, based on revised interpretation and expanded drilling. An example of this model in the context of the previous model is shown in Figure 14-2.

In addition to the expanded extents of the Mina Central area, Minera Corona geologists have modeled selected oxide zones in the Antacaca Sur area based on drilling and development data. This is considered a separate domain from the main Mina Central area for the purposes of data analysis and estimation.



Source: SRK, 2020

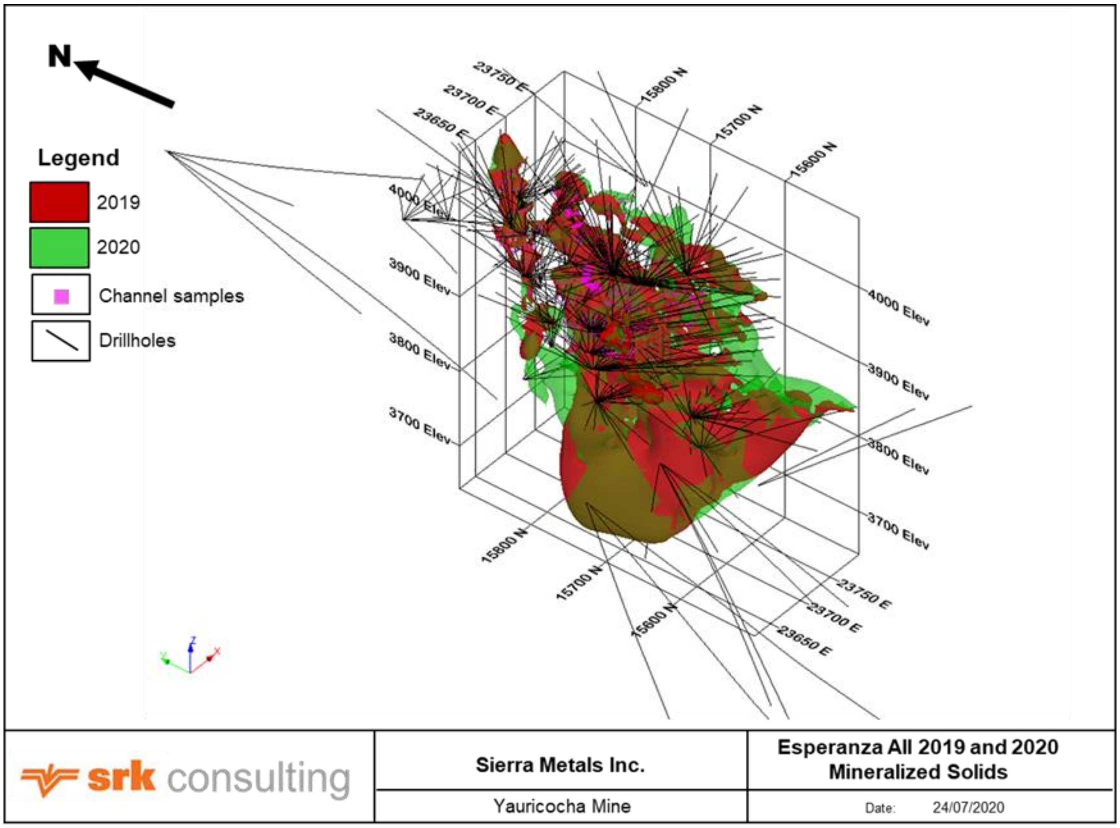
Figure 14-2: Mina Central Mineralized Model

14.2.2 Esperanza

The geological model for Esperanza has been constructed by Minera Corona site geologists. SRK has reviewed the geological model wireframes collaboratively with Minera Corona personnel and has noted that they appear to be reasonable representations of the polymetallic sulfide mineralization as logged and sampled in this area. This model is based on a very detailed drilling program as well as cross-sectional and level mapping in order to capture the inherent complexity of this area. The model is implicitly modeled from a series of eight different areas identified within Esperanza based on mineralogy or textures. These include three breccia zones, one copper zone, Esperanza North, Esperanza Distal, Esperanza main and a lower grade pyrite-rich Esperanza main outer shell. Four of the zones were not estimated namely:

- Esperanza Breccia 1 (mined-out);
- Esperanza Breccia 2 (mined-out);
- Esperanza Cobre (mined-out); and
- Esperanza Pirita (not economic).

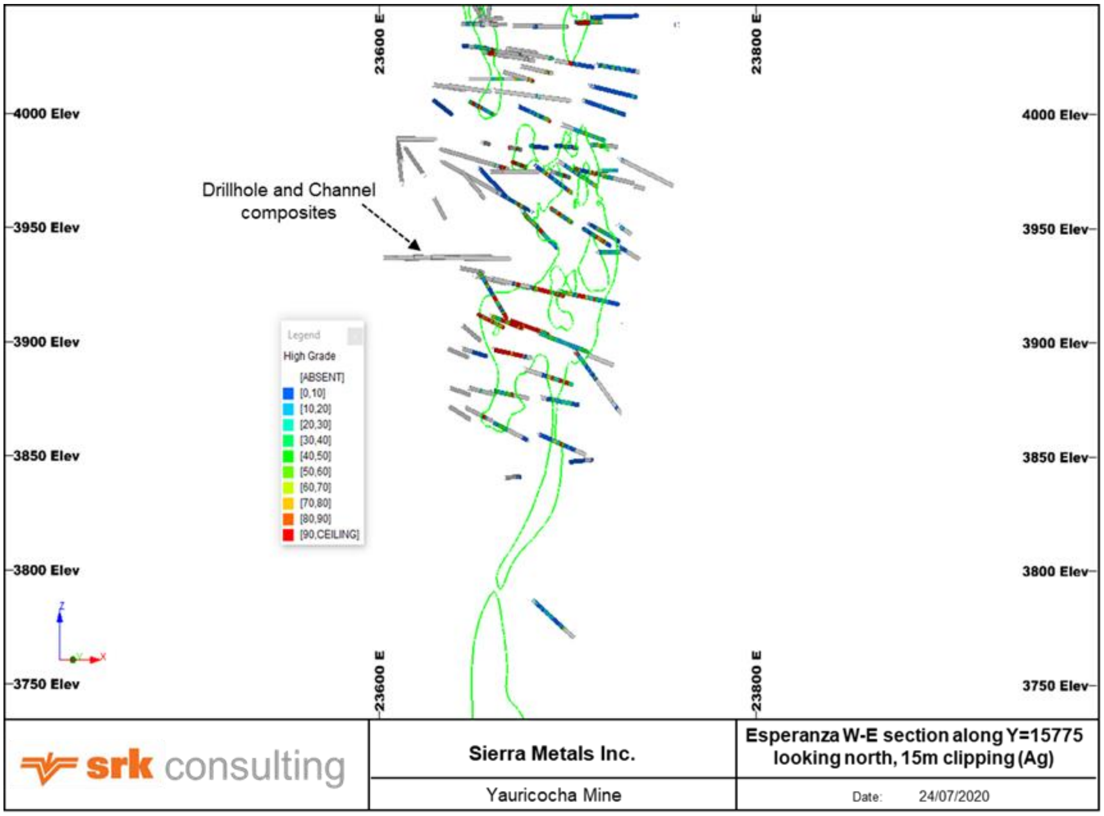
Esperanza ii is a newly discovered mineralized zone and was not estimated for the 2020 Mineral Resources. In 2020, a pyritic lower grade envelope was modelled and estimated as part of the main Esperanza mineralized body. This pyritic-rich material is more friable and tends to cave with the planned mined material causing added mining dilution. The Esperanza model represents what appears to be a single primary feeder structure at depth, which splits into many "finger-like" smaller structures in the upper levels. With recent drilling this mineralization morphology has been proven to some degree. Although general continuity along strike and down-dip is quite good, SRK notes that the mineralization varies dramatically in orientation and thickness, locally over short distances.



Source: SRK, 2020

Figure 14-3: Esperanza Mineralized Model

Examples of the Esperanza model in the context of the previous model are shown in Figure 14-3 and Figure 14-4.



Source: SRK, 2020

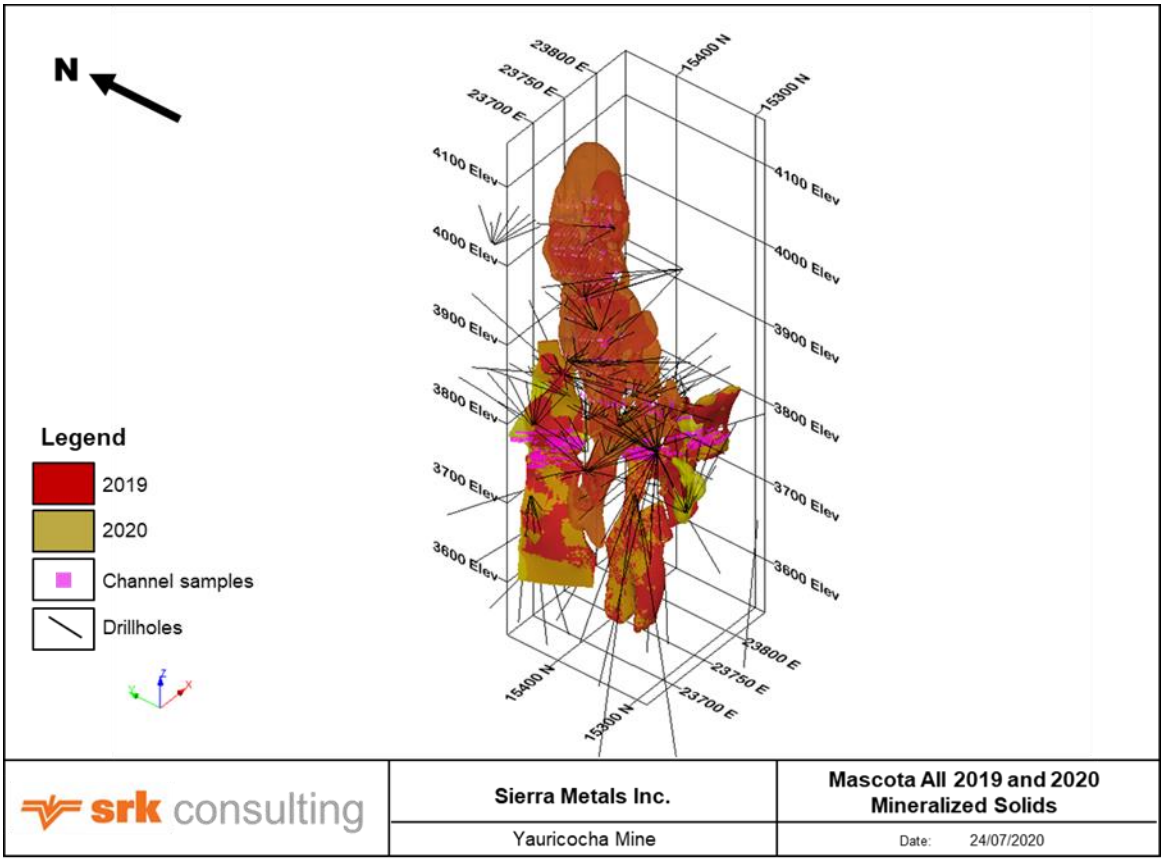
Figure 14-4: Cross-section of Esperanza Geological Model Showing Composite Ag Grades

14.2.3 Mascota

The geological model for Mascota has been constructed by Minera Corona site geologists using implicit modeling in Leapfrog. The model is based on the grouped lithologies from drilling and sampling in the Mascota Mine area. The mineralization style is complex and many faceted. The geological model includes copper-rich areas as well as the massive sulfide zones being explored at depth. These areas have been identified as Ag/Pb oxides, low-grade Ag/Pb oxides, Cu oxides, and polymetallic sulfides. They are considered as discrete by the Minera Corona geologists and have been domained separately for the purposes of estimation. The following mineralized areas were estimated independently in the Mascota area:

- Mascota Oxide Cu Pb-Ag;
- Mascota Polymetallic North;
- Mascota Polymetallic East;
- Mascota Polymetallic (South) East;
- Mascota Polymetallic South; and
- Mascota Sur Oxide Cu.

An example of this model in the context of the previous model is shown in Figure 14-5. SRK has reviewed the wireframes collaboratively with Minera Corona personnel and noted that they appear to be reasonable representations of the polymetallic oxide and sulfide mineralization as logged and sampled in this area.



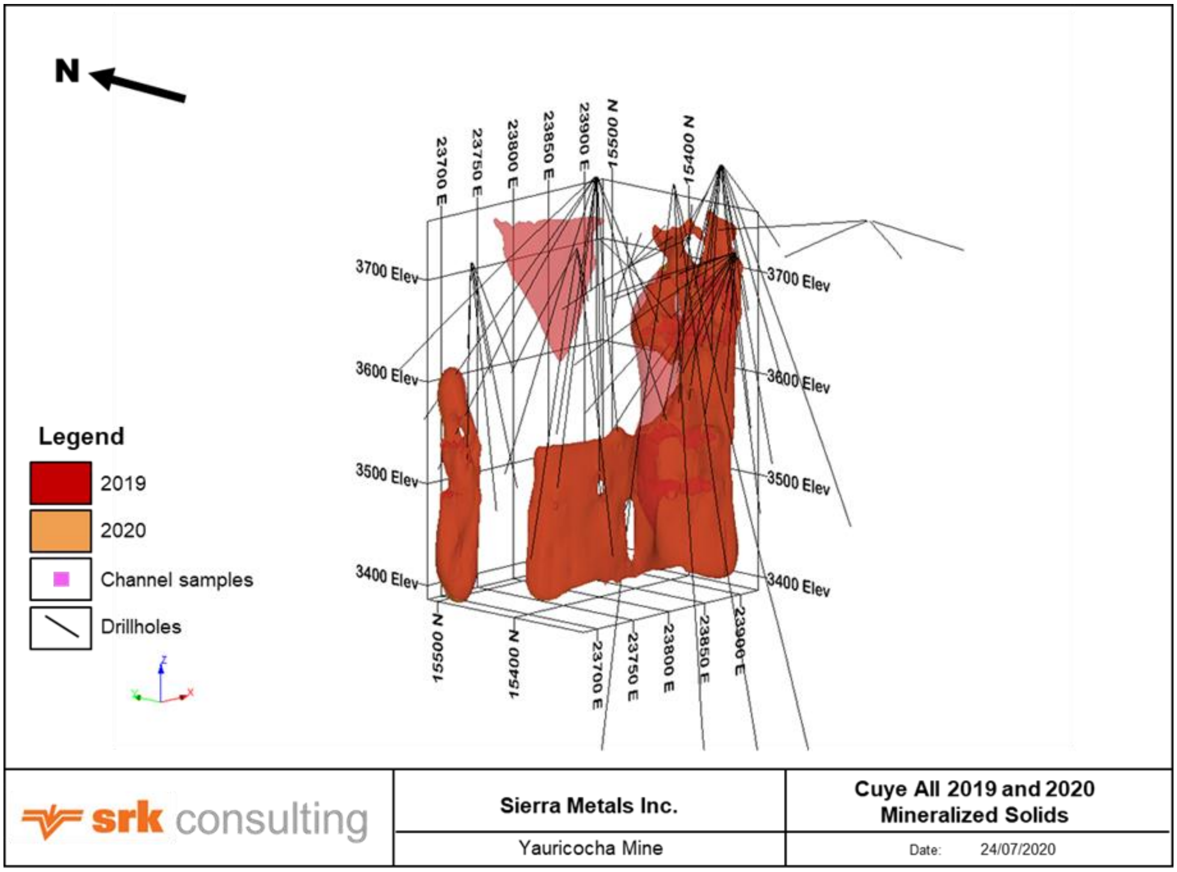
Source: SRK, 2020

Figure 14-5: Mascota Mineralized Model

14.2.4 Cuye

The geological model for Cuye has been constructed by Minera Corona site geologists. SRK has reviewed the geological model wireframes collaboratively with Minera Corona personnel and noted that they appear to be reasonable representations of the polymetallic sulfide mineralization as logged and sampled in this area. The Cuye zone has previously been reported as a series of smaller bodies situated between the Mina Central and Mascota areas. Unlike the smaller bodies, the new intersections are thicker and more continuous, if lower grade. Also, they potentially allude to an extension of the Mina Central mineralization to the north. The size and morphology of the Cuye area has completely changed from previous reports and fits more closely with a tabular, steeply dipping zone along the trend of the Mina Central and Esperanza areas. At present, Cuye has only been sampled by relatively widely spaced drilling. It, like Esperanza, also features some pyrite-rich zones which have been modeled separately within the greater Cuye zone. These areas have been excluded from the estimation as they are considered as waste rock for the mine.

The Cuye iii mineralized body, previously included in the 2019 Mineral Resources, has not been included in the 2020 Mineral Resources as exploration development was unable to intersect the zone, previously identified by three sparsely spaced drillholes. Furthermore, the recent 2019 and 2020 drilling has shown areas that were previously considered as mineralized to be poorly or non-mineralized. The geological model and estimates have been updated to reflect these significant changes. Exploration drilling has identified a new mineralized zone south of the main Cuye mineralized zone. It has been designated as Cuye Sur and it has not been included in the 2020 estimates as additional drilling is required to define the shape of the mineralization. An example of the Cuye mineralized zone, compared with the previous model, is shown in Figure 14-6.



Source: SRK, 2020

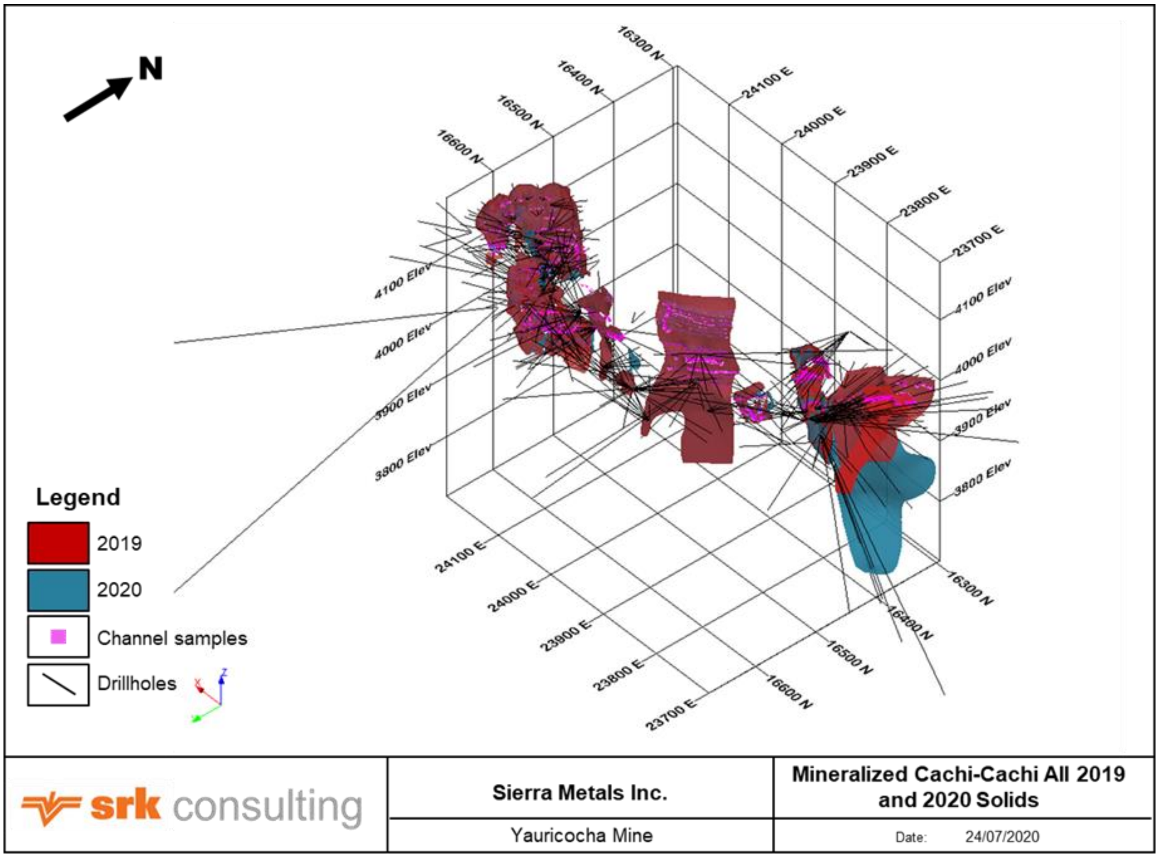
Figure 14-6: Cuye Mineralized Model

14.2.5 Cachi-Cachi

The geological model for Cachi-Cachi has been constructed by Minera Corona site geologists. SRK has reviewed the wireframes collaboratively with Minera Corona personnel and noted that they appear to be reasonable representations of the polymetallic sulfide mineralization as logged and sampled in this area. This model is based on cross-sectional and level mapping, and encompasses the following massive mineralized zones:

- Angelita;
- Carmencita;
- Karlita;
- Elissa;
- Escondida;
- Privatizadora;
- Vanessa; and
- Yoselim.

These are discrete mineralized bodies with unique morphologies and mineralization. Carmencita, Vanessa and Yoselim mineralized zones were discovered in late 2018 and early 2019. The Cachi Cachi mineralization has been domained using a variety of geometries and orientations, which are generally steeply dipping. Models are wireframes implicitly modeled in Leapfrog. Both channel sampling and drilling have been used to develop these models. SRK reviewed the wireframes collaboratively with Minera Corona personnel and noted that they appear to be a reasonable representation of the polymetallic sulfide mineralization as logged and sampled in this area. An example of these models is shown in Figure 14-7.



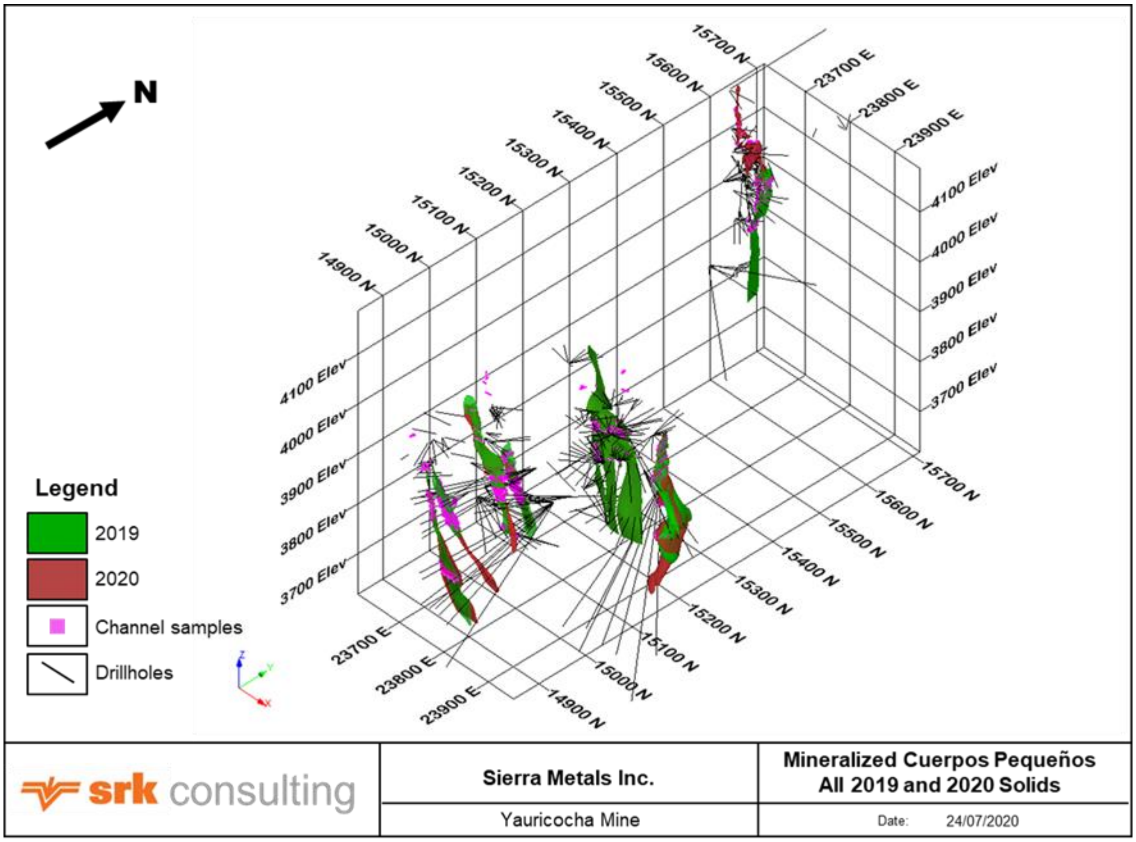
Source: SRK, 2020

Figure 14-7: Example of Cachi-Cachi Models

14.2.6 Cuerpos Pequeños

The geological models for Cuerpos Pequeños have been constructed by Minera Corona site geologists. These models are based on cross-sectional and level mapping as well as the drilling and channel sampling. Models generally encompass small chimney-shaped massive sulfide mineralization, considered to occur as discrete mineralized bodies with unique morphologies and mineralization. The models encompass the following zones (Figure 14-8):

- Contacto Oriental;
- Contacto Occidental;
- Contacto Occidental Oxide (not estimated or mined);
- Contacto Sur Medio (TJ6060);
- Contacto Sur Medio I (TJ8167);
- Contacto Sur Medio II (TJ1590); and
- Gallito.



Source: SRK, 2020

Figure 14-8: Cuerpos Pequeños Mineralized Model

The mineralization has been domained using a variety of geometries and orientations, which are generally steeply-dipping. Models are wireframes implicitly modeled in Leapfrog. Both channel sampling and drilling have been used to develop these models. SRK reviewed the wireframes collaboratively with Minera Corona personnel and noted that they appear to be a reasonable representation of the polymetallic sulfide mineralization as logged and sampled in this area.

The unpredictable nature of the mineralized zones and the exploration methodology used to delineate them makes for some uncertainty in the interpretation of the bodies, as they have been demonstrated to pinch and swell dramatically over short distances. Although an important source of Mineral Resources and production, these zones are not relied upon to the same degree as more massive bodies, such as Mina Central and Esperanza. SRK notes that there are several of the Cuerpos Pequeños-type mineralized zones that have not been modeled or estimated as part of this PEA, but which may have been included in previous reports and which may include mineralization that is currently being (or has previously been) selectively mined. This has historically made modeling and estimation of the smaller mineralized zones a distinct challenge, as the mineralization is often significantly or completely depleted through mining between the bi-annual modeling process.

14.2.7 Geological Models as Resource Domains

SRK considered the geological models to be hard boundaries, with respect to the resource estimation methods. However, for the purposes of exploratory data analysis, SRK grouped selected areas based on their geography or mineralogical relationships to ensure that the populations of data were sufficient to make informed decisions regarding compositing, capping, and variography.

For exploratory data analysis, SRK began with reviewing the sample distributions and mean grades for data within each local mineralization area. Based on the review of each local area, SRK elected to use each geologic domain (or subdomain) as a hard boundary to prevent estimation bias between adjacent smaller mineralized envelopes, which was evident from interim resource models produced by Minera Corona resource geologists in 2018. The individual domains were grouped based on a combination of factors including proximity, relative data populations, and mineralization style. The length weighted raw sample means (excluding absent values) for the respective domain, as well as the nomenclature and coding for the respective main domain groups are shown in Table 14-1.

In 2020, estimates for eight domains were not re-estimated as no additional drilling or sampling was available for the respective mineralized bodies; for details see Table 14-2. The 2020 physical depletions were applied where applicable and 2020 Net Smelter Return (NSR) cut-off values were applied for the 2020 Mineral Resource declaration. Celia was declared in 2019; however, in 2020, this area has been depleted entirely by mining.

Table 14-1: Raw Sample Mean Grades per Mineralized Zone

AREA	Model Prefix	Number of Samples	Ag (ppm)	Pb (%)	Cu (%)	Zn (%)	Au (ppm)	As (%)	Fe (%)	Length (m)*
Mina Central	ASO	951	88.54	1.09	1.22	1.49	0.58	0.28	24.42	1.20
Mina Central	MINAC	17,623	27.48	0.37	0.46	1.47	0.35	0.17	28.95	1.07
Mascota	MAPE	480	112.07	1.75	0.99	10.79	0.70	0.12	25.89	1.59
Mascota	MAPN	591	126.09	7.23	0.20	13.61	0.35	0.08	11.03	1.22
Mascota	MAPS	394	74.56	0.42	0.37	5.90	0.45	0.11	26.26	1.42
Mascota	MAS	143	3.62	0.06	2.60	8.51	0.02	0.16	19.73	0.69
Mascota	MOX	3,869	127.78	4.13	2.02	1.63	0.67	0.34	17.22	1.25
Esperanza	ESP	11,281	48.31	0.69	1.25	1.55	0.37	0.25	31.74	0.86
Esperanza	ESPBX	66	116.24	2.86	0.59	8.72	0.20	0.08	11.51	0.96
Esperanza	ESPD	458	46.24	4.15	0.19	8.70	0.17	0.12	16.04	1.00
Esperanza	ESPN	973	168.19	3.59	1.67	8.90	0.54	0.73	22.69	0.98
Cuye	CUYE	1,184	43.78	0.32	1.60	2.48	0.83	0.16	29.68	0.95
Cuerpos Pequeños	COC	362	100.93	2.87	0.12	7.43	0.29	0.08	17.97	1.44
Cuerpos Pequeños	COR	694	69.39	1.56	0.33	6.58	0.34	0.41	19.39	0.82
Cuerpos Pequeños	CSM	274	228.06	8.45	0.13	8.88	0.34	0.07	11.59	2.30
Cuerpos Pequeños	CSMI	371	169.37	10.17	0.08	12.72	0.09	0.05	7.71	1.58
Cuerpos Pequeños	CSMII	420	311.04	9.90	0.21	11.67	0.25	0.28	12.43	1.57
Cuerpos Pequeños	GAL	324	48.88	2.03	0.86	6.73	0.21	0.33	24.36	1.59
Cachi-Cachi	ANG	2,565	10.14	0.20	0.25	2.71	0.16	0.11	30.49	1.00
Cachi-Cachi	CAR	252	72.20	1.22	0.25	4.00	0.75	0.16	21.06	1.58
Cachi-Cachi	ELI	1,004	56.79	1.20	0.10	5.03	0.19	0.30	20.53	2.00
Cachi-Cachi	ESC	674	74.53	3.09	0.22	5.77	0.59	0.19	28.39	1.42
Cachi-Cachi	KAR	1,808	77.54	1.23	0.71	4.87	0.69	0.21	31.90	1.31
Cachi-Cachi	PVT	349	56.86	2.31	0.11	7.00	0.62	0.13	27.46	1.13
Cachi-Cachi	VAN	217	44.49	1.66	0.31	6.11	0.35	0.12	22.35	0.98
Cachi-Cachi	YOS	195	89.21	2.27	0.09	5.57	0.56	0.48	23.60	2.08

* Length weighting not applied
Source: SRK, 2020

Table 14-2: Summary of Main Resource Domain Groups in Geological Models

Area	Model Prefix	Domain Description	Estimation Date
Mina Central	MINAC	Mina Central	2020
	ASO	Antacaca Sur Oxidos	2019**
Esperanza	ESP	Esperanza	2020
	ESPBX	Esperanza Breccia 3	2020
	ESPD	Esperanza Distal	2020
	ESPN	Esperanza Norte	2020
Mascota	MAS	Mascota Sur Oxide Cu	2019**
	MAPN	Mascota Polymetallic North	2020
	MAPE	Mascota Polymetallic East	2020
	MAPS	Mascota Polymetallic South / South (East)	2020
	MOX	Mascota Oxide Pb-Ag / Cu	2019**
Cuye	CUYE	Cuye	2020
Cuerpos Pequeños	COR	Contacto Oriental	2020
	COC	Contacto Occidental	2020
	CSM	Contacto Sur Medio (TJ6060)	2019*
	CSMI	Contacto Sur Medio I (TJ8167)	2019*
	CSMII	Contacto Sur Medio II (TJ1590)	2020
	GAL	Gallito	2019*
Cachi-Cachi	ANG	Angelica	2020
	CAR	Carmencita	2020
	ELI	Elissa	2019*
	ESC	Escondida	2020
	KAR	Karlita	2020
	PVT	Privatizadora	2020
	VAN	Vanessa	2020
	YOS	Yoselim	2019*

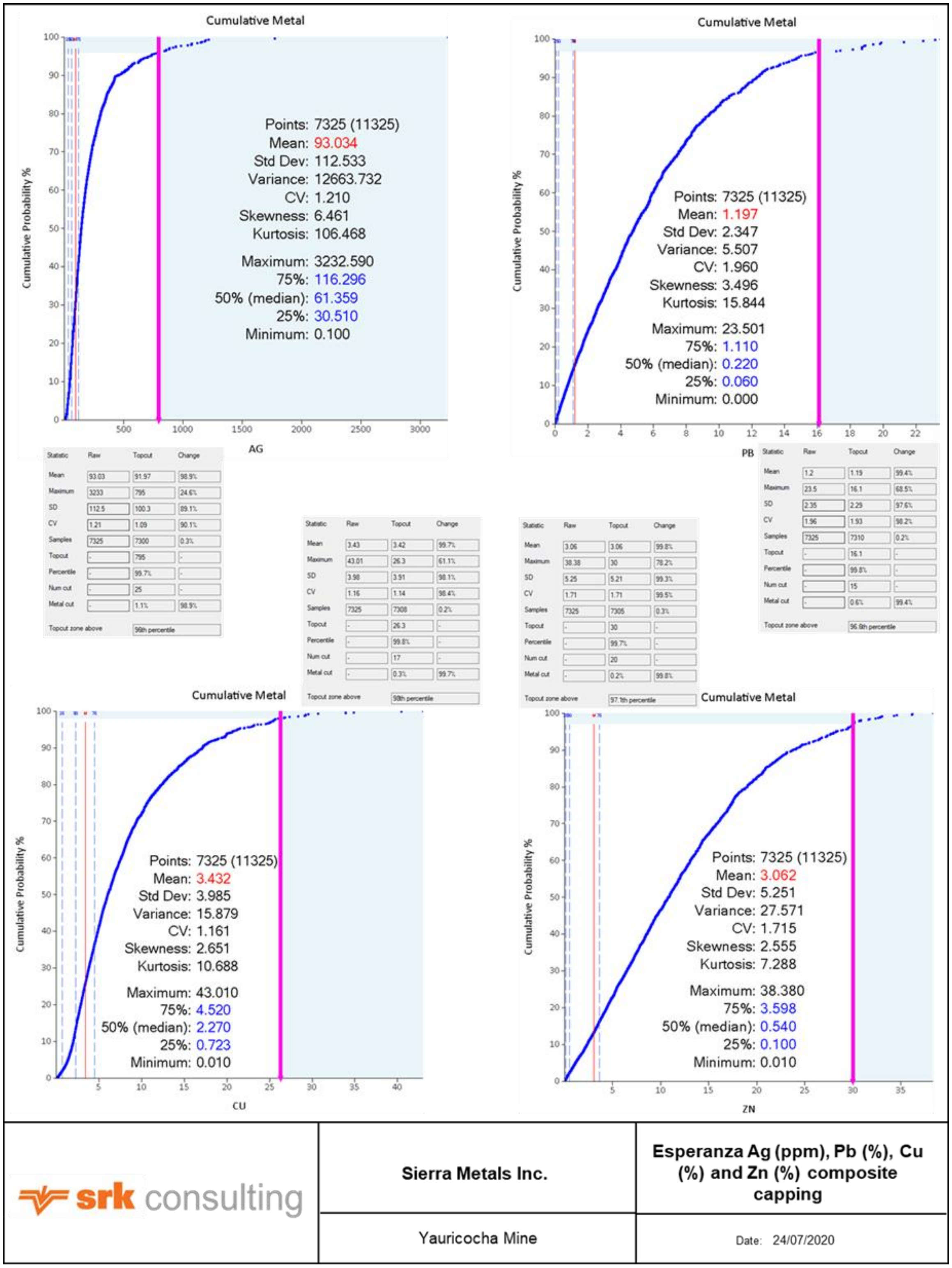
* Not re-estimated in 2020 only 2020 physical depletion applied and 2020 NSR cut-off's applied for Mineral Resources
** Not re-estimated in 2020 only 2020 NSR cut-off's applied for Mineral Resources
Source: Sierra Metals, 2020

14.3 Assay Capping and Compositing

SRK conducted compositing and then capping for the drillhole and channel sampling databases supporting all the estimation domains.

14.3.1 Outliers

SRK reviewed the outliers for the original sample data in each area or domain using a combination of histograms, log probability plots, and descriptive statistics. Outliers are evaluated from the original, un-composited data, flagged by the 3D geological model. An example of the log probability plot reviewed for Ag, Pb, Cu and Zn at Esperanza is shown in Figure 14-9. The capping value in this case lies between the 98-99th percentile range. This capping analysis reviewed the impact of the cap on several factors in the database, including total reduction in contained metal, percentage of samples capped, and reduction to the Coefficient of Variation (CV). All capping was completed after compositing. Capping limits assigned for each dominant volume per resource area estimated by SRK are shown in Table 14-3. Minor volumes may have different capping limits to prevent conditional bias in the resource estimate.



Source: SRK, 2020

Figure 14-9: Log Cumulative Probability Plots for Capping Analysis – Esperanza

Table 14-3: Capping Limits for Dominant Volumes in Mineral Resource Areas

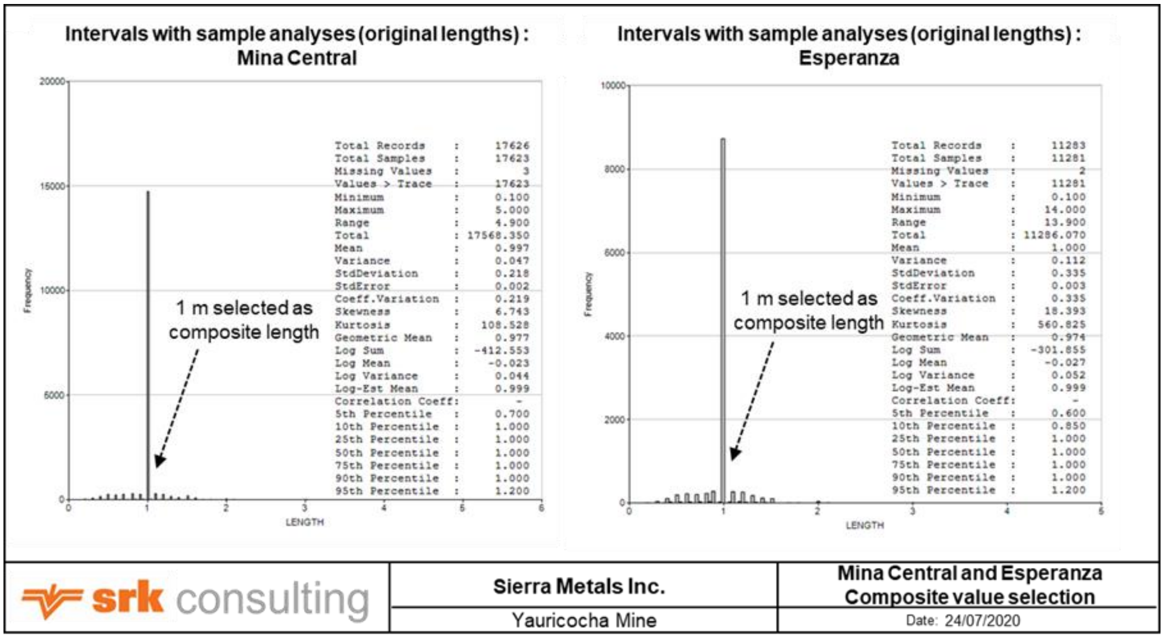
Area	Model Prefix	AgC (ppm)	PbC (%)	CuC (%)	ZnC (%)	AuC (ppm)	AsC (%)	FeC (%)
Mina Central	ASO	687	5.08	1.80	8.54	7.40	1.04	-
Mina Central	MINAC	850	18.20	14.30	37.50	15.90	2.40	58.00
Mascota	MAPE	344	13.20	6.90	29.00	3.70	0.40	-
Mascota	MAPN	623	31.50	1.60	39.00	3.95	0.18	25.00
Mascota	MAPS	142	0.88	0.80	12.30	0.80	0.19	32.50
Mascota	MAS	6	0.20	12.73	-	0.05	0.41	29.20
Mascota	MOX	1,991	59.70	5.04	14.50	22.90	2.48	-
Esperanza	ESP	795	16.10	26.30	30.00	11.00	5.50	47.50
Esperanza	ESPBX	241	7.00	1.96	16.50	0.42	0.25	21.04
Esperanza	ESPD	277	23.90	2.30	35.00	1.16	0.61	34.00
Esperanza	ESPN	455	14.50	10.50	25.20	6.60	3.00	-
Cuye	CUYE	199	2.20	6.30	22.70	3.40	1.20	-
Cuerpos Pequeños	COR	512	21.00	4.20	38.00	6.85	2.10	-
Cuerpos Pequeños	CSM	948	32.40	0.87	-	1.70	0.22	-
Cuerpos Pequeños	CSMI	607	-	0.35	42.95	0.68	-	22.30
Cuerpos Pequeños	CSMII	760	24.70	0.70	31.30	0.93	1.90	-
Cuerpos Pequeños	GAL	410	17.23	10.63	-	1.57	1.91	41.56
Cachi-Cachi	ANG	290	7.80	3.50	23.00	2.00	0.60	-
Cachi-Cachi	CAR	255	5.30	1.25	12.85	3.60	0.40	-
Cachi-Cachi	ELI	790	13.03	3.36	-	2.72	1.59	-
Cachi-Cachi	KAR	595	16.80	5.80	31.90	5.70	1.50	-
Cachi-Cachi	PVT	335	10.75	0.73	22.90	2.05	0.40	-
Cachi-Cachi	VAN	216	15.10	0.36	31.50	2.13	0.35	-
Cachi-Cachi	YOS	438	11.62	0.67	23.85	3.03	2.37	-
Mina Central	ASO	687	5.08	1.80	8.54	7.40	1.04	-
Mina Central	MINAC	850	18.20	14.30	37.50	15.90	2.40	58.00

Source: SRK, 2020

14.3.2 Compositing

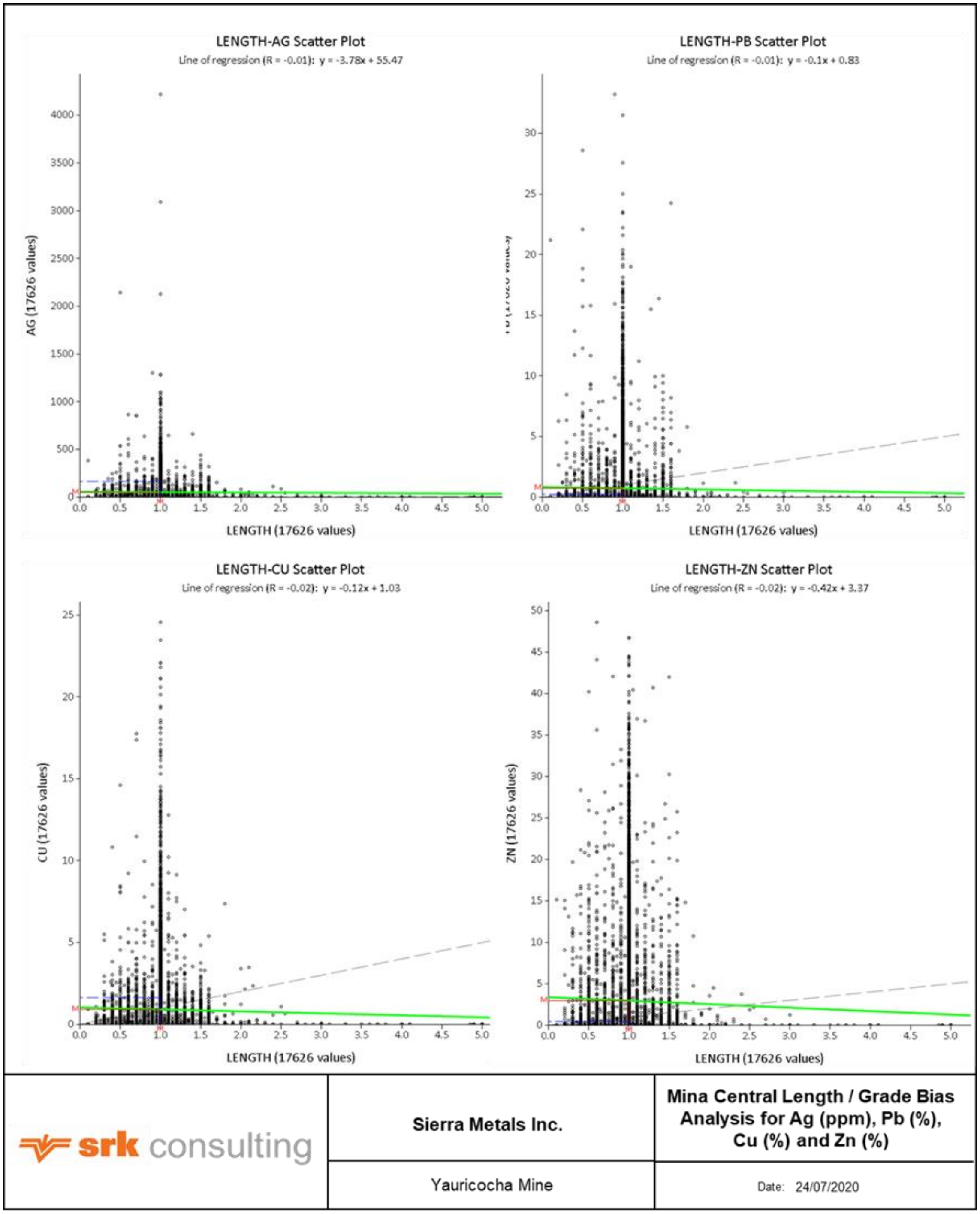
SRK composited the raw sample data within the geologic wireframes using standard run lengths. These composite lengths vary between various areas, but the analysis is the same to ensure that the composites are representative of the Selective Mining Unit (SMU) and minimize variance at the scale of the estimation. The compositing analysis generally features a review of the variable sample lengths in a histogram as well as review of the sample lengths vs. grade scatter plots (Figure 14-10 and Figure 14-11) to ensure that there are not material populations of high grade samples above the nominal composite length. Composite lengths for each area are summarized in Table 14-4.

All intervals without values were populated with trace values as only mineralized material is sampled by the mine geological staff. However, one exception to this was the arsenic and iron values, which were left blank. Arsenic is regarded as a deleterious element and iron is an integral part of the density relationship and is generally higher in mineralized zones. Initially, a mean value was considered rather than allowing the estimate to establish a value. However, estimation artifacts resulted, hence the missing value route was taken for these arsenic and iron values. Minor composite lengths were restricted in the compositing process by selecting MODE=1 in Datamine's COMPDH process.



Source: SRK, 2020

Figure 14-10: Raw Sample Length Histogram for Mina Central and Esperanza



Source: SRK, 2020

Figure 14-11: Sample Length vs. Ag, Pb, Cu and Zn Grade Plot for Mina Central

Table 14-4: Composite Statistics

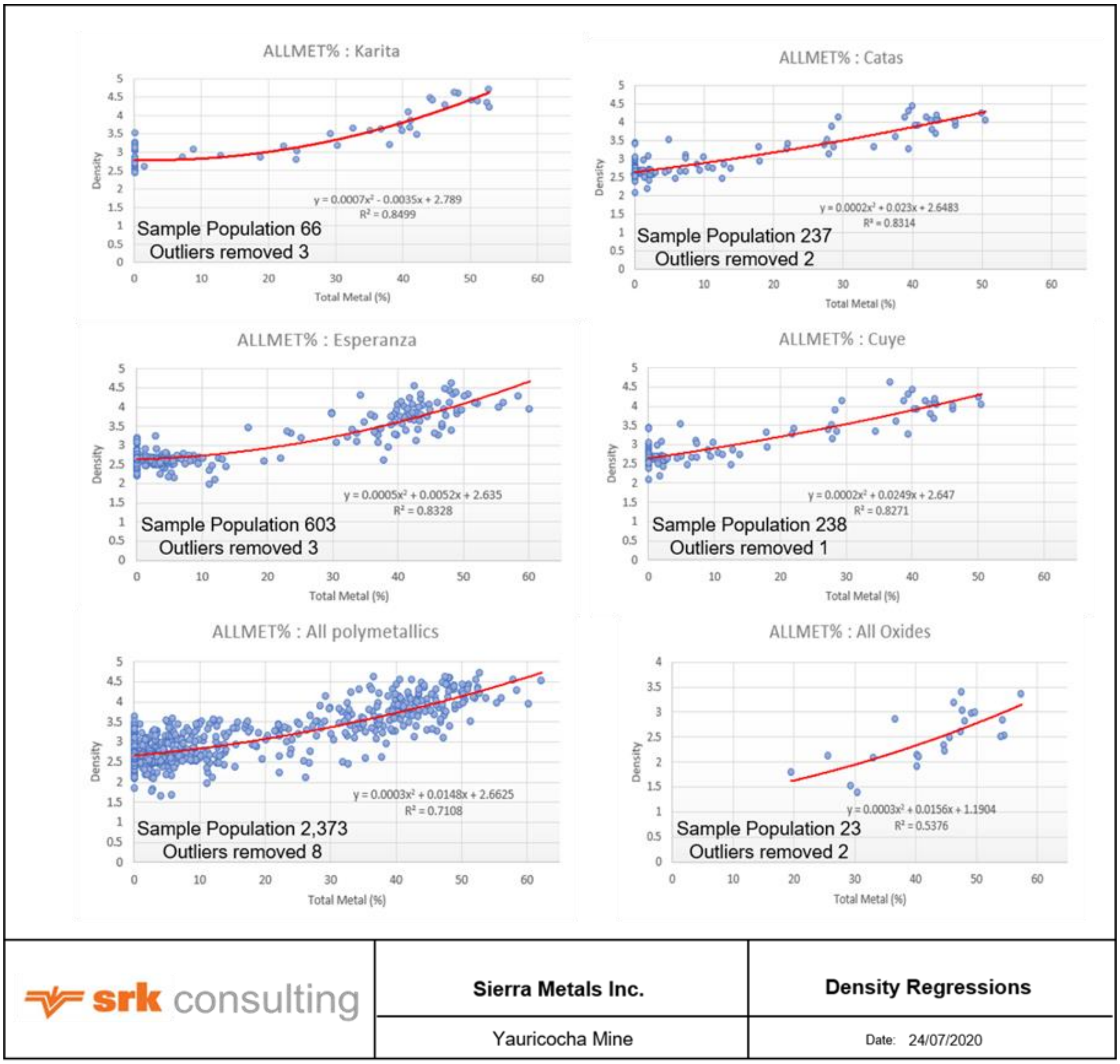
Area	Model Prefix	Composite Length (m)	Minimum (m)	Mean (m)	Maximum (m)
Mina Central	ASO	1	0.50	0.99	1.20
Mina Central	MINAC	1	0.40	1.00	1.40
Mascota	MAPE	1	0.75	0.98	1.50
Mascota	MAPN	2	0.20	1.72	3.00
Mascota	MAPS	1	0.65	0.98	1.50
Mascota	MAS	1	0.80	0.99	1.30
Mascota	MOX	1	0.50	1.00	1.40
Esperanza	ESP	1	0.40	1.00	1.45
Esperanza	ESPBX	1	0.45	0.99	1.30
Esperanza	ESPD	1	0.83	1.00	1.25
Esperanza	ESPN	1	0.30	1.00	1.30
Cuye	CUYE	1	0.85	1.00	1.40
Cuerpos Pequeños	COC	1	0.20	0.94	1.50
Cuerpos Pequeños	COR	2	0.80	1.95	2.90
Cuerpos Pequeños	CSM	2	0.50	1.89	2.90
Cuerpos Pequeños	CSMI	2	0.40	1.88	3.00
Cuerpos Pequeños	CSMII	2	0.20	1.76	3.00
Cuerpos Pequeños	GAL	2	0.30	1.83	2.90
Cachi-Cachi	ANG	1	0.40	1.00	1.40
Cachi-Cachi	CAR	1	0.75	0.98	1.40
Cachi-Cachi	ELI	2	0.36	1.91	3.00
Cachi-Cachi	ESC	1	0.75	0.98	1.40
Cachi-Cachi	KAR	1	0.14	0.99	1.45
Cachi-Cachi	PVT	1	0.50	0.98	1.35
Cachi-Cachi	VAN	2	0.45	1.83	3.00
Cachi-Cachi	YOS	2	0.30	1.97	2.95

Source: SRK, 2020

14.4 Density

Density determinations are based on bulk density measurements taken from representative core samples or grab samples in each area. The volume displacement method is utilized to establish the density of a sample. Historically, mine personnel assigned a single bulk density to each mineralized area. However, this is an invalid assumption for Mineral Resources in polymetallic mineralization styles, as the density varies substantially from lower to higher grade metal content areas. The effect of applying a single density per mineralization zone based on current mining results, is to bias the overall tonnage to that respective metal content. Whereas, the grades vary significantly throughout the mineralized zones, as substantiated by measurements taken on the mine site, as requested by SRK.

SRK produced regression analyses of density versus total accumulated content, i.e., silver, lead, copper, zinc, gold, arsenic and iron for specific mineralization styles and areas (Figure 14-12). A generalized polymetallic regression was utilized for polymetallic mineralization that did not have a statistical representative density population of samples. Unfortunately, the relationship was not representative with respect to the oxide mineralization. All regressions were limited to a maximum content of 55% as the predicted value deviates substantially after this point. Global values as supplied by Minera Corona personnel were applied to MAS (3.555), MOX (3.162) and ASO (3.162) respectively.



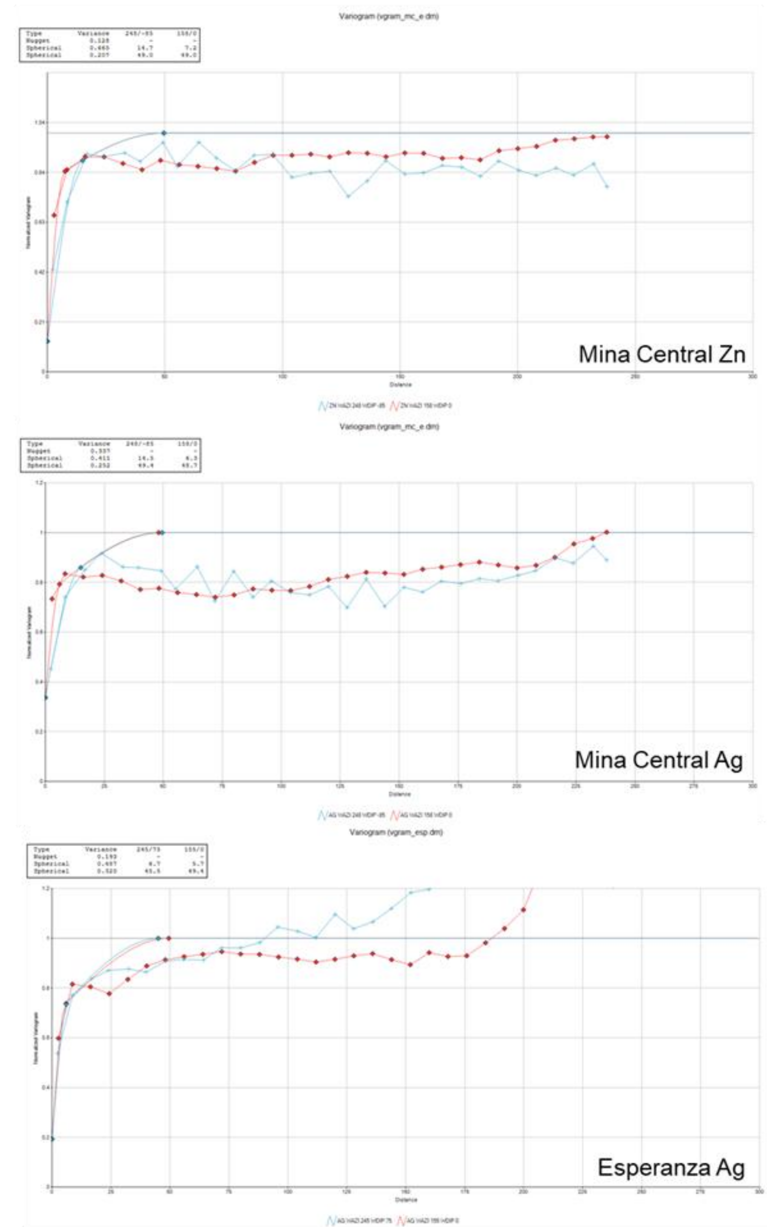
Source: SRK, 2020

Figure 14-12: Total Metal Content vs. Density Regressions

14.5 Variogram Analysis and Modeling

SRK conducted detailed variogram analysis to assess orientations and ranges of continuity within the mineralized zones. Directional variograms were calculated for the primary mineralization areas of Mina Central and Mascota, as the quantities of data and orientations of the mineralized zones are well-understood. Directional variograms defining an ellipsoid resulted in 3D continuity models for each element. In all cases, appropriate nugget effects were determined from downhole variograms, then utilized in the directional variograms. A linear model of coregionalization was maintained for each continuity model, and the three variograms were plotted on a single graph to define the shape of the ellipsoid. The ellipsoids were reviewed against the data distribution to ensure reasonableness and consistency. The continuity parameters derived from the directional variography in each area and for each metal are used in the Ordinary Kriging estimation process.

A total of 182 variograms were modeled between Minera Corona staff. SRK verified orientations and checked variograms. In SRK's opinion the variogram models were reasonable fits to the experimental variograms. However, SRK noted in some instances that more anisotropic definition could be achieved by gaussian or log transforming the composites for variogram modelling purposes and then back transforming the variogram models for estimation purposes. Figure 14-13 shows examples of Minera Corona modelled variograms for Mina Central and Esperanza. Table 14-5 details a subset of modelled variogram models as examples from Esperanza, Cuye and Mina Central mineralized domains, representing the dominant proportion of the Mineral Resources. All variograms were normalized for estimation purposes.



srk consulting	**Sierra Metals Inc.**	**Mina Central and Esperanza variogram modelling examples**
	Yauricocha Mine	Date: 24/07/2020

Source: SRK, 2020

Figure 14-13: Examples of Modelled Variograms for Mina Central and Esperanza

Table 14-5: Datamine Normalized Modelled Semi-Variogram Models

Model Prefix	VDESC	VREFNUM	VANGLE1	VANGLE2	VANGLE3	VAXIS1	VAXIS2	VAXIS3	NUGGET	ST1	ST1PAR1	ST1PAR2	ST1PAR3	ST1PAR4	ST2	ST2PAR1	ST2PAR2	ST2PAR3	ST2PAR4
CUYE	AG NORM	1	132	-90	0	3	2	1	0.044	1	9.3	9.3	3	0.486	1	36.4	26.9	6	0.469
CUYE	PB NORM	2	132	-90	0	3	2	1	0.138	1	7.7	7.5	3	0.487	1	36.5	25.6	5.5	0.375
CUYE	CU NORM	3	132	-90	0	3	2	1	0.117	1	7.5	7	3	0.577	1	37.3	26.4	5.6	0.306
CUYE	ZN NORM	4	132	-90	0	3	2	1	0.083	1	5.4	5	3	0.444	1	36.5	25.7	5.6	0.473
CUYE	AU NORM	5	132	-90	0	3	2	1	0.064	1	3	3	3.2	0.601	1	36.6	24.4	5.4	0.335
CUYE	AS NORM	6	132	-90	0	3	2	1	0.143	1	6.8	7.3	3	0.524	1	36.2	23.3	5.5	0.333
CUYE	FE NORM	7	132	-90	0	3	2	1	0.12	1	5.2	5.9	3	0.275	1	39.4	27.2	5.6	0.604
ESP	AG NORM	1	155	-75	0	3	2	1	0.193	1	6.7	5.7	3.7	0.487	1	45.5	49.4	9.3	0.32
ESP	PB NORM	2	155	-75	0	3	2	1	0.183	1	11.7	16.2	3	0.378	1	44.9	48.6	9.1	0.439
ESP	CU NORM	3	155	-75	0	3	2	1	0.153	1	10	6.7	4.3	0.548	1	48.2	47.2	9	0.299
ESP	ZN NORM	4	155	-75	0	3	2	1	0.123	1	11.2	13.6	3	0.354	1	48	46.2	9.2	0.523
ESP	AU NORM	5	155	-75	0	3	2	1	0.103	1	7.3	10.4	4.7	0.675	1	47.7	50.3	9	0.222
ESP	AS NORM	6	155	-75	0	3	2	1	0.101	1	5.5	6.3	3.1	0.635	1	48.3	48.9	9.8	0.264
ESP	FE NORM	7	155	-75	0	3	2	1	0.109	1	9.4	10.6	4.1	0.58	1	48.4	47.4	9.2	0.311
ESP	AG NORM	1	155	-75	0	3	2	1	0.149	1	4.7	4.5	3.6	0.486	1	49.5	50.4	8.1	0.365
ESP	PB NORM	2	155	-75	0	3	2	1	0.162	1	10.7	10.2	3	0.601	1	48.5	48.3	8.6	0.237
ESP	CU NORM	3	155	-75	0	3	2	1	0.085	1	6.7	6.3	4.6	0.677	1	45.6	44.9	9.9	0.238
ESP	ZN NORM	4	155	-75	0	3	2	1	0.202	1	7.6	6.7	5	0.404	1	46.2	47	9.4	0.395
ESP	AU NORM	5	155	-75	0	3	2	1	0.089	1	6.5	9.7	4.8	0.684	1	47.1	45	10.3	0.227
ESP	AS NORM	6	155	-75	0	3	2	1	0.145	1	8.9	10.8	3.5	0.702	1	49.8	44.7	9.5	0.153
ESP	FE NORM	7	155	-75	0	3	2	1	0.126	1	9.5	10	4.9	0.562	1	48.4	45.6	10.4	0.311
MINAC	AGC NORM	1	158	85	0	3	2	1	0.337	1	14.5	6.3	4	0.411	1	49.4	48.7	9	0.252
MINAC	PBC NORM	2	158	85	0	3	2	1	0.168	1	12.6	13.1	3	0.613	1	50	51	10.4	0.219
MINAC	CUC NORM	3	158	85	0	3	2	1	0.119	1	6.7	8.2	3	0.587	1	48.9	49	11	0.294
MINAC	ZNC NORM	4	158	85	0	3	2	1	0.128	1	14.7	7.2	4	0.665	1	49	49	11	0.207
MINAC	AUC NORM	5	158	85	0	3	2	1	0.185	1	11.8	5.1	3	0.619	1	50.7	49.3	10.6	0.196
MINAC	ASC NORM	6	158	85	0	3	2	1	0.15	1	5.3	11.1	3	0.55	1	50.5	49.5	10	0.3
MINAC	FEC NORM	7	158	85	0	3	2	1	0.204	1	8.8	9.6	4.1	0.613	1	49.2	49.6	11	0.183

Source: SRK, 2020

14.6 Block Model

Block models were generated by SRK in Datamine Studio RM™. Sub-blocking was utilized to approximate geologic contacts. Rotated block models were generated to assist in the mine planning process where mineralization solids crossed the orthogonal grid obliquely, facilitating less dilution in the stope optimization studies.

Blocks were flagged by mineralization area and domain. Details of the parameters used for the block models are summarized in Table 14-6.

Table 14-6: Block Model Parameters

Model Prefix	Parent			Range			Origin (minimum value block corner)			Rotation (Datamine)	
	X (m)	Y (m)	Z (m)	X (m)	Y (m)	Z (m)	X Local (m)	Y Local (m)	Z Local (m)	Angle (°)	Axis
ANG	4	4	4	88	164	180	24,056	16,546	4,026	39	Z
ASO	4	4	4	72	204	292	24,227	14,640	3,827	-30	Z
COC	2	2	2	106	66	378	23,786	15,137	3,683	-	Z
CSM	2	2	2	84	74	496	23,750	14,927	3,819	34	Z
CSMI	2	2	2	56	48	172	23,789	14,967	3,773	-21	Z
CSMII	2	2	2	76	92	312	23,766	14,822	3,642	-45	Z
CUYE	4	4	4	288	252	416	23,660	15,288	3,366	-	Z
ELI	2	2	2	40	136	302	23,838	16,504	3,850	50	Z
ESC	2	2	2	82	82	222	23,756	16,380	3,849	-	Z
ESP	4	4	4	192	460	532	23,740	15,434	3,602	-25	Z
ESPBX	2	2	2	64	48	268	23,656	15,666	3,884	0	Z
ESPD	4	4	4	56	88	148	23,656	15,644	3,824	-28	Z
ESPN	4	4	4	152	96	340	23,644	15,758	3,770	-30	Z
GAL	2	2	2	34	72	260	23,617	15,650	3,752	-	Z
KAR	2	2	2	86	124	198	24,002	16,589	3,964	34	Z
MAPE	2	2	2	76	96	356	23,755	15,319	3,524	-40	Z
MAPN	2	2	2	56	96	316	23,690	15,370	3,596	-30	Z
MAPS	2	2	2	92	96	228	23,838	15,286	3,618	-70	Z
MAS	2	2	2	40	52	78	23,721	15,297	3,697	28	Z
MINAC	4	4	4	200	760	848	24,180	14,620	3,308	-30	Z
MOX	4	4	4	92	152	520	23,750	15,298	3,645	-50	Z
PVT	2	2	2	80	166	314	23,664	16,334	3,690	55	Z
VAN	2	2	2	62	92	192	23,943	16,603	3,955	70	Z
YOS	2	2	2	46	106	174	23,683	16,349	3,841	45	Z
ANG	4	4	4	88	164	180	24,056	16,546	4,026	39	Z
ASO	4	4	4	72	204	292	24,227	14,640	3,827	-30	Z

Source: SRK, 2020

14.7 Estimation Methodology

SRK utilized either Ordinary Kriging (OK) or Inverse Distance to the Power 2 weighting to interpolate grade in all resource areas. The decision on the estimation type to use was based on the confidence of the geologist in the ability of the variography to reflect the continuity of grade within the mineralized body, as well as the need for some measure of declustering based on data spacing. In some cases where mineralized bodies could not be related to those with reasonable variograms, an Inverse Distance method was utilized.

The estimation type and sample selection criteria were chosen to target a reasonably reliable local estimation of grade that does not bias the global resource estimation. SRK generally utilized the geological models as hard boundaries in the estimation and estimated blocks within these boundaries using the capped composites in the same boundaries. Ranges for interpolation were derived from omni-directional variogram analysis or continuity assumptions from site geologists based on underground mining observations. All estimations utilized both channel and drillhole samples. SRK utilized three nested estimation passes for each domain. Local Varying Anisotropy (LVA) was utilized for several estimates as a static search orientation did not produce representative estimates.

The search parameters were optimized in the larger mineralized areas by completing a Qualitative Kriging Neighborhood Analysis (QKNA). The search parameters were focused on the major NSR contributing element for any mineralized zone. Samples where limited per channel/drillhole source (MAXKEY). Additional estimates were completed for cross validation purposes. These included, Nearest Neighbor (NN), Arithmetic Mean (AV) and Inverse Distance to the Power 2. The kriging efficiency and the geostatistical RSlope values were calculated per OK estimate. The complete estimation parameters are summarized in Table 14-7.

Table 14-7: Estimation Parameters

Model Prefix	Classifier	SDESC	SREFNUM	METHOD	X	Y	Z	ANGLE1	ANGLE2	ANGLE3	AXIS1	AXIS2	AXIS3	PASS 1		PASS 2			PASS 3			MAXKEY
					SDIST1	SDIST2	SDIST3							MIN	MAX	FACTOR	MIN	MAX	FACTOR	MIN	MAX	
ANG	ZNOK	ZN	4	LVA	20	20	6	219	-85	0	3	2	1	5	15	2	3	15	3	3	10	2
ASO	AGOK	AG	1	STATIC	20	20	8	-30	-80	0	3	2	1	5	15	2	3	15	3	3	10	2
CAR	ZNID	ZN	4	LVA	12.5	12.5	5	104	-90	0	3	2	1	5	15	2	3	15	3	3	10	2
COC	ZNOK	ZN	4	LVA	25	25	6	70	-90	0	3	2	1	5	15	2	3	15	3	3	10	2
COR	ZNOK	ZN	4	STATIC	15	15	8	167	76	0	3	2	1	5	15	2	3	15	3	3	10	2
CSM	ZNOK	ZN	4	STATIC	15	15	5	50	-80	0	3	2	1	5	15	2	3	15	3	3	10	2
CSMI	ZNOK	ZN	4	STATIC	15	15	5	-35	-75	0	3	2	1	5	15	2	3	15	3	3	10	2
CSMII	ZNOK	ZN	4	STATIC	20	20	6	115	76	0	3	2	1	5	15	2	3	15	3	3	10	2
CUYE	CUOK	CU	3	LVA	25	25	5	132	-90	0	3	2	1	5	15	2	3	15	4	3	10	2
ELI	ZNOK	ZN	4	LVA	20	20	6	0	-90	126	3	2	1	5	15	2	3	15	3	3	10	2
ESC	ZNOK	ZN	4	LVA	15	15	5	210	-90	0	3	2	1	5	15	2	3	15	3	3	10	2
ESP	CUOK	CU	3	STATIC	25	25	10	155	-75	0	3	2	1	5	15	2	3	15	4	3	10	2
ESPD	ZNOK	ZN	4	STATIC	12.5	12.5	5	152	74	0	3	2	1	5	10	2	3	10	4	3	10	2
ESPBX	ZNID	ZN	4	LVA	12.5	12.5	7.5	-60	90	0	3	2	1	3	10	2	3	10	5	2	5	0
ESPN	ZNOK	ZN	4	STATIC	12.5	12.5	5	130	-74	0	3	2	1	5	10	2	3	10	4	3	10	2
GAL	ZNOK	ZN	4	STATIC	15	15	5	0	-90	200	3	2	1	5	15	2	3	15	3	3	10	2
KAR	ZNOK	ZN	4	STATIC	15	15	6	224	-90	0	3	2	1	5	15	2	3	15	3	3	10	2
MAPE	ZNOK	ZN	4	STATIC	15	15	5	137	-90	0	3	2	1	5	15	2	3	15	3	3	10	2
MAPN	ZNOK	ZN	4	STATIC	20	20	5	140	-83	0	3	2	1	5	15	2	3	15	3	3	10	2
MAPS	ZNOK	ZN	4	STATIC	12.5	12.5	6	110	80	0	3	2	1	5	15	2	3	15	3	3	10	2
MAS	CUID	CU	3	STATIC	20	20	8	28	-90	0	3	2	1	5	10	2	3	10	3	3	10	2
MINAC	ZNOK	ZN	4	LVA	25	25	10	158	85	0	3	2	1	5	15	2	3	15	4	3	10	2
MOX	PBOK	PB	2	STATIC	20	20	6	0	-90	210	3	2	1	5	15	2	3	15	3	3	10	2
PVT	ZNOK	ZN	4	LVA	20	20	10	230	-85	0	3	2	1	5	15	2	3	15	3	3	10	2
VAN	ZNOK	ZN	4	STATIC	15	15	5	250	80	0	3	2	1	5	15	2	3	15	3	3	10	2
YOS	ZNOK	ZN	4	STATIC	20	20	6	0	-90	-40	3	2	1	5	15	2	3	15	3	3	10	2
ANG	ZNOK	ZN	4	LVA	20	20	6	219	-85	0	3	2	1	5	15	2	3	15	3	3	10	2
ASO	AGOK	AG	1	STATIC	20	20	8	-30	-80	0	3	2	1	5	15	2	3	15	3	3	10	2
CAR	ZNID	ZN	4	LVA	12.5	12.5	5	104	-90	0	3	2	1	5	15	2	3	15	3	3	10	2

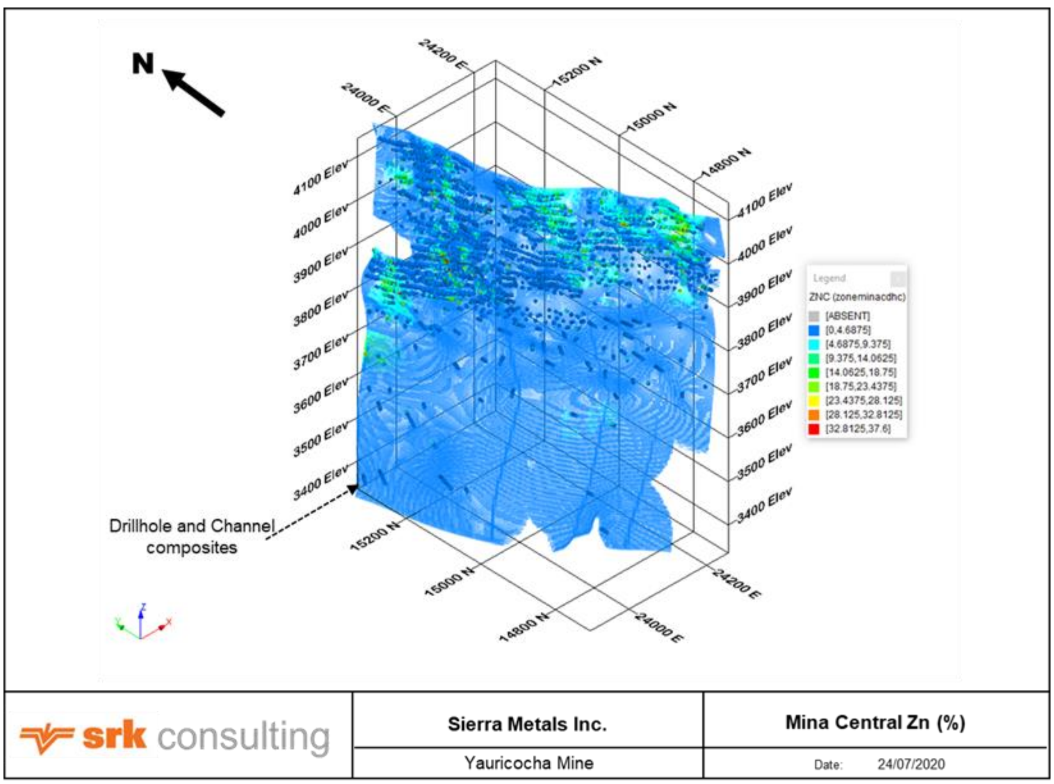
Source: SRK, 2020

14.8 Model Variation

All models have been validated utilizing visual and statistical measures to assess the probability of conditional bias in the estimation. Swath plots were also generated to validate the estimation. SRK is of the opinion that the validation of the models is sufficient for relying upon them as Mineral Resources. However, SRK notes that the ultimate validation of the models is in the fact that the mine continuously produces material from the areas modeled and projected by the Mineral Resource estimations. SRK notes that reconciliation of the production to the resource models is not a consistent part of the current validation methods but is under consideration by Sierra Metals for future models.

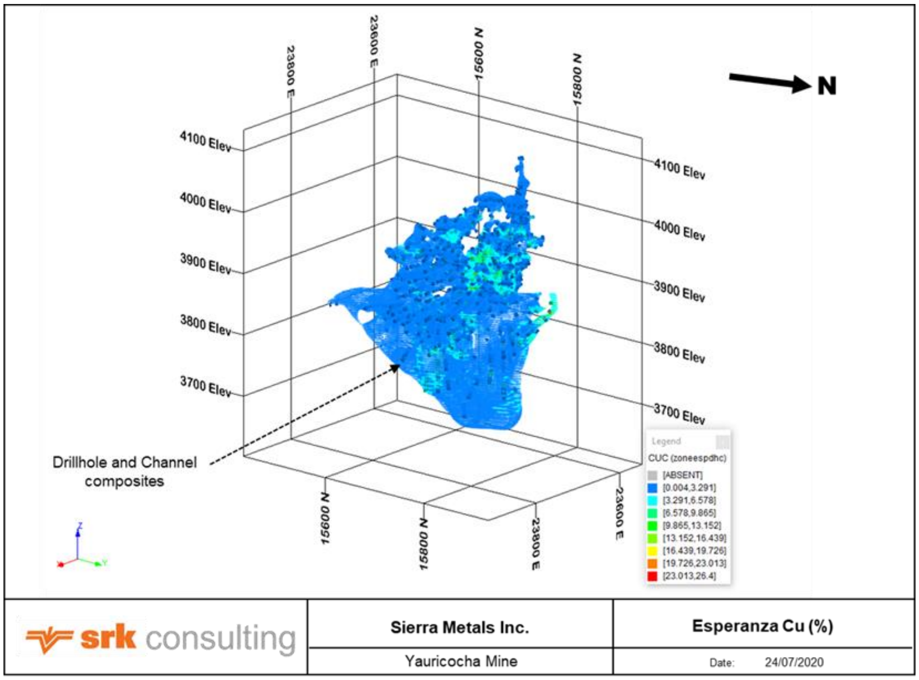
14.8.1 Visual Comparison

Both SRK and Minera Corona have conducted visual comparisons of the composite grades to the block grades in each model. In general, block grade distributions match well in level and cross-section views through the various mineralized zones. Some of these examples are shown below in Figure 14-14 through Figure 14-16.



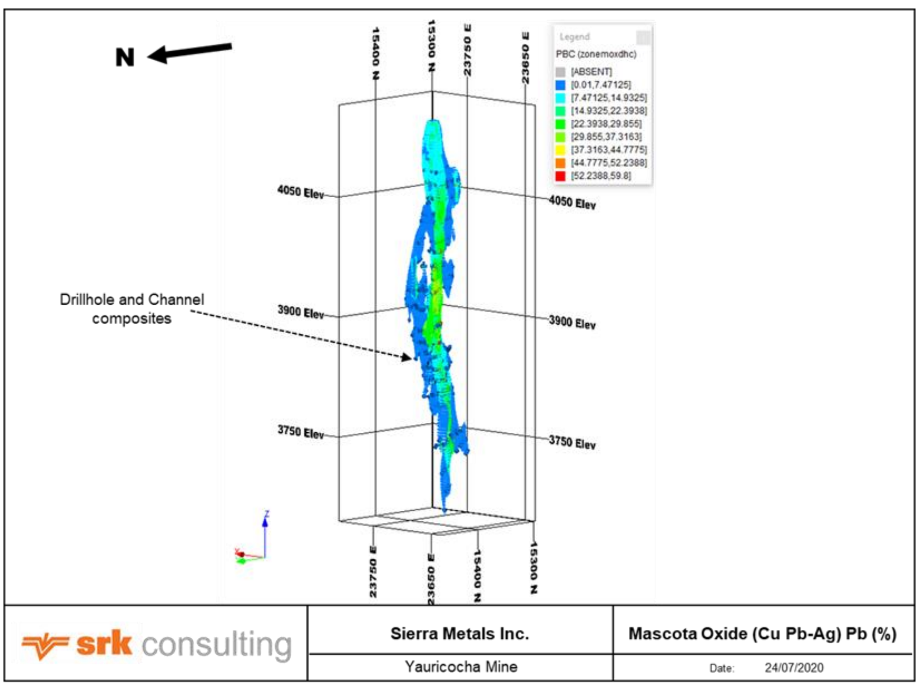
Source: SRK, 2020

Figure 14-14: Visual Block to Composite Comparison – Mina Central



Source: SRK, 2020

Figure 14-15: Visual Block to Composite Comparison – Esperanza



Source: SRK, 2020

Figure 14-16: Visual Block to Composite Comparison – Mascota

14.8.2 Comparative Statistics

SRK compared the estimated block grades to the composite grades utilized in the estimation, for the same zones and volumes to ensure that both are representative. SRK generally weighted the statistics by composite length or polygonal declustering with mineralized envelope constraints to weight for the composites, and by volume for the blocks. The results show that, in almost all cases, the blocks feature a lower or similar mean to the composite grades. An example of the estimate versus the composite statistics completed for Mina Central Zn (%) and Esperanza Cu (%) are shown in Figure 14-17. These analyses were completed for all estimated values in all mineralized zones, to establish whether there was any over / under estimation.

Where blocks locally exceed the composite grades, SRK notes that these appear to be limited occurrences, and generally the potentially over-estimated areas are in areas which have been mined previously or where very few samples occur within a respective mineralized envelope. An estimate should have a similar mean to the original composites. However, the estimates produce a smoothed result and the distribution of the estimated blocks relative to the original composites will produce a narrower range histogram. This is evident from the box and whisker plots in Figure 14-17. SRK is of the opinion that these results show that there is reasonable agreement between the models and the supporting data, with low risk for global over-estimation.

ZONE	1		
ZNOK vs ZNC	Unweighted Samples	Weighted Samples	Model Cells
No. of Records	17,526	17,526	1,866,913
No. of Samples	17,526	17,526	1,764,108
Minimum	0	0	0
Q1	0.13	0.13	0.51
Median	0.78	0.78	1.69
Q3	3.42	3.42	4.07
Maximum	37.5	37.5	26.33
Mean	2.93	1.64	1.55
Mean Diff v Model	1.38	0.08	-
%Mean Diff v Model	47.03	5.12	-
Std. Dev	4.97	3.7	2.42
Variance	24.67	13.71	5.86
%Coeff. Variation	169.46	226.29	155.95
MAD	2.72	2.72	2.16
Model Tonnes	-	-	21,029,886

ZONE	1 (Main Zone)			2			3 (Pyrite Dilution)		
CUOK vs CUC	Unweighted	Weighted Samples	Model Cells	Unweighted	Weighted Samples	Model Cells	Unweighted	Weighted Samples	Model Cells
No. of Records	7,325	7,325	683,302	93	93	10,532	3,907	3,907	312,288
No. of Samples	7,325	7,325	683,302	93	93	10,532	3,907	3,907	312,288
Minimum	0.01	0.01	0.04	0.01	0.01	0.22	0	0	0.01
Q1	0.72	0.72	1.48	0.19	0.19	0.65	0.18	-	0.39
Median	2.27	2.27	2.7	0.66	0.66	1.05	0.41	-	0.57
Q3	4.52	4.52	4.21	1.97	1.97	2.16	0.8	-	0.78
Maximum	26.3	26.3	15.79	19.89	19.89	12.84	5.3	5.3	3.27
Mean	3.42	2.65	2.71	2.18	2.24	2.26	0.59	0.59	0.55
Mean Diff v Model	0.72	-0.05	-	-0.08	-0.01	-	0.05	0.05	-
%Mean Diff v Model	20.91	-1.94	-	-3.7	-0.66	-	7.97	7.97	-
Std. Dev	3.91	3.39	1.78	3.63	3.6	2.58	0.63	0.63	0.28
Variance	15.29	11.51	3.15	13.19	12.96	6.67	0.4	0.4	0.08
%Coeff. Variation	114.29	127.84	65.65	166.69	160.41	114.32	106.89	106.89	50.86
MAD	2.52	2.52	1.71	1.92	1.92	1.13	0.41	0.41	0.24
Model Tonnes	-	-	4,328,019	-	-	19,840	-	-	1,527,664

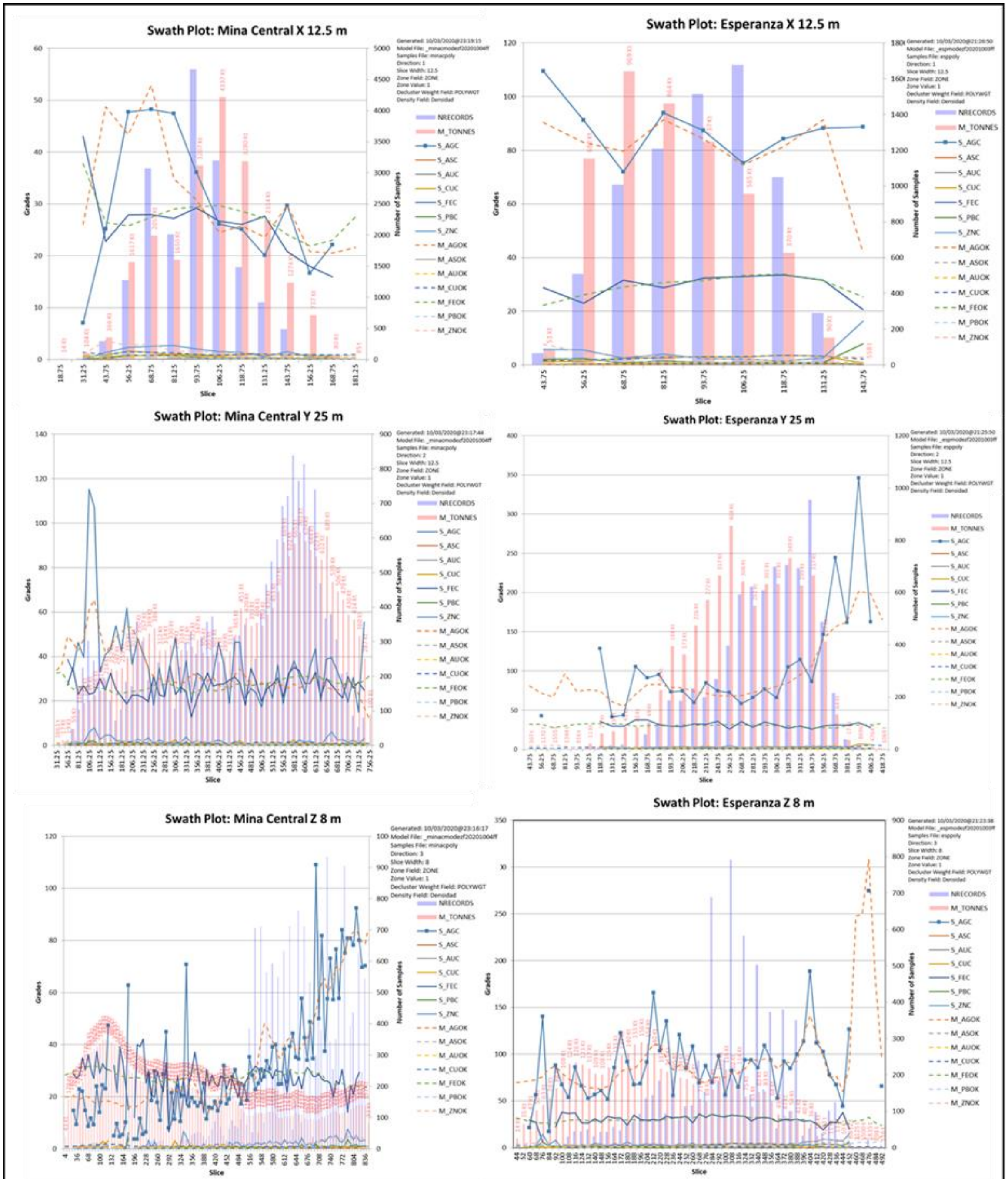
Source: SRK, 2020

Figure 14-17: Mina Central and Esperanza Ordinary Kriging Result Comparison to Declustered Capped Composite Values

14.8.3 Swath Plots

SRK has compiled swath plots to validate the estimation. A swath plot is a graphical display of the grade distribution derived from a series of meter thickness bands (12.5, 25 and 8 m width in this case), or swaths, generated in the X, Y, and Z orientations through the deposit. Grade variations from the block model are compared using the swath plot to the distribution derived from the composites or other estimation methods. An example of swath plots from Mina Central and Esperanza for all estimated grades is shown in Figure 14-18, illustrating the comparison between the OK estimation used for reporting to the original polygonal declustered composite grades. SRK notes that in general the estimated grades represent a smoothed approximation of the composite grades.

SRK did not produce these plots for every mineralized body, as narrow and tabular orientations do not necessarily allow for the swath plots as a reasonable comparison. For those mineralized zones with broader and less tabular morphology, this comparison is more reasonable.



srk consulting	Sierra Metals Inc.	Mina Central and Esperanza Swath Analysis
	Yauricocha Mine	Date: 24/07/2020

Source: SRK, 2020

Figure 14-18: Mina Central and Esperanza Swath Plots

14.9 Resource Classification

In SRK's opinion, the geological modelling honors the current geological information and knowledge. The location of the samples and the assay data are sufficiently reliable to support resource evaluation. The sampling information was acquired primarily by core drilling and limited channel sampling.

The estimated blocks were classified according to:

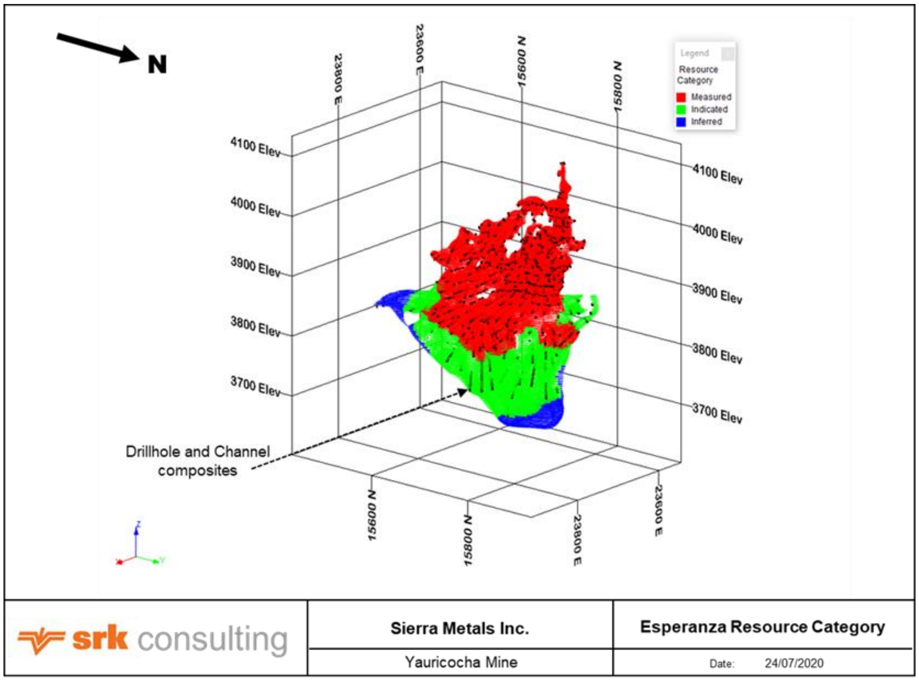
- Confidence in interpretation of the mineralized zones;
- Number of data (holes or channel samples) used to estimate a block; and
- Average distance to the composites used to estimate a block.

In order to classify mineralization as a Measured Mineral Resource the following statement must be considered: "quantity, grade or quality, densities, shape and physical characteristics are estimated with sufficient confidence to allow the application of Modifying Factors in sufficient detail to support detailed mine planning and evaluation of the economic viability of the deposit" (CIM Definition Standards on Mineral Resources and Mineral Reserves, May 2014). For the classification of Indicated Mineral Resources the CIM standard requires the following: "quantity, grade or quality, densities, shape and physical characteristics are estimated with sufficient confidence to allow the application of Modifying Factors in sufficient detail to support mine planning and evaluation of the economic viability of the deposit". SRK utilized the following general criteria for classification of the Mineral Resource at Yauricocha:

- Measured: Blocks estimated with a distance of 10 to 25 m and informed by at least three drillholes;
- Indicated: Blocks estimated with a distance of 20 to 50 m and informed by at least two drillholes; and
- Inferred: Blocks estimated with a distance of 30 to 100 m and informed by at least two drillholes.

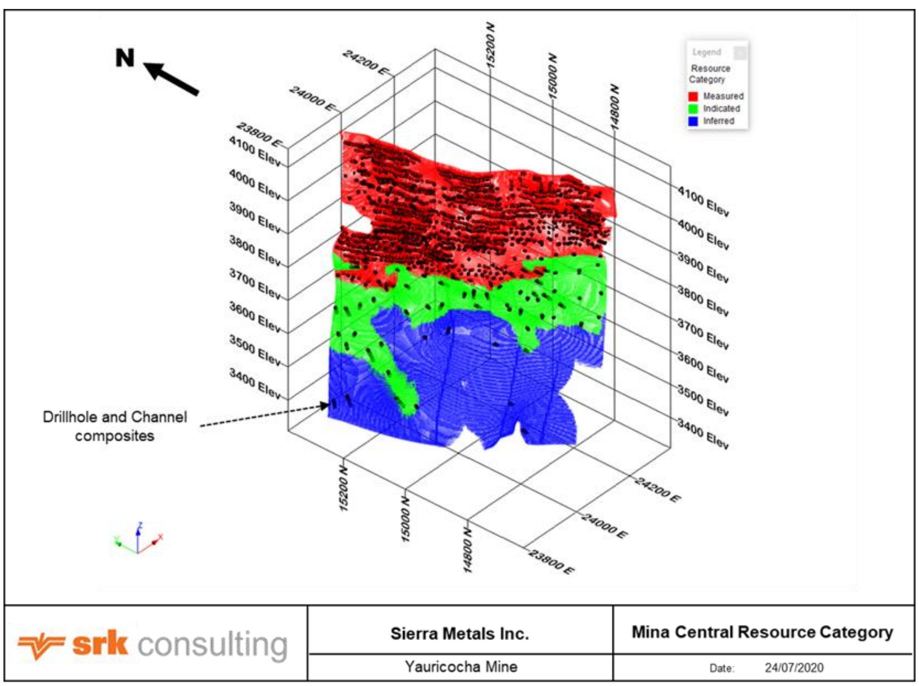
All solid envelopes containing two or less drillholes were decategorized from Mineral Resources. These areas should be considered as exploration areas and require additional drilling to satisfy CIM Definition Standards. The resource classification was initially scripted based on the range of influence of the dominant NSR contributor, generally zinc or copper. A manual override of the isolated resource category blocks was completed in Datamine's graphical interface by selecting the respective parent cell centroids and assigning a representative / realistic resource category.

Examples of this scripted classification scheme are shown in Figure 14-19, Figure 14-20 and Figure 14-21. SRK notes that this scripted method is not perfect, and locally results in some classification artifacts along the margins of wide-spaced drilling or in areas where data spacing varies significantly. SRK notes that this is likely something that can be improved upon as additional drilling (currently underway) infills some of these areas.



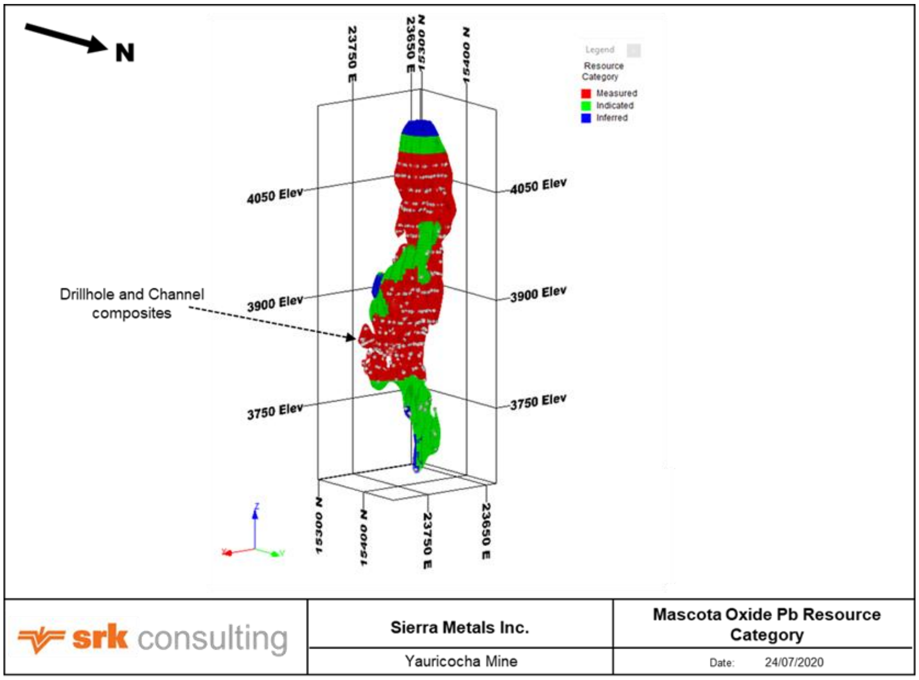
Source: SRK, 2020

Figure 14-19: Example of Scripted and Re-classed Classification for Esperanza



Source: SRK, 2020

Figure 14-20: Example of Scripted and Re-classed Classification for Mina Central



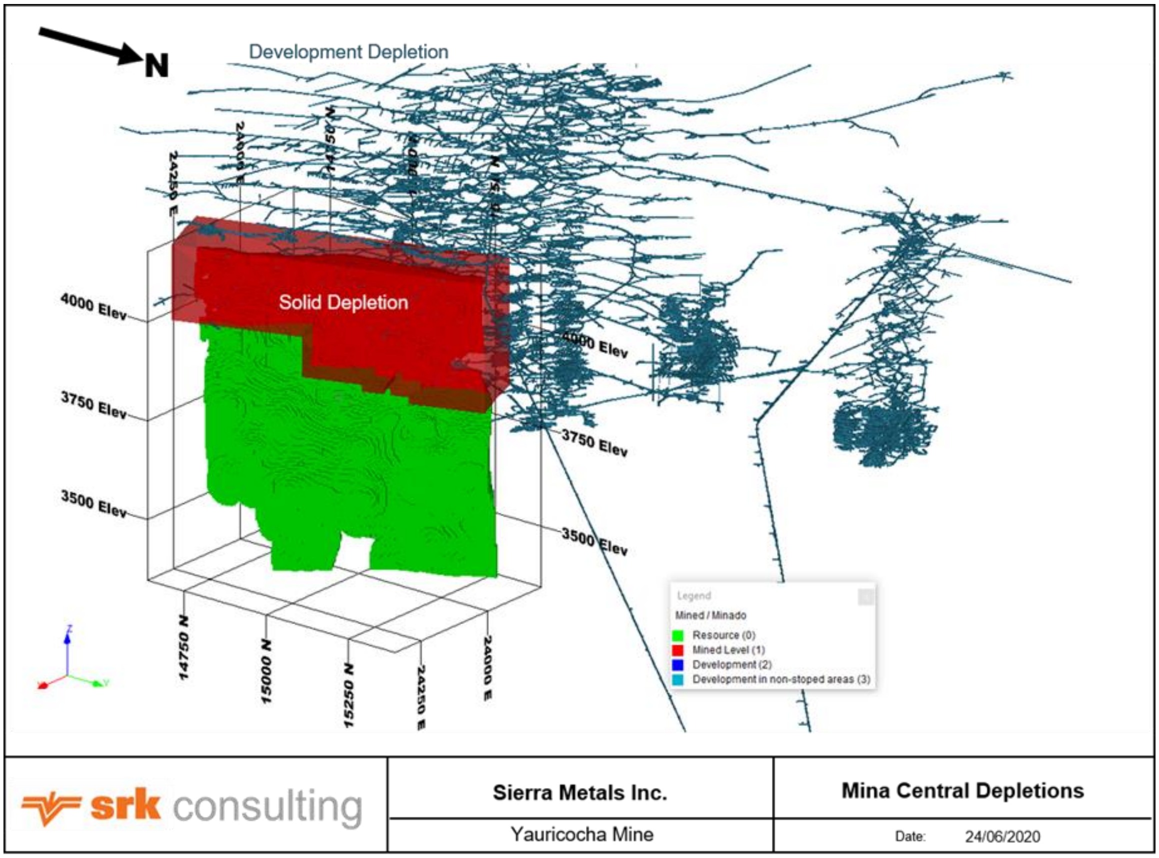
Source: SRK, 2020

Figure 14-21: Example of Scripted and Re-classed Classification for Mascota Oxide Cu Pb-Ag

14.10 Depletion

SRK depleted the block models using provided wireframe solids based on digitized polygons projected on long sections and cross-sections from Minera Corona. SRK notes that this is a conservative approach, given that it effectively ignores pillars or other areas which are known to have not been completely mined. However, SRK agrees with this approach and notes that extensive surveying of previously mined areas would need to be done in order to reasonably incorporate the remaining material above these levels. All material within each solid was flagged with a mined variable (MINED or Minado) in the block model, with 1 representing completely mined, and 0 representing completely available. Depletion was applied to the resource models in areas where drift and development ends intersect the resource model. In depleted areas, a mined flag of two was assigned and in non-mined areas, a mined flag of three was assigned.

An example of this is shown in Figure 14-22 for the Mina Central area.



Source: SRK, 2020

Figure 14-22: Example of Mining Depletion in Block Models – Mina Central

14.11 Mineral Resource Statement

CIM Definition Standards for Mineral Resources and Mineral Reserves (May 2014) defines a Mineral Resource as:

“a concentration or occurrence of solid material of economic interest in or on the Earth’s crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling”.

The “reasonable prospects for economic extraction” requirement generally implies that the quantity and grade estimates meet certain economic thresholds and that the Mineral Resources are reported at an appropriate cut-off value (COV) considering extraction scenarios and processing recoveries. SRK is of the opinion that the costs provided by Minera Corona represent the approximate direct marginal mining and processing cost for various mining methods. To satisfy the criteria of reasonable prospects for economic extraction, SRK has calculated unit values for the blocks in the models based on the grades estimated, metal price assumptions, and metallurgical recovery factors in the form of an NSR value. The NSR value also takes into consideration arsenic, as it is considered a deleterious element in the current smelter contracts. For the mineralized zones that are designated to be exploited utilizing a sub-level caving method, the block models were regularized to their respective parent cell and diluted at zero grade. This allowed for isolated sub-cells to fall below the COV and hence be removed from the Mineral Resource, as these particular blocks do not satisfy the *"reasonable prospects for eventual economic extraction"* as stated in the CIM definitions.

The metal price assumptions have been derived from 2020 Consensus Commodity prices and are reasonable for the statement of Mineral Resources. These prices are generally higher than those used in the previous Technical Report filed in 2017 and reflect the relative increase in commodity prices since that report. These prices are summarized in Table 14-8.

Table 14-8: Unit Value Price Assumptions

Consensus Pricing	Gold (US$/oz)	Silver (US$/oz)	Copper (US$/lb)	Lead (US$/lb)	Zinc (US$/lb)
Long Term 2020	1,502	18.24	3.05	0.91	1.06

Source: CIBC Global Mining Group, August 2020

The metallurgical recovery factors are based on actual to-date 2019 metallurgical recoveries for the various processes and concentrates produced by the Yauricocha Mine. SRK has considered that the mineralized bodies stated in Mineral Resources fall into one of three general categories in terms of process route: polymetallic sulfide, lead oxide, and copper sulfide. The copper sulfide process route was abandoned in 2017. The overwhelming majority of the mineralized zones are considered as polymetallic sulfide, with very limited production from Pb Oxide areas, and effectively no consistent production from Cu-Oxide areas. Oxide material constitutes 2.2% of the total declared Measured and Indicated Mineral Resources for 2020 and 0.3% of the Inferred Mineral Resources are regarded as oxide material. The summary of the recovery discounts applied during the unit value calculation are shown in Table 14-9. SRK notes that the recoveries stated for the unit value calculations do not consider payability or penalties in the concentrates, as these are variable and may depend on contracts to be negotiated.

Table 14-9: Metallurgical Recovery Assumptions

Date	Process Recovery	Ag (%)	Au (%)	Cu (%)	Pb (%)	Zn (%)
2020	Polymetallic	76	22	75	89	89
	Pb Oxide	51	53	0	65	0
2019	Polymetallic	76	17	80	89	89
	Pb Oxide	51	53	0	65	0
2017	Polymetallic	67	16	65	85	89
	Pb Oxide	51	54	0	66	0
	Cu Oxide	28	0	39	0	0

Source: Sierra Metals, 2020

The general unit value calculation can then be summarized as the estimated grade of each metal, multiplied by the price (US$/g or US$/%), multiplied by the process recovery. This yields a dollar value of the block per tonne, which can be utilized to report resources above the break-even variable costs for mining, processing, and G&A. Sierra provided these costs to SRK, noting that they are generalized given the flexibility of the mining methods within each area or individual mineralized body. For example, several mineralized bodies feature a majority of a specific mining method, but will locally utilize others on necessity, or require adjusted pumping capacity or ground conditions, which may locally move this cost up or down. SRK considers the application of a single unit value cut-off to each mineralized body as reasonable. The unit value sub-marginal costs provided by Sierra are summarized in Table 14-10.

Table 14-10: Unit Value Cut-off by Mining Method (US$/t)

Description	Break-Even Cost 2019	Break-Even Cost 2020
Sub-level Caving: Conventional (SLCM1)	$46	$25
Sub-level Caving: Mechanized, No Water (SLCM2)	$47	$27
Sub-level Caving: Mechanized, Low Water (SLCM3)	$49	$27
Cut and Fill: Overhead Conventional CRAM	$55	$36
Cut and fill: Overhead Mechanized	Not Utilized	Not Utilized
Cut and Fill: Overhead Mechanized w/ Pillars	Not Utilized	Not Utilized

Source: Sierra Metals, 2020

Sierra has provided an explanation as to why the 2020 mining costs have decreased since 2019. Through better cost controls, improved equipment and worker utilization, an improved mine management team, reduced workforce and better operating procedures and improved short-term and long-term mining plans, the mine has been able to drive down costs and successfully manage with reduced operating budgets.

In addition, the workforce has been dramatically reduced in size from 2,500 workers in 2019 to 1,500 in 2020, and ground support costs, power costs, maintenance costs and warehouse costs have all been reduced collectively by over $11.00/tonne. Sierra also discovered during Covid-19 work reductions that they were able to achieve better efficiencies and production rates with fewer people and therefore operating budgets have now been decreased accordingly. The mine has also switched to a new cost management system which has allowed the mine to better measure and track costs, and to drive further cost reductions.

The June 30, 2020, consolidated Mineral Resource statement for the Yauricocha Mine is presented in Table 14-11. The individual detailed Mineral Resource statements by mining area are presented in Table 14-12.

Table 14-11: Consolidated Yauricocha Mine Mineral Resource Statement as of 30 June, 2020 – SRK Consulting (Canada), Inc. [(1) (2) (3) (4) (5) (6) (7) (8) (9)]

Classification	Volume (m^3) '000	Tonnes (K t)	Density (kg/m^3)	Ag (g/t)	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	As (%)	Fe (%)	NSR (USD/t)	Ag (M oz)	Au (K oz)	Cu (M lb)	Pb (M lb)	Zn (M lb)
Measured	1,458	4,904	3.36	55.81	0.59	1.13	0.83	2.59	0.18	24.47	113	8.8	93.5	122.2	89.4	280.1
Indicated	3,226	11,020	3.42	38.39	0.50	1.20	0.52	2.05	0.14	25.41	98	13.6	178.0	291.1	126.7	498.9
Measured + Indicated	4,684	15,924	3.40	43.75	0.53	1.18	0.62	2.22	0.15	25.12	103	22.4	271.5	413.3	216.2	779.0
Inferred	3,346	11,633	3.48	27.54	0.45	1.40	0.31	0.95	0.07	26.65	84	10.3	167.4	357.9	79.3	242.5

Notes:

(1) Mineral Resources have been classified in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum ("CIM") Definition Standards on Mineral Resources and Mineral Reserves, whose definitions are incorporated by reference into NI 43-101.

(2) Mineral Resources are reported inclusive of Mineral Reserves. Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability. All figures are rounded to reflect the relative accuracy of the estimates. Silver, gold, copper, lead, zinc, arsenic (deleterious) and iron assays were capped / cut where appropriate.

(3) The consolidated Yauricocha Mineral Resource estimate is comprised of Measured, Indicated and Inferred Resources in the Mina Central, Cuerpos Pequeños, Cuye, Mascota, Esperanza and Cachi-Cachi mining areas.

(4) Polymetallic Mineral Resources are reported at Cut-Off Values (COVs) based on 2020 actual metallurgical recoveries and 2020 smelter contracts.

(5) Metal price assumptions used for polymetallic feed considered CIBC, August 2020 long-term consensus pricing (Gold (US$1,502/oz), Silver (US$18.24/oz), Copper (US$3.05/lb), Lead (US$0.91/lb), and Zinc (US$1.06/lb).

(6) Lead Oxide Mineral Resources are reported at COVs based on 2020 actual metallurgical recoveries and 2020 smelter contracts.

(7) Metal price assumptions used for lead oxide feed considered CIBC, August 2020 long-term consensus pricing (Gold (US$1,502/oz), Silver (US$18.24/oz) and Lead (US$0.91/lb).

(8) The mining costs are based on 2020 actual costs and are variable by mining method.

(9) The unit value COVs are variable by mining area and proposed mining method. The marginal COV ranges from US$25 to US$36.

Table 14-12: Individual Mineral Resource Statements for Yauricocha Mine Areas as of June 30, 2020 – SRK Consulting (Canada), Inc.(1) (2) (3) (4) (5) (6) (7) (8) (9) (10)

Mina Central (MINAC) - Polymetallic	COV	27		Grades							Value	Contained Metal						
	Category	Tonnes (K t)	Density (kg/m³)	Ag (g/t)	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	As (%)	Fe (%)	NSR (USD/t)	Ag (K oz)	Au (K oz)	Cu (K lb)	Pb (K lb)	Zn (K lb)	As (K t)	Fe (K t)
	Measured	1,278	3.46	23.31	0.54	0.77	0.12	2.14	0.16	25.40	74	957.6	22.06	21,829.7	3,480.9	60,383.2	1.991	324.6
	Indicated	4,021	3.51	20.78	0.53	1.16	0.06	1.36	0.11	27.16	76	2,686.0	68.04	102,956.4	5,743.0	120,681.6	4.349	1,092.2
	Measured + Indicated	5,299	3.50	21.39	0.53	1.07	0.08	1.55	0.12	26.74	75	3,643.6	90.10	124,786.1	9,223.9	181,064.8	6.340	1,416.8
	Inferred	7,249	3.47	20.42	0.45	1.44	0.15	0.64	0.06	26.56	77	4,760.1	104.03	230,773.7	24,458.1	102,053.2	4.153	1,925.4
	Includes all Catas and Antacaca																	

Mina Central (MINAC) - Polymetallic	COV	27		Grades							Value	Contained Metal						
	Category	Tonnes (K t)	Density (kg/m³)	Ag (g/t)	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	As (%)	Fe (%)	NSR (USD/t)	Ag (K oz)	Au (K oz)	Cu (K lb)	Pb (K lb)	Zn (K lb)	As (K t)	Fe (K t)
	Measured	689	3.27	35.31	0.53	0.58	0.59	2.04	0.12	18.92	75	782.2	11.72	8,750.4	8,915.0	31,000.5	0.846	130.4
	Indicated	1,145	3.30	24.45	0.39	0.82	0.09	0.73	0.10	21.73	54	899.9	14.47	20,733.6	2,177.1	18,315.3	1.092	248.8
	Measured + Indicated	1,834	3.29	28.53	0.44	0.73	0.27	1.22	0.11	20.67	62	1,682.1	26.19	29,483.9	11,092.1	49,315.8	1.938	379.2
	Inferred	2,137	3.50	17.79	0.36	1.38	0.12	0.48	0.04	27.61	70	1,222.5	24.51	64,918.1	5,640.5	22,428.0	0.911	590.1
	Includes all Rosaura and Antacaca Sur																	

Mina Central (ASO) – Pb / Ag Oxide	COV	27		Grades							Value	Contained Metal						
	Category	Tonnes (K t)	Density (kg/m³)	Ag (g/t)	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	As (%)	Fe (%)	NSR (USD/t)	Ag (K oz)	Au (K oz)	Cu (K lb)	Pb (K lb)	Zn (K lb)	As (K t)	Fe (K t)
	Measured	242	3.10	127.60	1.26	0.23	1.56	0.54	0.30	28.98	67	992.8	9.83	1,239.0	8,298.4	2,865.6	0.717	70.1
	Indicated	217	3.14	79.68	1.06	0.36	0.96	0.76	0.27	30.44	47	555.9	7.41	1,713.0	4,572.6	3,641.6	0.579	66.1
	Measured + Indicated	459	3.12	104.95	1.17	0.29	1.27	0.64	0.28	29.67	57	1,548.7	17.24	2,952.0	12,871.0	6,507.2	1.297	136.2
	Inferred	32	3.20	126.26	1.59	0.27	0.63	0.65	0.25	29.45	63	129.9	1.63	191.1	443.8	460.1	0.080	9.4
	Includes all Antacaca Sur Oxidos																	

Cuerpos Pequeños (CSM, CSMI and CSMII) - Polymetallic	COV	36		Grades							Value	Contained Metal						
	Category	Tonnes (K t)	Density (kg/m³)	Ag (g/t)	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	As (%)	Fe (%)	NSR (USD/t)	Ag (K oz)	Au (K oz)	Cu (K lb)	Pb (K lb)	Zn (K lb)	As (K t)	Fe (K t)
	Measured	48	3.20	177.94	0.11	0.12	6.37	8.77	0.12	5.42	291	274.6	0.18	130.3	6,745.9	9,279.0	0.058	2.6
	Indicated	122	3.13	156.95	0.12	0.14	5.01	8.69	0.10	6.36	262	615.6	0.46	389.8	13,466.9	23,365.9	0.127	7.8
	Measured + Indicated	170	3.15	162.87	0.12	0.14	5.39	8.71	0.11	6.10	270	890.2	0.64	520.1	20,212.8	32,644.9	0.185	10.4
	Inferred	66	3.14	181.72	0.12	0.11	6.48	8.52	0.08	5.14	289	385.6	0.26	158.7	9,434.9	12,395.5	0.050	3.4
	Includes all Contacto Sur Medio: TJ6060, TJ8167 (I) and TJ1590 (II)																	

Zone	COV	36		Grades							Value	Contained Metal						
Cuerpos Pequeños (GAL) - Polymetallic	Category	Tonnes (K t)	Density (kg/m³)	Ag (g/t)	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	As (%)	Fe (%)	NSR (USD/t)	Ag (K oz)	Au (K oz)	Cu (K lb)	Pb (K lb)	Zn (K lb)	As (K t)	Fe (K t)
	Measured	9	3.37	69.12	0.26	1.67	1.20	6.10	0.36	19.24	197	20.0	0.07	330.9	238.5	1,209.9	0.033	1.7
	Indicated	5	3.24	27.37	0.12	0.07	2.56	9.40	0.09	10.58	192	4.40	0.02	7.7	282.4	1,035.7	0.005	0.5
	Measured + Indicated	14	3.32	54.21	0.21	1.10	1.69	7.28	0.27	16.15	195	24.4	0.09	338.6	521	2,245.6	0.037	2.3
	Inferred	34	3.13	31.56	0.11	0.09	3.21	9.83	0.07	7.78	211	34.5	0.12	64.6	2,409.4	7,367.4	0.024	2.6
	Includes all Gallito																	
Cuerpos Pequeños (COR) - Polymetallic	COV	36		Grades							Value	Contained Metal						
	Category	Tonnes (K t)	Density (kg/m³)	Ag (g/t)	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	As (%)	Fe (%)	NSR (USD/t)	Ag (K oz)	Au (K oz)	Cu (K lb)	Pb (K lb)	Zn (K lb)	As (K t)	Fe (K t)
	Measured	70	3.50	55.59	0.12	0.38	0.59	8.02	0.18	24.86	161	125.1	0.27	593	904.3	12,377.8	0.126	17.4
	Indicated	139	3.48	46.12	0.12	0.30	0.46	8.01	0.17	24.83	153	206.1	0.52	926.2	1,414.7	24,559.9	0.234	34.5
	Measured + Indicated	209	3.48	49.29	0.12	0.33	0.50	8.02	0.17	24.84	156	331.2	0.79	1,519.2	2,319.0	36,937.7	0.360	51.9
	Inferred	79	3.29	65.40	0.18	0.16	1.59	6.24	0.06	19.77	145	166.1	0.46	286.8	2,767.0	10,862.4	0.044	15.6
	Includes all Oriental																	
Cuerpos Pequeños (COC) - Polymetallic	COV	36		Grades							Value	Contained Metal						
	Category	Tonnes (K t)	Density (kg/m³)	Ag (g/t)	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	As (%)	Fe (%)	NSR (USD/t)	Ag (K oz)	Au (K oz)	Cu (K lb)	Pb (K lb)	Zn (K lb)	As (K t)	Fe (K t)
	Measured	33	3.00	53.91	0.30	0.17	0.75	5.65	0.05	12.24	121	57.2	0.32	127.0	547.8	4,114.0	0.018	4.0
	Indicated	62	3.10	47.16	0.28	0.15	0.62	5.86	0.05	11.01	119	94.0	0.56	209.9	851.2	8,009.2	0.032	6.8
	Measured + Indicated	95	3.06	49.50	0.29	0.16	0.67	5.79	0.05	11.44	120	151.2	0.87	336.9	1,399.1	12,123.2	0.049	10.9
	Inferred	2	2.85	24.88	0.12	0.09	0.07	3.08	0.02	6.77	59	1.6	0.01	4.0	2.9	135.6	0.000	0.1
	Includes all Occidental																	
Cuye (CUYE) - Polymetallic	COV	25		Grades							Value	Contained Metal						
	Category	Tonnes (K t)	Density (kg/m³)	Ag (g/t)	Au (g/t)	Cu (%)	Pb (%)	Zn (%)	As (%)	Fe (%)	NSR (USD/t)	Ag (K oz)	Au (K oz)	Cu (K lb)	Pb (K lb)	Zn (K lb)	As (K t)	Fe (K t)
	Measured	0	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0
	Indicated	2,197	3.60	19.72	0.54	1.35	0.10	1.13	0.12	28.44	80	1,392.7	38.17	65,182.9	4,886.3	54,908.0	2.597	624.8
	Measured + Indicated	2,197	3.60	19.72	0.54	1.35	0.10	1.13	0.12	28.44	80	1,392.7	38.17	65,182.9	4,886.3	54,908.0	2.597	624.8
	Inferred	1,273	3.65	32.44	0.52	1.65	0.09	0.34	0.13	30.68	83	1,327.7	21.15	46,366.2	2,386.9	9,582.6	1.595	390.6
	Includes all Cuye																	

Domain	COV	25 + 36 [10]		Grades							Value	Contained Metal						
Mascota (MAPE, MAPN, MAPS, MAS and MOX) – Polymetallic and Cu / Pb / Ag Oxides	**Category**	**Tonnes (K t)**	**Density (kg/m³)**	**Ag (g/t)**	**Au (g/t)**	**Cu (%)**	**Pb (%)**	**Zn (%)**	**As (%)**	**Fe (%)**	**NSR (USD/t)**	**Ag (K oz)**	**Au (K oz)**	**Cu (K lb)**	**Pb (K lb)**	**Zn (K lb)**	**As (K t)**	**Fe (K t)**
	Measured	154	3.14	139.52	0.96	0.95	4.04	4.91	0.16	16.31	172	690.8	4.77	3,213.9	13,720.2	16,660.8	0.253	25.1
	Indicated	545	3.24	122.34	0.64	0.97	2.79	6.05	0.13	17.40	184	2,143.7	11.15	11,698.4	33,572.0	72,735.5	0.710	94.8
	Measured + Indicated	699	3.22	126.13	0.71	0.97	3.07	5.80	0.14	17.16	181	2,834.5	15.92	14,912.3	47,292.2	89,396.2	0.962	119.9
	Inferred	278	3.43	142.42	1.04	0.55	2.39	5.54	0.09	23.41	185	1,272.9	9.28	3,377.7	14,619.1	33,940.6	0.253	65.1
	Includes all Mascota Oxidos Cu Pb-Ag, Mascota Polymetallic North, Mascota Polymetallic East, Mascota Polymetallic (South) East, Mascota Polymetallic South and Mascota Sur Oxidos Cu																	

Domain	COV	25 + 27 [10]		Grades							Value	Contained Metal						
Esperanza (ESP, ESPD, ESPN and ESPBX) - Polymetallic	**Category**	**Tonnes (K t)**	**Density (kg/m³)**	**Ag (g/t)**	**Au (g/t)**	**Cu (%)**	**Pb (%)**	**Zn (%)**	**As (%)**	**Fe (%)**	**NSR (USD/t)**	**Ag (K oz)**	**Au (K oz)**	**Cu (K lb)**	**Pb (K lb)**	**Zn (K lb)**	**As (K t)**	**Fe (K t)**
	Measured	1,998	3.37	66.35	0.59	1.88	0.84	2.33	0.23	28.76	144	4,261.9	38.11	82,743.8	36,943.0	102,467.0	4.499	574.6
	Indicated	2,226	3.27	61.28	0.46	1.73	1.03	2.87	0.22	25.52	147	4,385.8	32.80	84,711.0	50,706.7	140,700.8	4.799	568.0
	Measured + Indicated	4,224	3.32	63.68	0.52	1.80	0.94	2.61	0.22	27.05	146	8,647.7	70.90	167,454.8	87,649.7	243,167.8	9.298	1,142.70
	Inferred	360	3.24	70.12	0.34	1.43	1.70	4.11	0.27	22.50	167	811.6	3.96	11,310.6	13,524.2	32,596.0	0.973	81
	Includes all Esperanza, Esperanza Norte, Esperanza Distal, Esperanza Breccia 3																	

Domain	COV	27		Grades							Value	Contained Metal						
Cachi-Cachi (ANG) - Polymetallic	**Category**	**Tonnes (K t)**	**Density (kg/m³)**	**Ag (g/t)**	**Au (g/t)**	**Cu (%)**	**Pb (%)**	**Zn (%)**	**As (%)**	**Fe (%)**	**NSR (USD/t)**	**Ag (K oz)**	**Au (K oz)**	**Cu (K lb)**	**Pb (K lb)**	**Zn (K lb)**	**As (K t)**	**Fe (K t)**
	Measured	41	3.42	10.01	0.30	0.58	0.16	2.19	0.08	24.26	63	13.2	0.39	527.3	148.6	1,981.3	0.032	9.9
	Indicated	25	3.13	30.36	0.51	0.64	0.50	2.18	0.10	23.30	77	24.4	0.41	354.3	274.0	1,204.2	0.025	5.8
	Measured + Indicated	66	3.30	17.72	0.38	0.61	0.29	2.19	0.09	23.90	68	37.6	0.80	881.6	422.6	3,185.5	0.057	15.8
	Inferred	0	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0
	Includes all Angelita																	

Domain	COV	36		Grades							Value	Contained Metal						
Cachi-Cachi (CAR) - Polymetallic	**Category**	**Tonnes (K t)**	**Density (kg/m³)**	**Ag (g/t)**	**Au (g/t)**	**Cu (%)**	**Pb (%)**	**Zn (%)**	**As (%)**	**Fe (%)**	**NSR (USD/t)**	**Ag (K oz)**	**Au (K oz)**	**Cu (K lb)**	**Pb (K lb)**	**Zn (K lb)**	**As (K t)**	**Fe (K t)**
	Measured	31	3.44	68.63	0.99	0.21	0.89	4.15	0.12	21.57	109.74	68.4	0.99	142.4	609.6	2,837.1	0.037	6.7
	Indicated	5	3.32	49.14	0.79	0.13	1.01	4.02	0.14	16.32	100	7.9	0.13	14.8	111.3	443.3	0.007	0.8
	Measured + Indicated	36	3.43	65.92	0.96	0.20	0.91	4.13	0.12	20.84	108	76.3	1.11	157.2	720.9	3,280.5	0.044	7.5
	Inferred	4	3.18	73.09	1.66	0.06	2.48	5.70	0.22	8.27	157	9.4	0.21	5.1	218.9	502.4	0.009	0.3
	Includes all Carmencita																	

	COV	36		Grades							Value	Contained Metal						
Cachi-Cachi (ELI) – Polymetallic	**Category**	**Tonnes (K t)**	**Density (kg/m³)**	**Ag (g/t)**	**Au (g/t)**	**Cu (%)**	**Pb (%)**	**Zn (%)**	**As (%)**	**Fe (%)**	**NSR (USD/t)**	**Ag (K oz)**	**Au (K oz)**	**Cu (K lb)**	**Pb (K lb)**	**Zn (K lb)**	**As (K t)**	**Fe (K t)**
	Measured	35	3.18	98.11	0.41	0.36	1.47	7.21	0.15	12.49	177	110.4	0.47	276.7	1,135.4	5,560.3	0.053	4.4
	Indicated	42	3.00	124.71	0.52	0.67	1.53	3.9	0.15	9.09	149	168.4	0.70	616.9	1,418.0	3,607.6	0.061	3.8
	Measured + Indicated	77	3.08	112.62	0.47	0.53	1.50	5.40	0.15	10.64	161	278.8	1.17	893.5	2,553.4	9,167.9	0.114	8.2
	Inferred	14	2.80	77.54	0.25	0.54	0.84	1.68	0.06	6.06	84	34.9	0.11	165.8	260.1	518.7	0.009	0.8
	Includes all Elissa																	

	COV	36		Grades							Value	Contained Metal						
Cachi-Cachi (ESC) - Polymetallic	**Category**	**Tonnes (K t)**	**Density (kg/m³)**	**Ag (g/t)**	**Au (g/t)**	**Cu (%)**	**Pb (%)**	**Zn (%)**	**As (%)**	**Fe (%)**	**NSR (USD/t)**	**Ag (K oz)**	**Au (K oz)**	**Cu (K lb)**	**Pb (K lb)**	**Zn (K lb)**	**As (K t)**	**Fe (K t)**
	Measured	20	3.33	47.59	0.30	0.14	2.17	5.77	0.09	23.09	141	30.6	0.19	61.5	955.7	2,542.8	0.018	4.6
	Indicated	46	3.29	30.09	0.26	0.07	1.33	4.50	0.12	18.50	101	44.5	0.39	67.9	1,353.4	4,561.6	0.057	8.5
	Measured + Indicated	66	3.30	35.39	0.27	0.09	1.59	4.88	0.11	19.89	113	75.1	0.58	129.4	2,309.1	7,104.4	0.074	13.1
	Inferred	37	3.08	30.77	0.28	0.07	1.06	4.05	0.14	15.15	91	36.6	0.33	56.9	863.8	3,307.4	0.051	5.6
	Includes all Escondida																	

	COV	36		Grades							Value	Contained Metal						
Cachi-Cachi (KAR) - Polymetallic	**Category**	**Tonnes (K t)**	**Density (kg/m³)**	**Ag (g/t)**	**Au (g/t)**	**Cu (%)**	**Pb (%)**	**Zn (%)**	**As (%)**	**Fe (%)**	**NSR (USD/t)**	**Ag (K oz)**	**Au (K oz)**	**Cu (K lb)**	**Pb (K lb)**	**Zn (K lb)**	**As (K t)**	**Fe (K t)**
	Measured	133	3.91	47.22	0.53	0.69	0.39	3.09	0.11	32.64	96	201.9	2.29	2,029.6	1,151.0	9,061.9	0.144	43.4
	Indicated	52	3.71	30.27	0.42	0.69	0.32	3.23	0.10	29.91	91	50.6	0.70	788.2	364.4	3,707.5	0.053	15.6
	Measured + Indicated	185	3.85	42.45	0.50	0.69	0.37	3.13	0.11	31.88	95	252.5	2.99	2,817.7	1,515.5	12,769.4	0.197	59.0
	Inferred	1	3.94	12.44	0.44	0.56	0.11	0.99	0.10	27.69	45	0.4	0.01	12.3	2.4	21.8	0.001	0.3
	Includes all Karlita																	

	COV	36		Grades							Value	Contained Metal						
Cachi-Cachi (PVT) - Polymetallic	**Category**	**Tonnes (K t)**	**Density (kg/m³)**	**Ag (g/t)**	**Au (g/t)**	**Cu (%)**	**Pb (%)**	**Zn (%)**	**As (%)**	**Fe (%)**	**NSR (USD/t)**	**Ag (K oz)**	**Au (K oz)**	**Cu (K lb)**	**Pb (K lb)**	**Zn (K lb)**	**As (K t)**	**Fe (K t)**
	Measured	83	3.32	39.98	0.45	0.06	1.94	5.71	0.08	22.12	132	106.7	1.2	113.5	3,558.0	10,447.5	0.070	18.4
	Indicated	113	3.32	46.60	0.34	0.10	1.35	3.91	0.08	21.11	99	169.3	1.22	252.9	3,354.5	9,749.9	0.089	23.9
	Measured + Indicated	196	3.32	43.80	0.38	0.08	1.60	4.67	0.08	21.54	113	276.0	2.42	366.4	6,912.6	20,197.4	0.160	42.2
	Inferred	36	3.00	32.92	0.37	0.10	0.58	1.85	0.09	17.80	52	38.1	0.42	78.9	461.2	1,470.3	0.034	6.4
	Includes all Privatizadora																	

Cachi-Cachi (VAN) - Polymetallic	COV	36		Grades							Value	Contained Metal						
	Category	Tonnes	Density	Ag	Au	Cu	Pb	Zn	As	Fe	NSR	Ag	Au	Cu	Pb	Zn	As	Fe
		(K t)	(kg/m³)	(g/t)	(g/t)	(%)	(%)	(%)	(%)	(%)	(USD/t)	(K oz)	(K oz)	(K lb)	(K lb)	(K lb)	(K t)	(K t)
	Measured	14	3.50	67.98	0.49	0.11	3.00	11.88	0.09	12.91	252	30.6	0.22	34.0	924.4	3,665.4	0.012	1.8
	Indicated	29	3.22	45.90	0.55	0.66	0.99	5.84	0.07	21.41	145	42.8	0.52	421.7	633.8	3,734.2	0.021	6.2
	Measured + Indicated	43	3.31	53.09	0.53	0.48	1.64	7.81	0.08	18.64	180	73.4	0.74	455.7	1,558.2	7,399.6	0.033	8.0
	Inferred	10	3.33	55.99	0.74	0.30	1.49	10.12	0.08	19.17	207	18.0	0.24	66.6	328	2,231.7	0.008	1.9
	Includes all Vanessa																	

Cachi-Cachi (YOS) - Polymetallic	COV	36		Grades							Value	Contained Metal						
	Category	Tonnes	Density	Ag	Au	Cu	Pb	Zn	As	Fe	NSR	Ag	Au	Cu	Pb	Zn	As	Fe
		(K t)	(kg/m³)	(g/t)	(g/t)	(%)	(%)	(%)	(%)	(%)	(USD/t)	(K oz)	(K oz)	(K lb)	(K lb)	(K lb)	(K t)	(K t)
	Measured	26	3.25	121.3	0.53	0.11	2.02	6.44	0.31	19.36	172	101.4	0.45	61.5	1,158.5	3,688.8	0.080	5.0
	Indicated	29	3.22	108.11	0.37	0.12	2.44	6.09	0.23	19.01	169	100.8	0.35	74.3	1,561.8	3,894.7	0.066	5.5
	Measured + Indicated	55	3.24	114.35	0.45	0.11	2.24	6.25	0.27	19.17	170	202.2	0.79	135.8	2,720.3	7,583.5	0.147	10.5
	Inferred	21	3.50	100.12	0.97	0.21	3.10	5.71	0.20	15.16	177	67.6	0.65	96.6	1,433.0	2,642.5	0.043	3.2
	Includes all Yoselim																	

Source: SRK, 2020

Notes:

(1) Mineral Resources have been classified in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum ("CIM") Definition Standards on Mineral Resources and Mineral Reserves, whose definitions are incorporated by reference into NI 43-101.

(2) Mineral Resources are reported inclusive of Mineral Reserves. Mineral Resources are not Mineral Reserves and do not have demonstrated economic viability. All figures are rounded to reflect the relative accuracy of the estimates. Silver, gold, copper, lead, zinc, arsenic (deleterious) and iron assays were capped / cut where appropriate.

(3) The consolidated Yauricocha Resource Estimate is comprised of Measured, Indicated and Inferred Resources in the Mina Central, Cuerpos Pequeños, Cuye, Mascota, Esperanza and Cachi-Cachi mining areas.

(4) Polymetallic Mineral Resources are reported at Cut-Off Values (COVs) based on 2020 actual metallurgical recoveries and 2020 smelter contracts.

(5) Metal price assumptions used for polymetallic feed considered CIBC, August 2020 long term consensus pricing (Gold (US$1,502/oz), Silver (US$18.24/oz), Copper (US$3.05/lb), Lead (US$0.91/lb), and Zinc (US$1.06/lb).

(6) Lead Oxide Mineral Resources are reported at COVs based on 2020 actual metallurgical recoveries and 2020 smelter contracts.

(7) Metal price assumptions used for lead oxide feed considered CIBC, August 2020 long term consensus pricing (Gold (US$1,502/oz), Silver (US$18.24/oz) and Lead (US$0.91/lb).

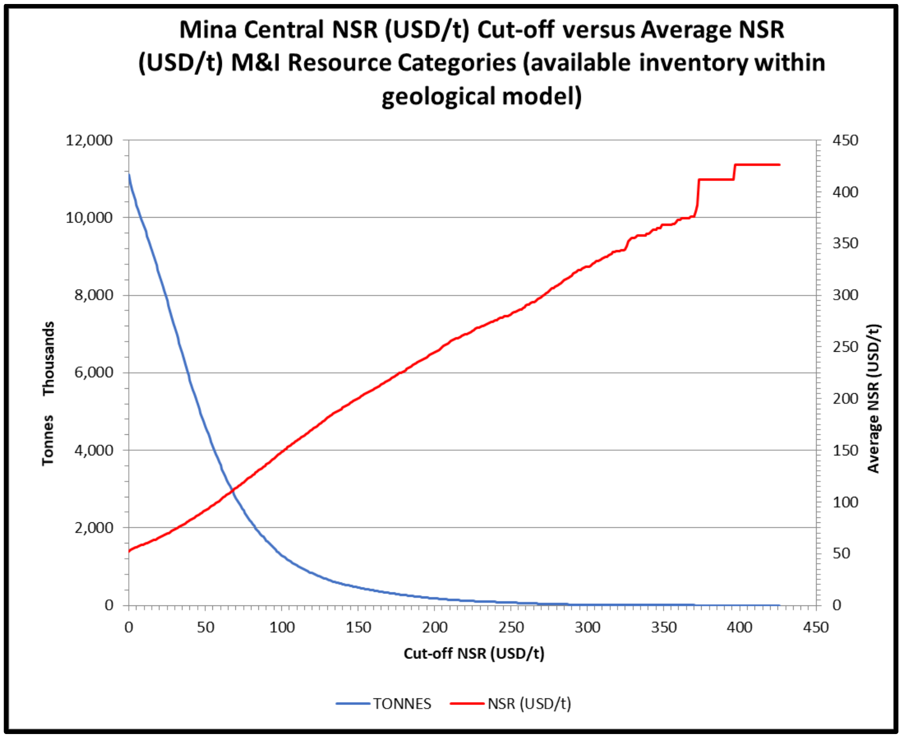
(8) The mining costs are based on 2020 actual costs and are variable by mining method.

(9) The unit value COVs are variable by mining area and proposed mining method. The marginal COV ranges from US$25 to US$36.

(10) Two or more mining methods employed, hence multiple cut-off applied to the respective regions.

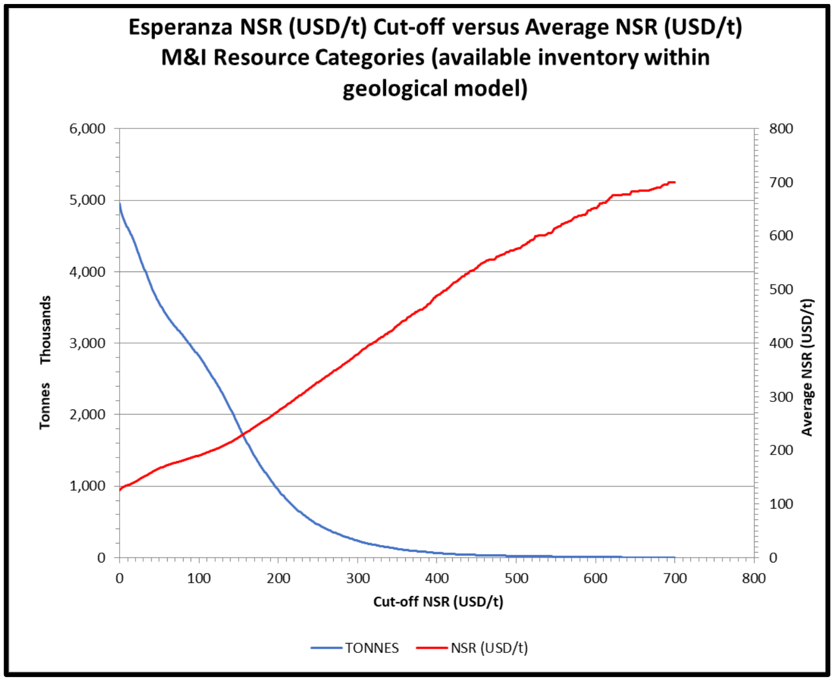
14.12 Mineral Resource Sensitivity

To demonstrate the sensitivity of the Mineral Resource estimations to factors such as changes in commodity prices or mining / processing costs, SRK has produced value vs. tonnage charts at various unit value cut-offs for each mining area, for all Measured and Indicated (M&I) Resources (Figure 14-23 through Figure 14-28). Figure 14-29 shows the total Mineral Resources for the Yauricocha Mine. This shows that the majority of the Mineral Resources defined in Mina Central, Esperanza, Mascota, Cuye, Cuerpos Pequeños and Cachi-Cachi have some sensitivity to the unit value cut-off (varying in degree between mineralized bodies), and that this should be considered in the context of the impact of changing cost assumptions with respect to the contained Mineral Resources.



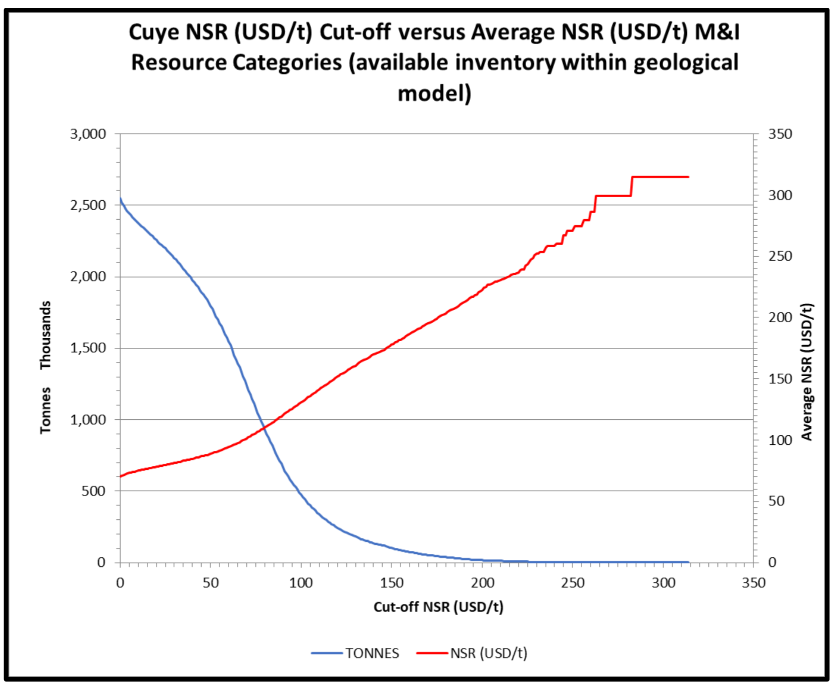
Source: SRK, 2020

Figure 14-23: Mina Central Value vs. Tonnage Chart for M&I Resource Categories



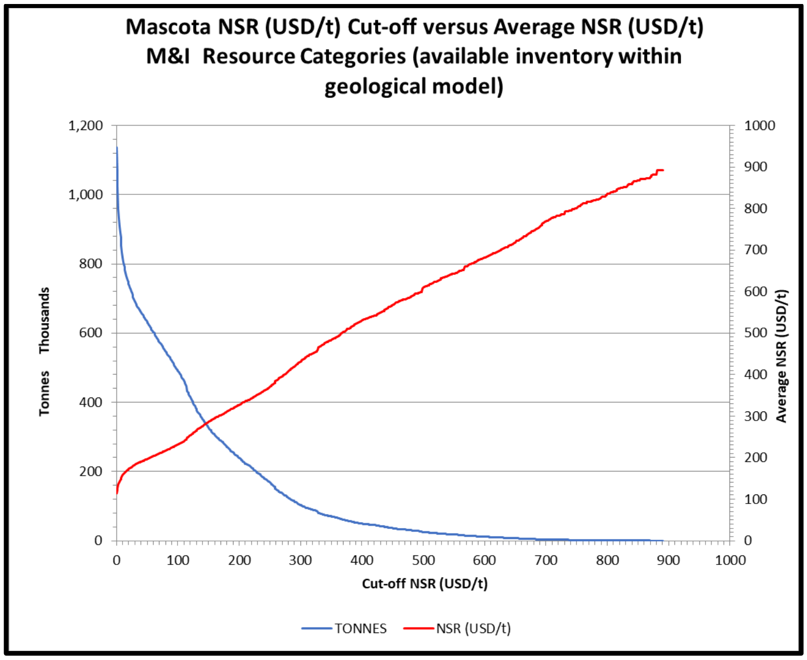
Source: SRK, 2020

Figure 14-24: Esperanza Value vs. Tonnage Chart for M&I Resource Categories



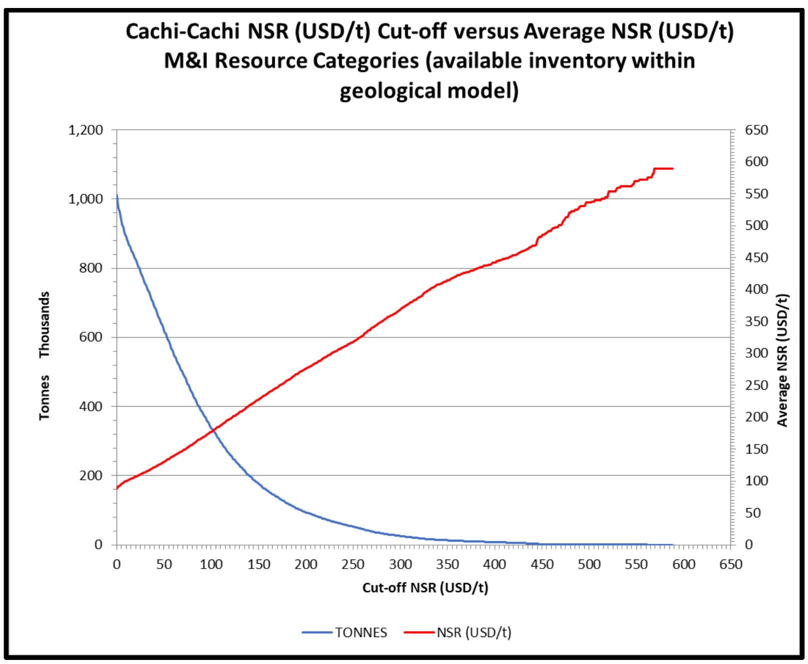
Source: SRK, 2020

Figure 14-25: Cuye Value vs. Tonnage Chart for M&I Resource Categories



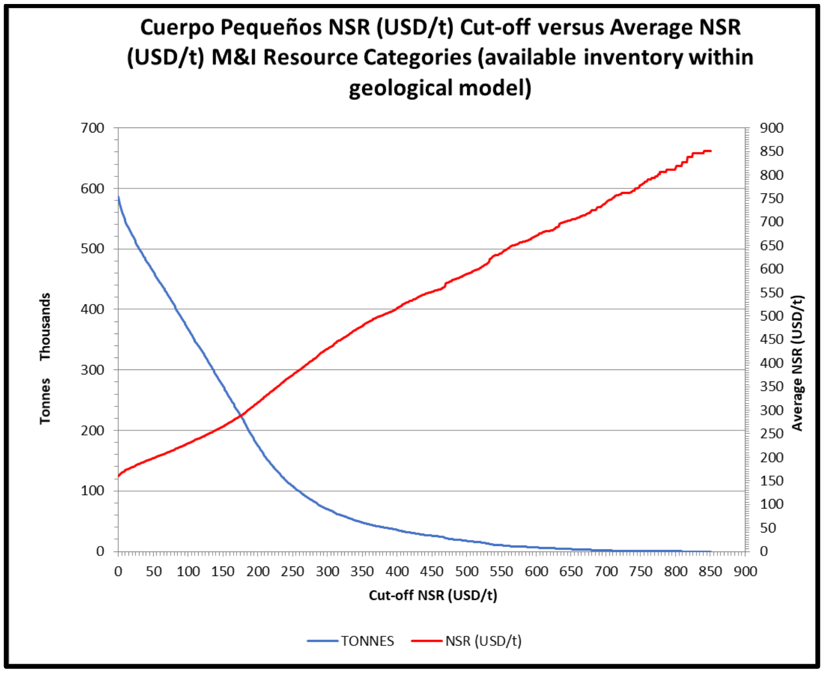
Source: SRK, 2020

Figure 14-26: Mascota Value vs. Tonnage Chart for M&I Resource Categories



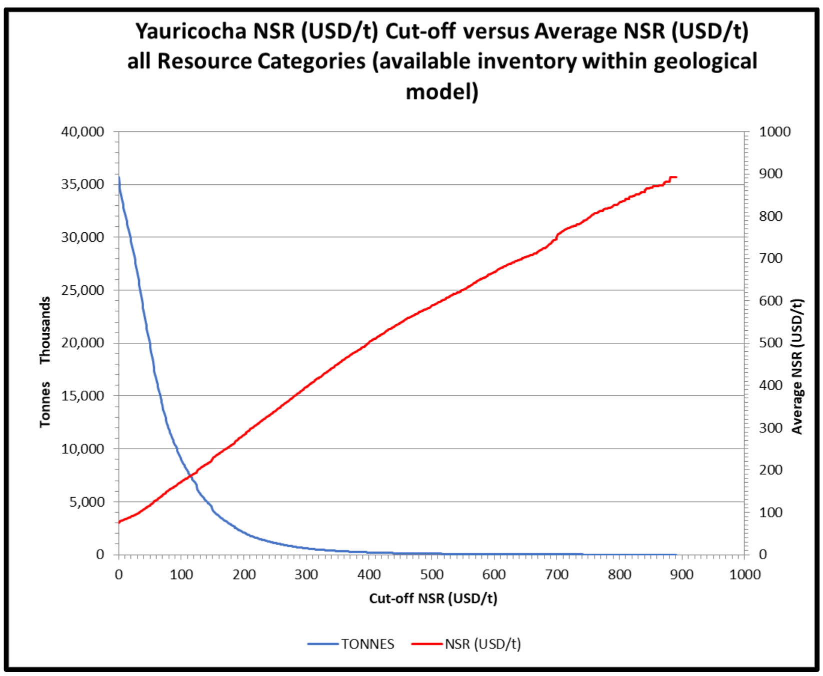
Source: SRK, 2020

Figure 14-27: Cachi-Cachi Value vs. Tonnage Chart for M&I Resource Categories



Source: SRK, 2020

Figure 14-28: Cuerpos Pequeños Value vs. Tonnage Chart for M&I Resource Categories



Source: SRK, 2020

Figure 14-29: Yauricocha Value vs. Tonnage Chart for all Resource Categories

14.13 Relevant Factors

There are no other relevant factors that SRK is aware of that would affect the Mineral Resource estimates.

15 Mineral Reserve Estimates

A Mineral Reserve is the economically mineable part of a Measured and/or Indicated Resource. It includes diluting material and allowances for losses, which may occur when the material is mined or extracted and is defined by studies at Prefeasibility or Feasibility level as appropriate that include the application of Modifying Factors.

A Mineral Reserve has not been estimated for the Project as part of this PEA.

The PEA includes Inferred Mineral Resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as Mineral Reserves.

16 Mining Methods

The conceptual mine plans considered in this PEA includes Inferred Mineral Resources that are considered too speculative geologically to have economic considerations applied to them that would enable them to be categorized as Mineral Reserves, and there is no certainty that the results of the PEA will be realized.

16.1 Introduction

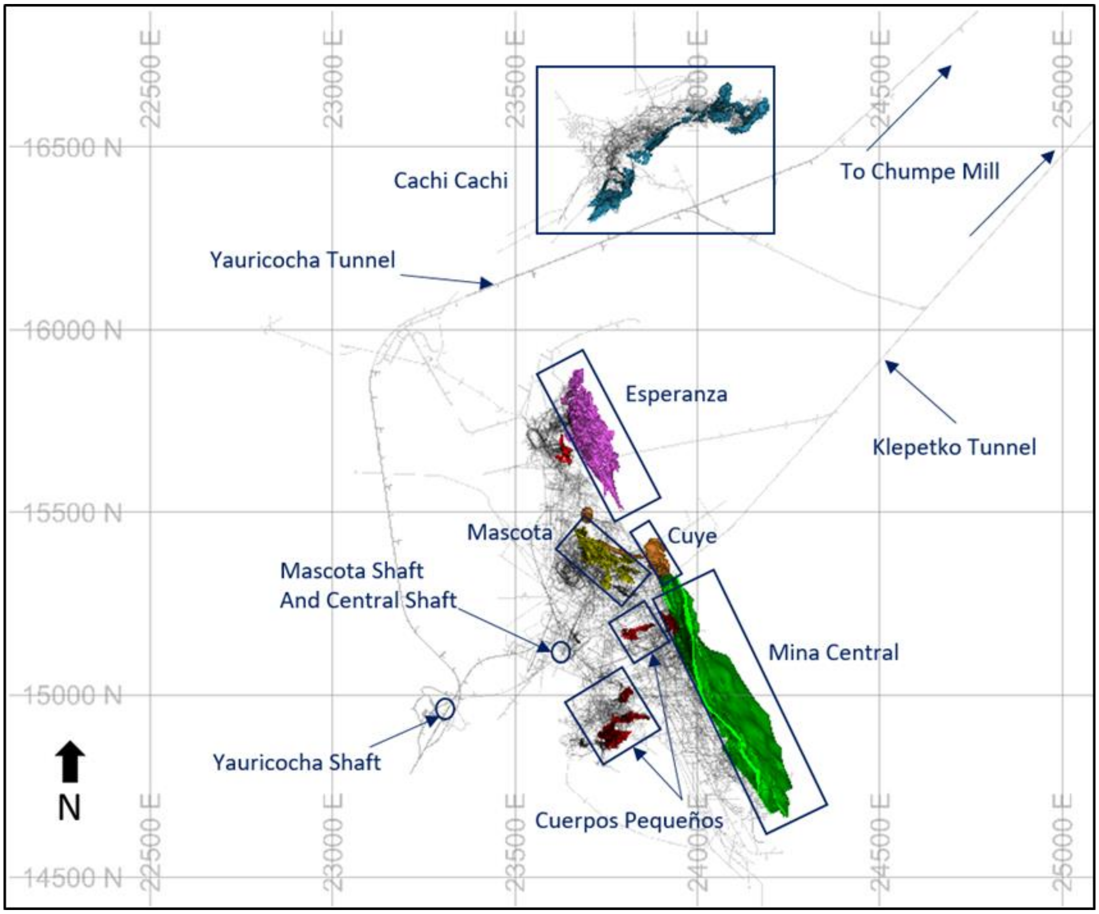
Sub-level caving (SLC) and overhand cut and fill (OCF) mining methods are currently used in the main areas of the mine to achieve production. The mining method used varies depending on geotechnical constraints, mineralization trends, dimensions, and mine production targets.

Using the most recent Mineral Resource estimate, Sierra Metals analysed how the Yauricocha Mine could achieve higher, sustainable production rates. The analysis determined that higher production rates are achievable through expansion of the use of the SLC mining method in the new production areas. Additionally, a new configuration of the SLC mining method will allow for a greater recovery of mining resources and increased productivity.

The mine is grouped into six primary mining areas on geographic location:

1. Mina Central;
2. Esperanza;
3. Mascota;
4. Cuye;
5. Cachi-Cachi; and
6. Cuerpos Pequeños.

The mining areas are shown in plan view in Figure 16-1.

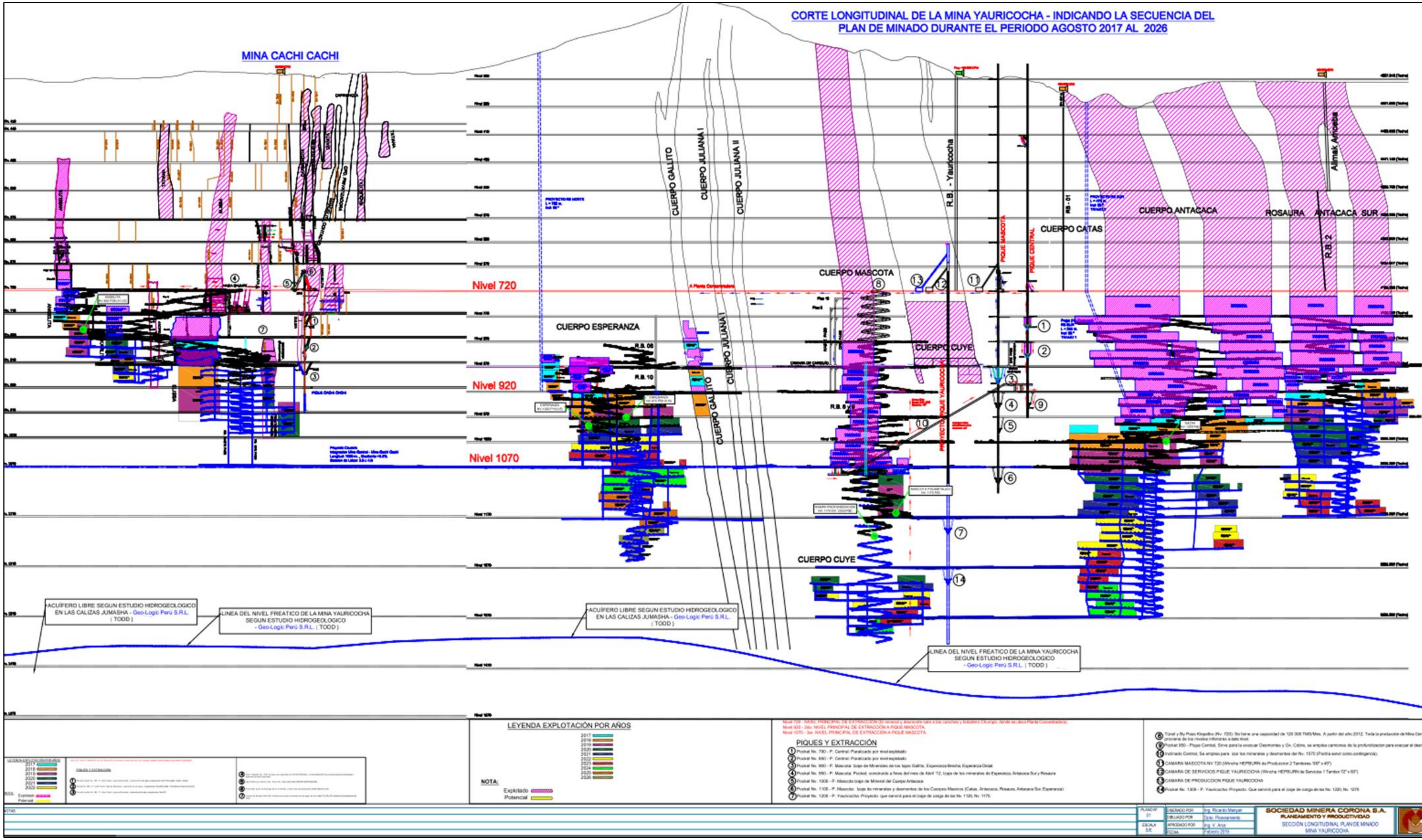


Source: Sierra Metals, Redco, 2020

Figure 16-1: Yauricocha Mine Showing Mining Areas (Plan View)

16.2 Mine Access and Materials Handling

Access to the mine is through the Mascota shaft, Central shaft, or Klepetko tunnel at 720 level. Ramps connect levels and sub-levels in the primary mining areas as shown in Figure 16-2. Previously mined out areas are shown in pink, existing development openings are black, and designed development is shown in blue. The life of mine (LOM) planning blocks are shown for reference and are coloured by production year.



Source: Sierra Metals, 2020

Figure 16-2: Yauricocha Long Section Showing Mining Areas and Mineralized Zones (Looking Northeast)

Main levels are 50 m apart, increasing to 100 m below the 1070 level. Mineralized material and waste generated in Mina Central is handled through a series of level passes into rail cars and then dumped into loading pockets in the Mascota shaft to be hoisted to the 720 main haulage level. A winze at Cachi-Cachi hoists production from lower levels in that area to the 720 main haulage level.

For mining at depths between 1170 level to 1370 levels, the Yauricocha shaft is under construction and expected to be commissioned in 2021. Mineralized material is transported by rail to the mill through the Klepetko and Yauricocha tunnels. The Yauricocha tunnel was recently built, and this new infrastructure provides additional haulage capacity to the mill.

16.3 Current Mining Methods

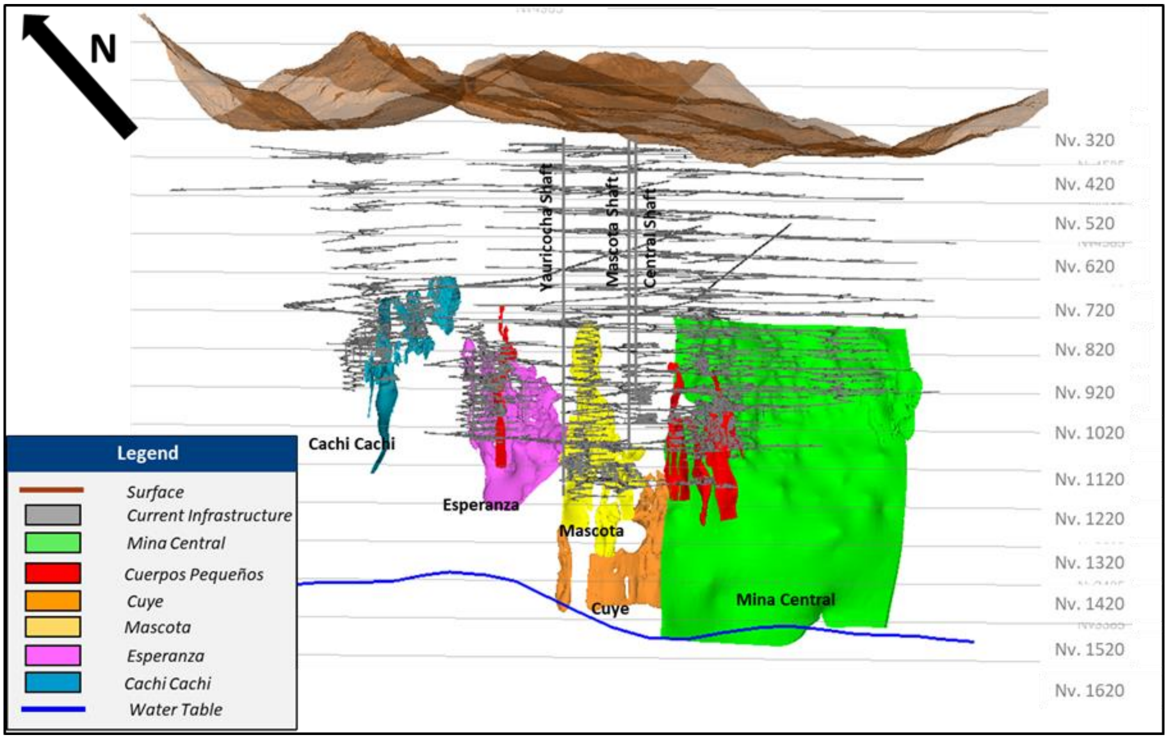
The mining method applied to the various mineralized zones at Yauricocha is generally chosen based on the mineralization style. Mineralization at Yauricocha encompasses two main styles, differentiated by scale, continuity, and development style.

1. Cuerpos masivos (larges bodies) are bodies formed along major structures of significant vertical extent (several hundreds of meters), consistent geometry, and significant strike length, and are mined by bulk mining methods (SLC).
2. Cuerpos chicos (small bodies) are smaller mineralized bodies of high grades and are often less continuous and less regular in form than the Cuerpos masivos. They are typically mined by OCF or similar high-selectivity mining methods. Cuerpos chicos in the Cachi-Cachi area are referred to by the area designation “Cachi-Cachi” and Cuerpos chicos occurring in the vicinity of Mina Central are collectively referred to as “Cuerpos Pequeños”.

Two main mining methods are used, namely:

1. Mechanized SLC for Cuerpos masivos, and
2. Mechanized OCF for Cuerpos chicos.

Table 16-1 shows the mining method used by mineralization area and zone and Figure 16-3 shows an isometric view of the mining areas and mineralized zones.



Source: Sierra Metals, 2020

Figure 16-3: Yauricocha Isometric Showing Mining Areas and Mineralized Zones

Table 16-1: Mining Method by Mineralization Area and Zone

Area	Zone	Mining Method	Mining Method Description
Mina Central	Catas	SLCM2	Mechanized Sub Level Caving – Some Water Present
	Antacaca	SLCM2	Mechanized Sub Level Caving – Some Water Present
	Rosaura	SLCM3	Mechanized Sub Level Caving – Water Present
	Antacaca Sur	SLCM3	Mechanized Sub Level Caving – Water Present
Esperanza	Esperanza	SLCM1	Mechanized Sub Level Caving – No Water Present
	Norte	SLCM2	Mechanized Sub Level Caving – Some Water Present
	Distal	SLCM1	Mechanized Sub Level Caving – No Water Present
Mascota	Oxide Ag-Pb	SLCM1	Mechanized Sub Level Caving – No Water Present
	Polymetallic (All)	CRAM	Mechanized Overhand Cut and Fill
Cuye	All	SLCM1	Mechanized Sub Level Caving – No Water Present
Cachi – Cachi	Angelita	SLCM2	Mechanized Sub Level Caving – Some Water Present
	Karlita	CRAM	Mechanized Overhand Cut and Fill
	Elissa	CRAM	Mechanized Overhand Cut and Fill

Area	Zone	Mining Method	Mining Method Description
	Celia	SLCM2	Mechanized Sub Level Caving – Some Water Present
	Escondida	CRAM	Mechanized Overhand Cut and Fill
	Privatizadora	CRAM	Mechanized Overhand Cut and Fill
	Vanessa	CRAM	Mechanized Overhand Cut and Fill
	Yoselim	CRAM	Mechanized Overhand Cut and Fill
	Carmencita	CRAM	Mechanized Overhand Cut and Fill
Cuerpos Pequeños	Gallito	CRAM	Mechanized Overhand Cut and Fill
	Oriental	CRAM	Mechanized Overhand Cut and Fill
	Occidental	CRAM	Mechanized Overhand Cut and Fill
	Contacto Sur Medio (TJ 6060)	CRAM	Mechanized Overhand Cut and Fill
	Contacto Sur Medio I (TJ 8167)	CRAM	Mechanized Overhand Cut and Fill
	Contacto Sur Medio II (TJ 1590)	CRAM	Mechanized Overhand Cut and Fill

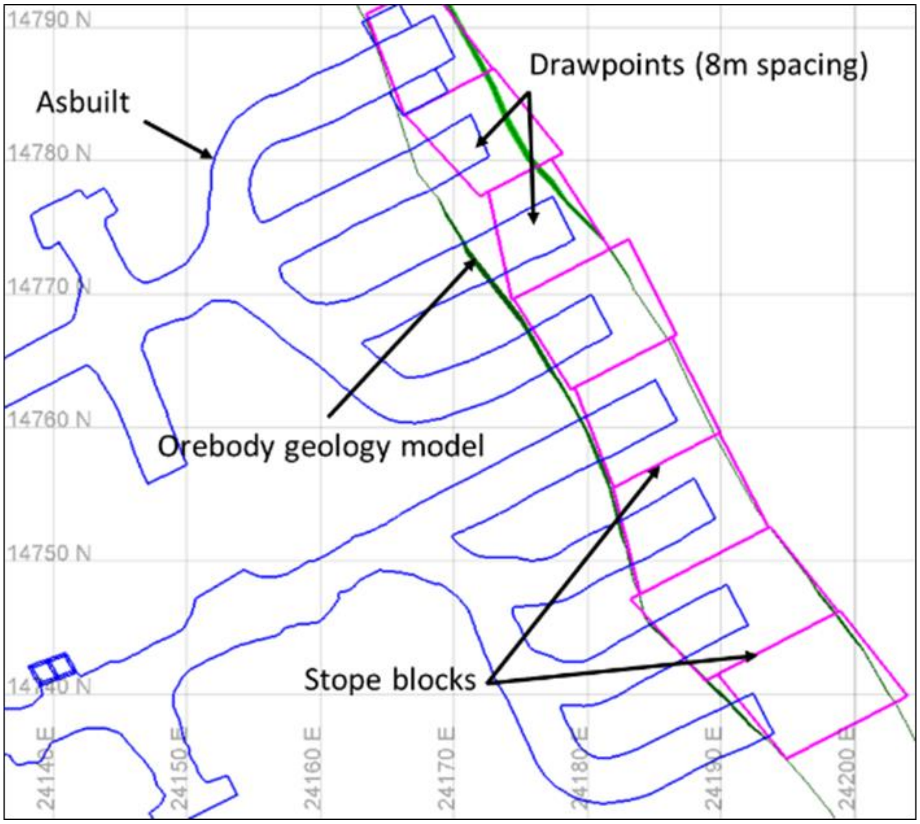
Source: Redco, 2020

16.4 Mining Method

16.4.1 Sub-level Caving (SLC)

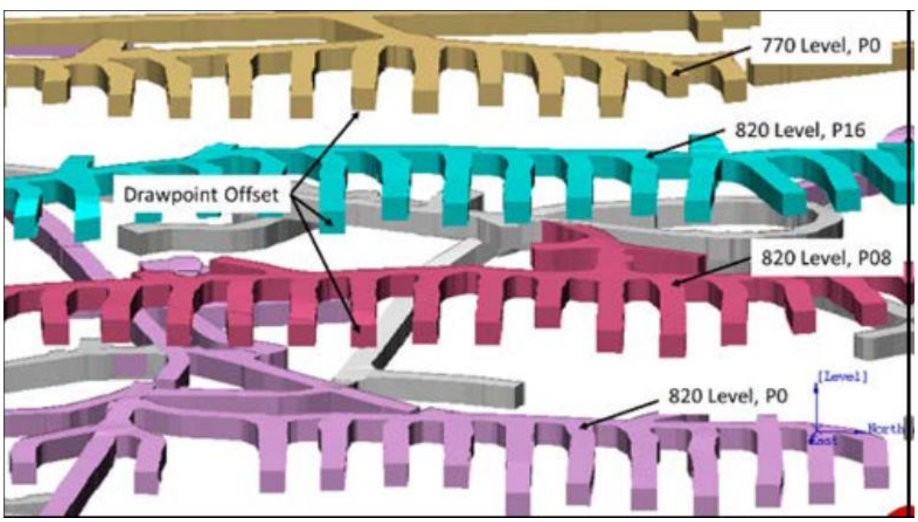
SLC is comprised of three sub-levels that are established for each 50 m level resulting in a planned 16.7 m between sub-levels labeled as pisos (floors). Material is caved from the sub-levels and recovered in a drawpoint. Drawpoints from the footwall into the mineralized material are typically 3.5 m wide x 3.5 m high and are spaced 8.0 m apart. Steel sets, shotcrete and bolting are used as ground support in the drawpoints and the length of each drawpoint varies with the thickness of the mineralized zones.

As the drawpoint is developed, samples of mineralized material are collected for grade control analysis from the left and right ribs. Upholes are drilled in stopes to initiate caving. Effective draw control is important to successful extraction for this mining method. Figure 16-4 shows a typical SLC layout, 870 Level - Piso 12 in Antacaca Sur. Figure 16-5 shows an isometric view of drawpoint as-builts in Mina Central illustrating the typical drawpoint layout and offset.



Source: Sierra Metals, 2020

Figure 16-4: Typical Sub-level Cave Layout, 870 Level - Piso 12 in Antacaca Sur (Plan View)

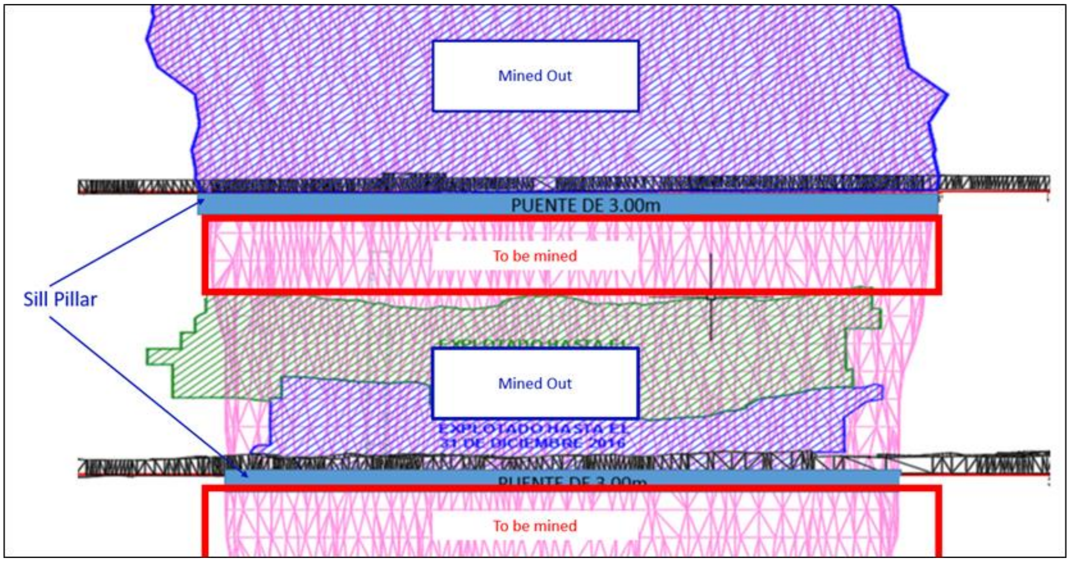


Source: Sierra Metals, 2020

Figure 16-5: Isometric View of Drawpoints in Mina Central (Looking West)

16.4.2 Overhand Cut and Fill (OCF)

OCF mining is employed in the smaller mineralized zones. Typically, the cuts are mined 2.0 m wide x 3.0 m high in an overhand (ascending) technique where the lower levels are filled as mining progresses to the next sub-level above. Sill pillars are left between levels as mining comes up underneath the previously mined level. Based on geotechnical constraints the sill pillars are typically a minimum of 3.0 m in thickness. The long section of the mineralized zone is shown in Figure 16-6 to show the method of OCF.



Source: Sierra Metals, 2020

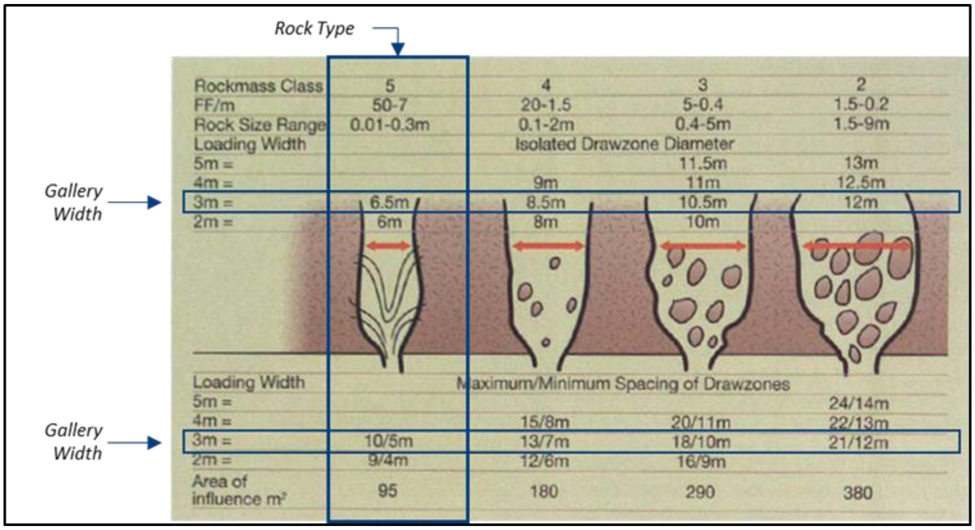
Figure 16-6: Schematic Showing Overhand Cut and Fill Mining (Long Section)

16.5 Mining Method Parameters

SLC is the primary mining method at Yauricocha representing 84% of the production. This method is in use Mina Central, Esperanza, Mascota, and Cuye. SLC and OCF are used for Cachi-Cachi, and only OCF is used for Cuerpos Pequeños.

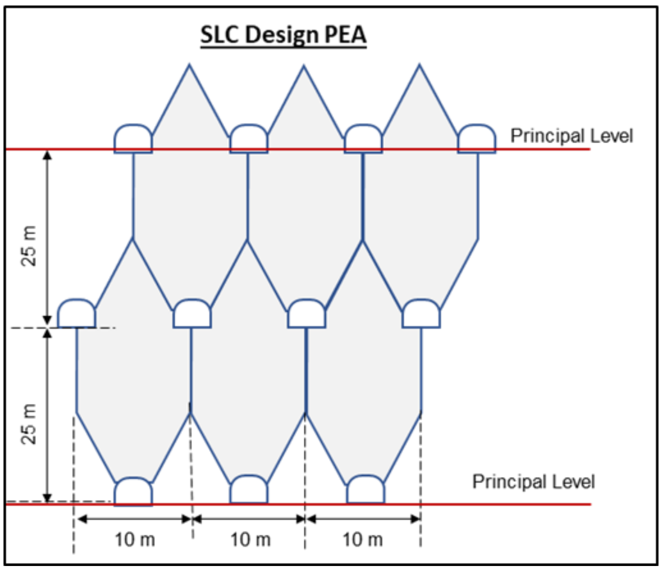
Currently, the mine uses horizontal distances of 8 m between the production windows, which translates into having effective pillars of 5 m.

Following previous studies by REDCO (PEA Analysis Yauricocha Mine 2018) and based on the Laubscher abacus (Figure 16-7), it was decided that in order to increase the production rate, the recommended horizontal distance between the production windows should be 10 m and the vertical distance between levels should be 25 m (Figure 16-8). These values were based on a design trade-off study considering dilution, recovery and an economic analysis using gravitational flow modelling.



Source: Redco, 2020

Figure 16-7: Laubscher Estimating for Drawpoints Design



Source: Redco, 2020

Figure 16-8: Final Stope Design for Yauricocha

Sub-Level Caving (SLC)

Principal levels, each 50 m apart, are divided in two sub-levels of 25 m. The rock support of the drawpoint can be a mix of ribs, shotcrete and/or bolts. The length of each drawpoint varies with the width of the mined body.

Design parameters for SLC and OCF are shown in Table 16-2 and Table 16-3 respectively.

Table 16-2: Parameters for SLC

Parameter	Value (m)
Level spacing	25.0 m
Drawpoint spacing	10.0 m
Labor width	3.5 m

Source: Sierra Metals, Redco, 2020

Table 16-3: Parameters for Mechanized OCF

Parameter	Value (m)
Cut width	2.0 m – 5.0 m
Cut high	3.0 m
Cut length	100 m – 120 m

Source: Sierra Metals, Redco, 2020

16.6 Parameters Relevant to Mine Designs

16.6.1 Geotechnical Data

This section presents details of the geotechnical data from previous studies, and additional data collected since, for this PEA study.

Field Investigations

Previous geotechnical field investigations focused primarily on the Antacaca Sur deposit (high mud-rush-risk area) and then extended to Antacaca, Catas, Rosaura and Mascota mining areas. As of 2015, the geotechnical investigations comprised 500 m of core logging and 6 km of mapping of the underground workings. In 2020, over 2,000 minor structures and discontinuities were mapped.

The geotechnical core logging was conducted to help delineate structural domains. SRK logged in accordance with the rock mass rating classification systems developed by Bieniawski (1976 and 1989). These classification systems are widely-used empirical methods for classifying the rock mass quality and internationally accepted practice. Data were collected on the following rock mass characteristics:

- lithology;
- faulting and shearing;
- orientation of structure for delineating joint sets;
- estimating intact rock strength;
- Rock Quality Designation (RQD);
- orientation of structure for delineating joint sets;
- number of discontinuities (joints);
- average fracture frequency; and

- joint spacing.

Data were also collected on the following discontinuity characteristics:

- openness/aperture;
- planarity;
- roughness;
- infilling/coating; and
- evidence of groundwater staining.

In the rock mass rating system, several of these characteristics have rating values which when summed together give a rock mass rating out of 100 points and an indication of the rock mass quality.

Summary rock mass rating results from the 6 km of underground mapping are presented in Table 16-4.

For the units encountered in the 6 km of workings mapped, Table 16-4 shows the statistics of the RMR_B89 data and Table 16-5 shows the statistics of the Geological Strength Index (GSI) data.

RMR_B(89)	**Crystallized Limestone**	**Marble Limestone**	**Grey Limestone**	**Skarn Limestone**	**Granodiorite**	**Monzonitic Intrusive**
Mean	**60**	**59**	**60**	**59**	**56**	**63**
Standard Error	0.3	0.6	1	0.5	2.2	0.9
Standard Deviation	10	10	10	10	10	10
Sample Variance	2.9	11	10.9	1.2	24.8	8.3
Minimum	**56**	**51**	**56**	**58**	**48**	**60**
Maximum	**62**	**64**	**64**	**60**	**62**	**67**

Source: Sierra Metals, Redco, 2020

Table 16-5: Summary Statistics of Geological Strength Index (GSI) from the Tunnel Mapping

GSI	**Crystallized Limestone**	**Marble Limestone**	**Grey Limestone**	**Skarn Limestone**	**Granodiorite**	**Monzonitic Intrusive**
Mean	**55**	**54**	**55**	**54**	**51**	**58**
Standard Error	0.3	0.6	1	0.5	2.2	0.9
Median	61	59	57	58	56	63
Standard Deviation	10	10	10	10	10	10
Sample Variance	2.9	11	10.9	1.2	24.8	8.3
Minimum	**51**	**46**	**51**	**49**	**45**	**55**
Maximum	**57**	**59**	**46**	**55**	**57**	**62**

Source: Sierra Metals, Redco, 2020

Although SRK was not provided with the geotechnical database for this PEA, Sierra stated that diamond cored drillholes (DDH) collared underground were geotechnically logged in accordance with RMR_B(89) and GSI rock mass rating systems. Although rating systems can be converted, the correlations are sometimes variable and area specific. As such, best practice is to collect data for two different systems. SRK understands, based on discussion with Sierra, that logging for the Q' (Barton, 1974) rock mass rating system is now also being conducted. The Q-system is most commonly used for underground applications and there are numerous industry-standard empirical design charts (e.g., ground support) established for this system.

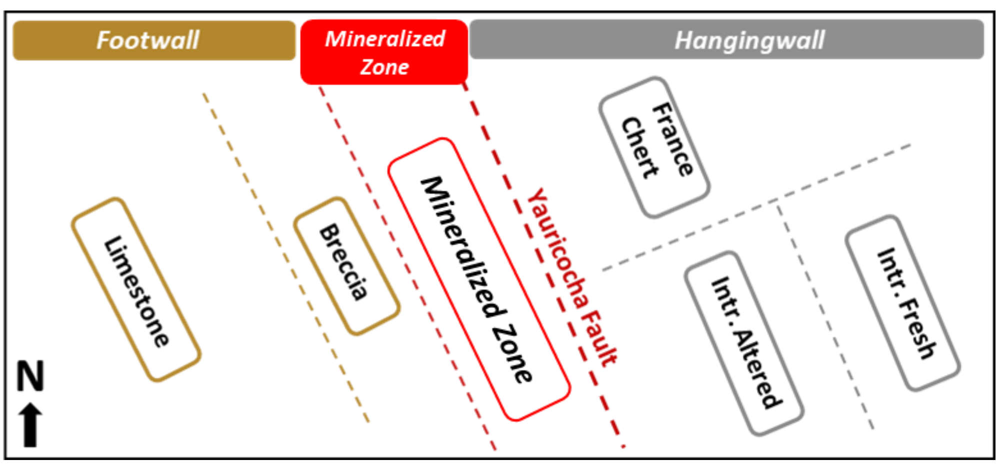
For this PEA, Sierra provided SRK with project geological models for the mining areas. The databases in each model contained details on each drillhole: collars, downhole survey and lithology, but did not contain geotechnical data. Although it is unclear which drillholes had geotechnical data collected, Table 16-6 provides a summary of the DDH in the models that are dated after 2015.

Table 16-6: Summary of Diamond Cored Drillholes Since 2015

Mining Area	Diamond Cored Drillholes	
	Number	Total Meters
Cuerpos Chicos	218	12.630,00
Esperanza	322	22.387,90
Mascota	17	1.510,00
Mina Central	131	13.169,40
Mina Cachi Cachi	133	11.277,30

Source: Sierra Metals, Redco and validated by SRK, 2020

Three broad geotechnical units; i) Hangingwall, ii) Footwall, and iii) Mineralized zone (Figure 16-9) were identified. Each geotechnical domain was subdivided into different geotechnical sub-domains based on rock mass quality and rock mass strength.



Source: Sierra Metals, Redco, 2020

Figure 16-9: Conceptual Geotechnical Model (Plan View)

i) The hangingwall domain also has two sub-domains, i) Intrusive, and ii) Weathered Intrusive. The intrusive is fresh and characterized as good to very good quality rock. The information collected from drainage drillholes indicates that the $RMR_B(89)$ ranges between IIIB to IIB.

The weathered intrusive sub-domain is an altered intrusive with low rock quality and low intact rock strength. This material is located on the immediate hangingwall of the mineralized material on the contact with the Yauricocha fault. This sub-domain is characterized by cubic blocks of intrusive material with clay infilling, which significantly reduces its rock mass strength. Closer to the fault there is more clay infill between blocks. Field observations and core logging indicate that the highly weathered intrusive hangingwall extends up to about 20 m from the Yauricocha fault.

ii) The footwall limestone domain is massive and covers most of the underground workings. Even though geologically there are different types of limestones, the $RMR_B(89)$ and the laboratory test results suggest that various limestones have similar mechanical behavior and can be grouped into a single geotechnical unit, referred to as “fresh limestone”. The altered breccia sub-domain is located along the immediate footwall contact with the mineralized zone. This sub-domain comprises weak altered material. Field observations indicate the footwall breccia is discontinuous and with variable thickness.

iii) The mineralized material has been defined as a separate geotechnical domain because of its distinctly weaker characteristics. The data (i.e. field observations, core logging and laboratory tests) indicate that this unit behaves as granular material. To understand the effect of the strength parameters under different moisture levels, five remolded multi-stage undrained triaxial tests were conducted at different moisture levels (2%, 3%, 4.8%, 6%, and 8%). The test results indicate reduction in strength with increasing moisture. The mineralized material has significantly lower cohesion at higher moisture contents, but the internal friction angle is only reduced slightly.

Mapping and Logging

For the 2015 technical study, the geotechnical field investigations focused primarily on the Antacaca Sur deposit (high mud-rush-risk area) and then extended to Antacaca, Catas, Rosaura and Mascota mining areas. As of 2015, the geotechnical investigations comprised 500 m of core logging, and 6 km of mapping of the underground workings. Then in 2020, over 2,000 minor structures and discontinuities were mapped.

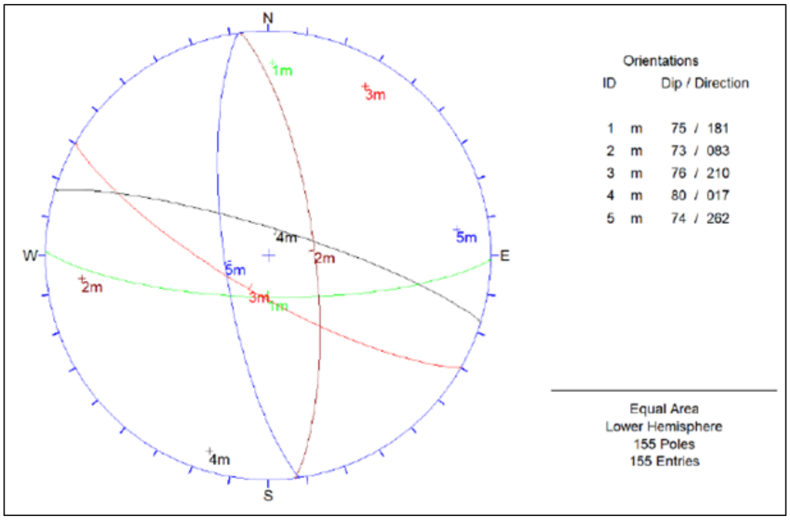
For this PEA, the main source of information for rock characterization comes from the underground characterization by DCR Ingenieros. DCR Ingenieros mapped in accordance with the rock mass rating classification systems developed by Bieniawski (1976 and 1989). These classification systems are widely-used empirical methods for classifying the rock mass quality and internationally accepted practice. Data were collected on the following rock mass characteristics:

- lithology;
- type of joint set;

- orientation of structure for delineating joint sets;
- joint spacing;
- persistence;
- openness / aperture;
- roughness;
- infilling / coating;
- weathering; and
- evidence of groundwater staining.

For interpretation of structural data, the joint sets registered in geological plans developed by the Geology Department of the Yauricocha Mine and data registered by DCR Ingenieros were used. To establish the joint sets distribution, data were processed in the software DIPS. The results indicate the existence of two main systems of joint sets and three secondary systems of joint sets (Figure 16-10):

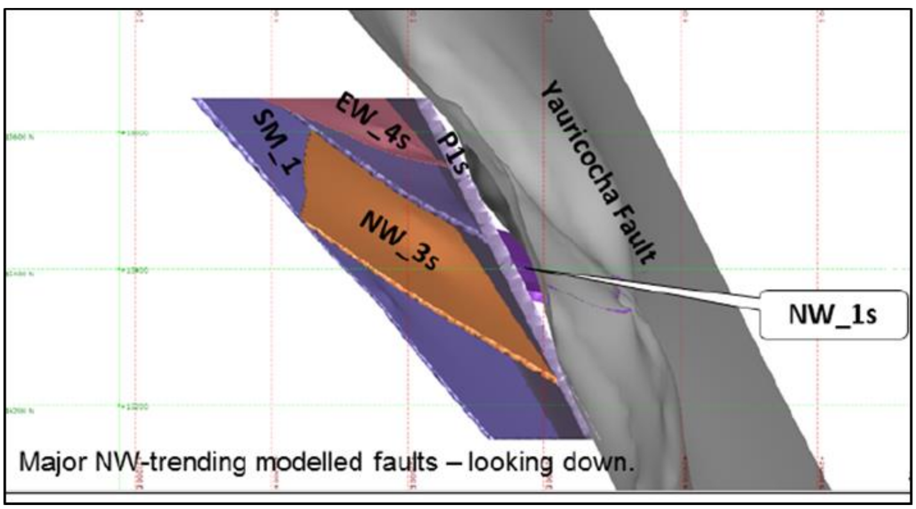
- System 1, azimuth EW and high dip to S;
- System 2, azimuth NS and high dip to E;
- System 3, azimuth NWW and high dip to SW;
- System 4, azimuth NWW and high dip to SE; and
- System 5, azimuth NNW and high dip to SW.



Source: DCR Ingenieros, 2019

Figure 16-10: Stereogram of Main Joint Families

Faults have a spacing of 20 m and a persistence between tens and hundreds of meters generally. These faults are located generally parallel to the Yauricocha fault. In the case of faults with infilling materials like clays and oxides, the aperture is between 10 to 50 cm. These faults are the conduit for the transport of underground water. Based on historical mapping and logging historical information, SRK developed a 3D Model of 13 main faults shown in Figure 16-11.



Source: SRK, 2015

Figure 16-11: Major Fault (Isometric View)

The source of information to classify the rock mass was the underground mapping in different levels of the mine. Also, it considered past information obtained from the upper levels of the mine developed by the Geomechanics Department of the Yauricocha Mine.

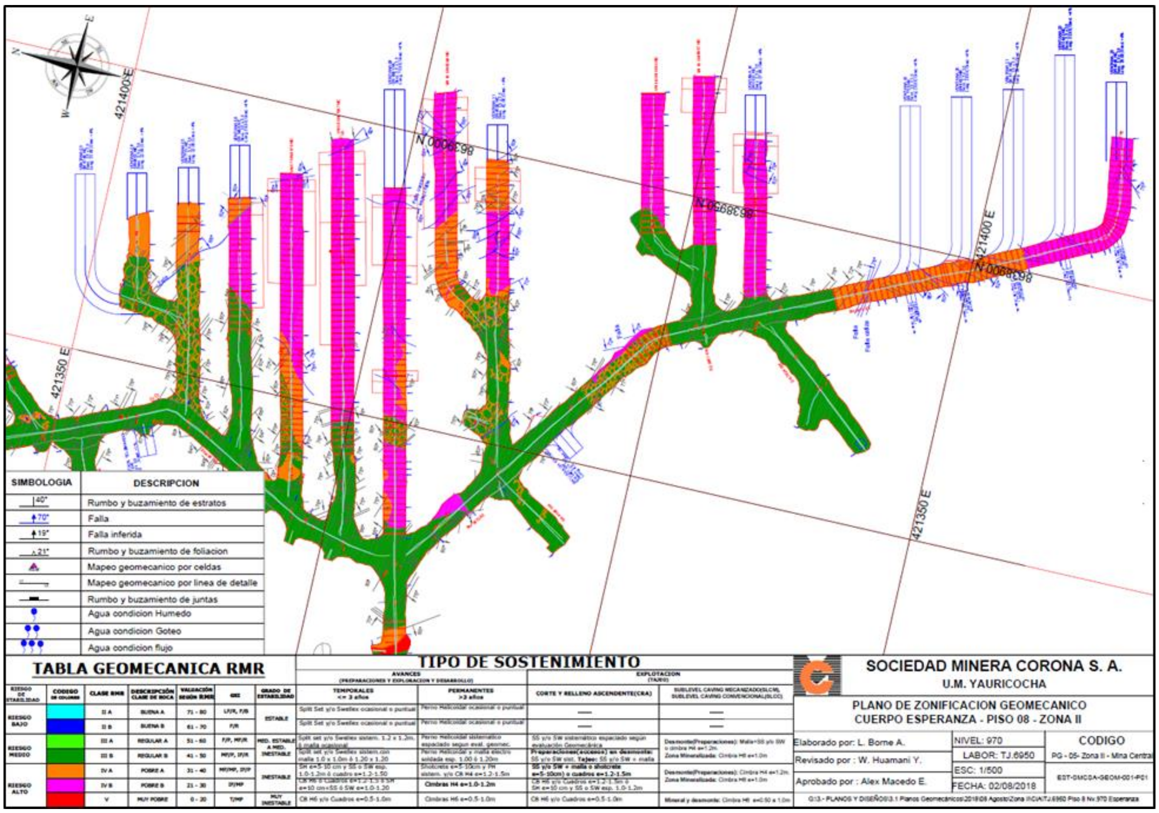
Results are shown in Table 16-7 as ranges of RMR for the domains mentioned above.

Table 16-7: Rock Mass Characterization for Domain

Domain	RMR Range	Rock Mass Characterization
Limestone	43 – 54	IIIB & IIIA
Mineralized Material	<21 – 22	V & IVB
Intrusive	47 – 53	IIIB & IIIA

Source: Sierra Metals, Redco, 2020

An example ground control management level plan showing the footwall development and mining access is shown in Figure 16-12. Consistent with the conceptual rock mass model, openings in the mineralized zones are shaded pink representing poor quality rock, development openings in the fresh limestone sub-domain are shaded green representing medium quality rock, and the limestone/mineralized zone contact is an intermediate (i.e., between pink and green) rock quality zone shaded orange.



Source: Sierra Metals, 2020

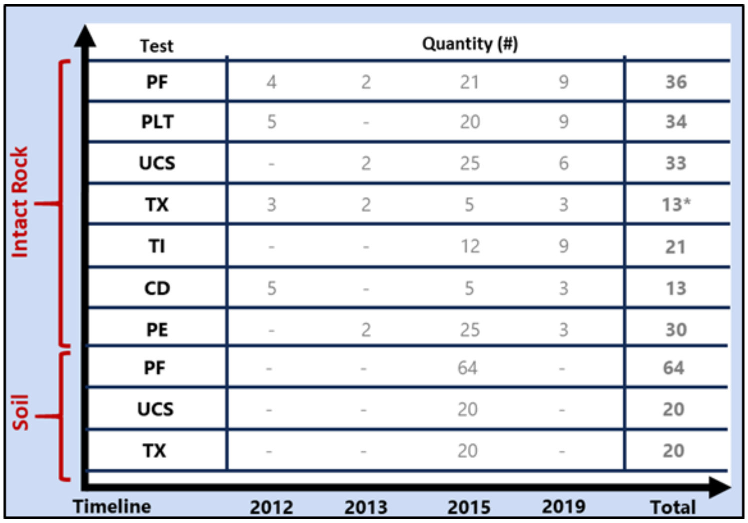
Figure 16-12: Example Ground Control Management Level Plan

Laboratory

Between 2012 and 2019 SRK, Minera Corona and DCR Ingenieros collected rock samples for laboratory strength testing. SRK defined the laboratory specifications according to international testing standards and prepared several memorandums specifying testing requirements. The intact rock tests were conducted for intrusive and limestone domains, and the Soil mechanics test were conducted for the mineralized material due to its granular behavior.

The intact rock tests were for physical properties, point load test, uniaxial compression strength, triaxial compression strength, Brazilian indirect tensile, direct shear and elastic modulus. Soil tests measured physical properties, uniaxial compression strength and triaxial compression strength.

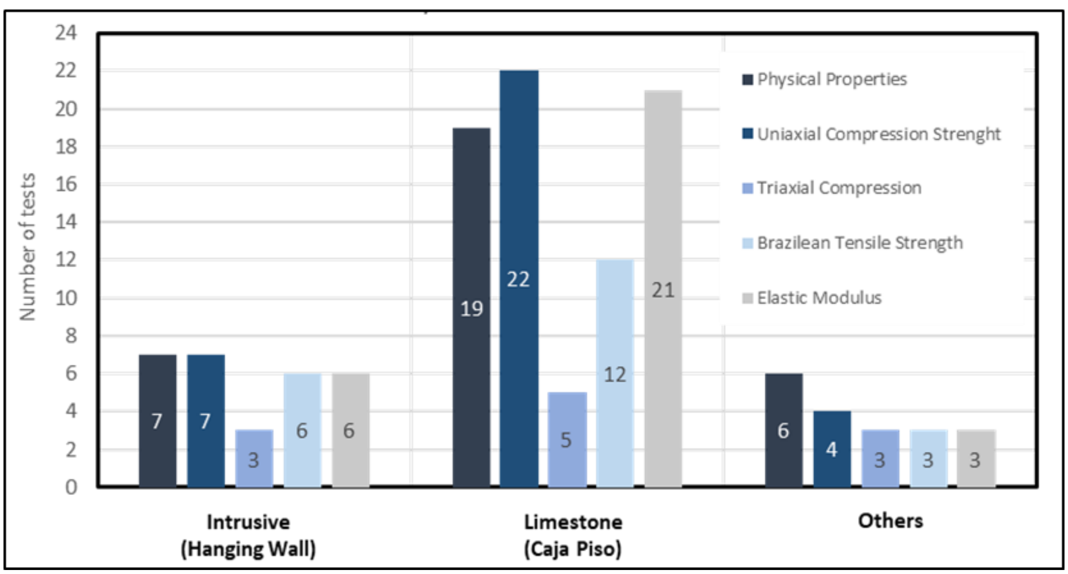
The laboratory testing timeline is shown in Figure 16-13 and the specific number of tests by domain is shown in Figure 16-14 and Figure 16-15. The spatial locations of samples collected for laboratory tests are shown in Figure 16-16.



	Test	Quantity (#)				
Intact Rock	PF	4	2	21	9	36
	PLT	5	-	20	9	34
	UCS	-	2	25	6	33
	TX	3	2	5	3	13*
	TI	-	-	12	9	21
	CD	5	-	5	3	13
	PE	-	2	25	3	30
Soil	PF	-	-	64	-	64
	UCS	-	-	20	-	20
	TX	-	-	20	-	20
	Timeline	2012	2013	2015	2019	Total

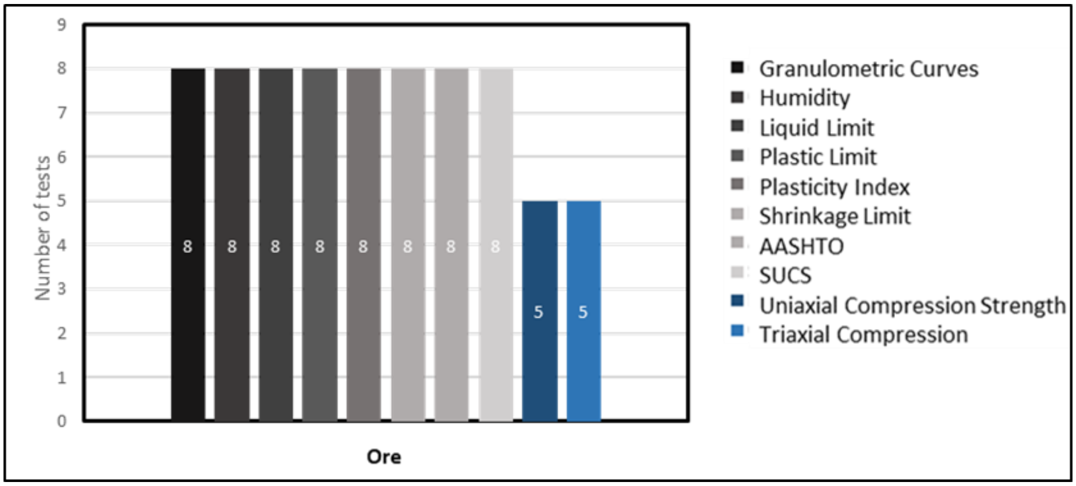
Source: Sierra Metals, Redco, 2020

Figure 16-13: Timeline for Laboratory Test



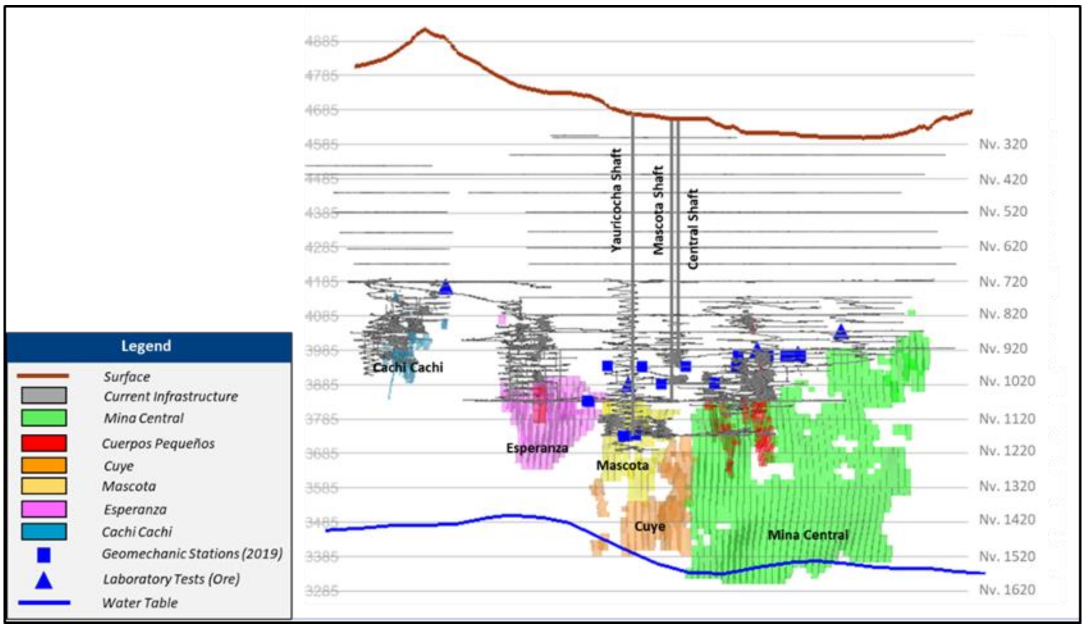
Source: Sierra Metals, Redco, 2020

Figure 16-14: Rock Mechanics Laboratory Tests (Intrusive and Limestone) Between 2012 to 2019



Source: Sierra Metals, Redco, 2020

Figure 16-15: Soil Mechanics Laboratory Tests (Mineralized Material) Between 2012 to 2019



Source: Sierra Metals, Redco, 2020

Figure 16-16: Laboratory Tests Spatially Georeferenced (Northeast View)

Table 16-8, Table 16-9 and Table 16-10 show the Uniaxial Compressive Strength (UCS), Elastic Modulus (E), and Poisson Ratio (PR) by rock domain.

Table 16-8: Summary of Uniaxial Compressive Strength (UCS) by Domain

Uniaxial Compressive Strength (UCS)					
Domain	**Minimum**	**Maximum**	**Mean**	**Std. Dev.**	**Var. Coef.**
Limestone	22	74	52	12	22%
Intrusive	107	193	155	34	22%

Source: Sierra Metals, Redco, 2020

Table 16-9: Summary of Elastic Modulus (E) by Domain

Elastic Module (E)					
Domain	**Minimum**	**Maximum**	**Mean**	**Std. Dev.**	**Var. Coef.**
Limestone	6	21	15	4	25%
Intrusive	20	26	22	2	11%

Source: Sierra Metals, Redco, 2020

Table 16-10: Summary of Poisson Ratio (PR) by Domain

Poisson Ratio (PR)					
Domain	**Minimum**	**Maximum**	**Mean**	**Std. Dev.**	**Var. Coef.**
Limestone	0.2	0.3	0.3	0	9%
Intrusive	0.2	0.2	0.2	0	5%

Source: Sierra Metals, Redco, 2020

16.6.2 Rock Mass Characterization

Rock Mass Strength

For the definition of the resistance parameters that characterize the rock mass, the Generalized Hoek and Brown (2002) failure criterion has been used; for the scaling of properties (resistance envelope of the rock mass), the uniaxial compressive resistance parameters (UCS) of the intact rock, the intact rock parameter “mi” (which is estimated from the triaxial compression laboratory tests), the GSI of the rock mass and the disturbance factor “D” (as a measure of grade of disturbance product of the blasting) have been used.

The UCS defined for each geomechanical domain of the Yauricocha Mine has been obtained as a result of UGC laboratory tests to estimate the UCS of the intact rock. The representative samples considered for each domain were contrasted with the predominant lithologies and the spatial location of the samples within each established geomechanical domain.

The parameter "mi" is related to the slope of the resistance curve of the intact rock; this curve is generated by graphing the confinement and the breaking load of the intact rock cores as results of the triaxial compression tests.

The GSI value describes the quality of the rock mass and this is obtained using the results of the three-dimensional model of rock mass qualities RMR described in the previous section for each domain. Since the mapping log results indicate wet conditions, the correction formula (Hoek and Brown 1997) described below is used to estimate the GSI based on the RMR.

$$GSI = RMR'_{89} - 5$$

This correction is made due to the fact that the RMR calculated for the boreholes uses the criterion of Bieniaswki 89 (whose assessment of the presence of water for dry conditions is 15) and the GSI must be estimated from the RMR Bieniaswki 76 (whose weighting of water for dry conditions has a maximum score of 10).

The disturbance factor “D” is related to the degree of disturbance on the excavations caused by the blasting. This factor is measured by field observations; it should be noted that since it is a simplified model and considering that the rocky environment on which it is will carry out the excavations has not been disturbed, therefore, a “D” value equal to zero (0) is considered.

The equations that describe the Generalized Hoek and Brown 2002 failure criterion are detailed below.

$$\sigma'_1 = \sigma'_3 + \sigma_{ci}\left(m_b \frac{\sigma'_3}{\sigma_{ci}} + s\right)^a$$

Where:

σ'_1 and σ'_3 are the major and minor effective principal stresses.

"σ_{ci}" is the uniaxial compressive strength of the intact rock.

"m_b" is the reduced value of the rock constant m_i and is given by:

$$m_b = m_i \; exp\left(\frac{GSI - 100}{28 - 14D}\right)$$

"s" and "a" are constants for the rock mass given by the following relationships:

$$s = exp\left(\frac{GSI - 100}{9 - 3D}\right)$$

$$a = \frac{1}{2} + \frac{1}{6}\left(e^{-GSI/15} - e^{-20/3}\right)$$

To estimate the modulus of elasticity (E), the equations proposed by Hoek and Diederichs are used, in which the factor "MR" (Modulus Ratio proposed by Deere) is used to estimate the E of the intact rock to subsequently scale to rocky massif according to the following equations:

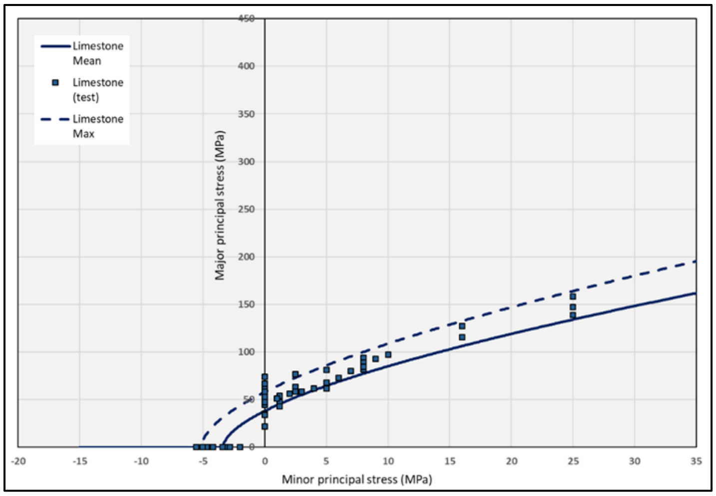
$$E_i = MR \; \sigma_i$$

$$E_{rm} = E_i\left(0.02 + \frac{1 - D/2}{1 + e^{\left(\frac{60+15D-GSI}{11}\right)}}\right)$$

The “MR” parameter is calculated using the empirical table proposed by Deere, defining value ranges according to the type of rock.

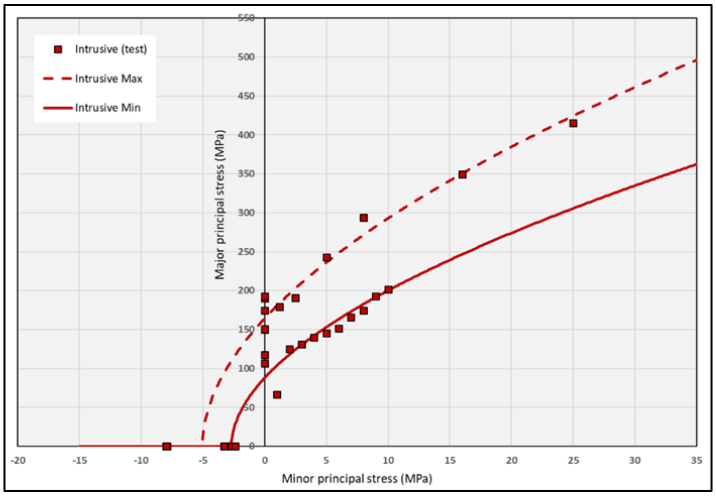
The Poisson's Ratio (PR) is part of the elastic constants that measures the relationship between lateral strain and axial strain, and considers a value between 0.2 and 0.3.

Figure 16-17 and Figure 16-18 show the envelopes of limestone and intrusive as a result of laboratory tests.



Source: Sierra Metals, Redco, 2020

Figure 16-17: Intact Rock Strength Envelope Hoek – Brown (Limestone)



Source: Sierra Metals, Redco, 2020

Figure 16-18: Intact Rock Strength Envelope Hoek – Brown (Intrusive)

Based on the failure envelopes for each lithology, the following parameters are defined at the intact rock level for limestone (Table 16-11) and intrusive (Table 16-12).

Table 16-11: Intact Rock Strength Parameters – Limestone

Limestone	UCS (MPa)	mi
Fresh Limestone	58	11
Breccia	38	11

Source: Sierra Metals, Redco, 2020

Table 16-12: Intact Rock Strength Parameters – Intrusive

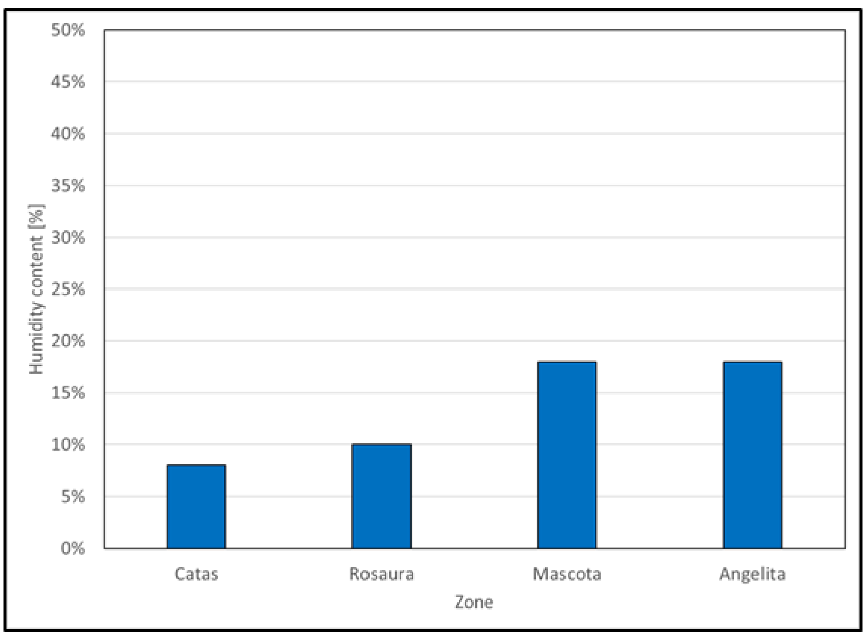
Limestone	UCS (MPa)	mi
Intrusive	164	32
Weathered Intrusive	88	32

Source: Sierra Metals, Redco, 2020

Mineralized Material Strength

Given that the mineralized material has soil-like behavior, parameters were calculated with laboratory soil tests of triaxial compression strength, uniaxial compressive strength, humidity content, the results of which are shown in the figures below.

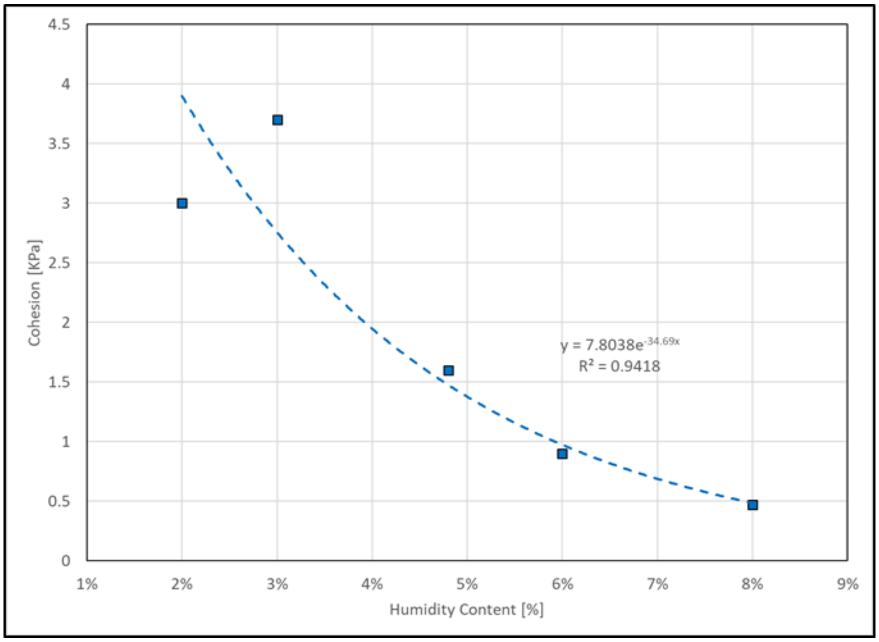
Based on the moisture content tests, it is determined that the mineralized areas of Mina Central have an average moisture content of 10% while the Cachi Cachi and Mascota areas have an average natural moisture content of 18% (Figure 16-19).



Source: Sierra Metals, Redco, 2020

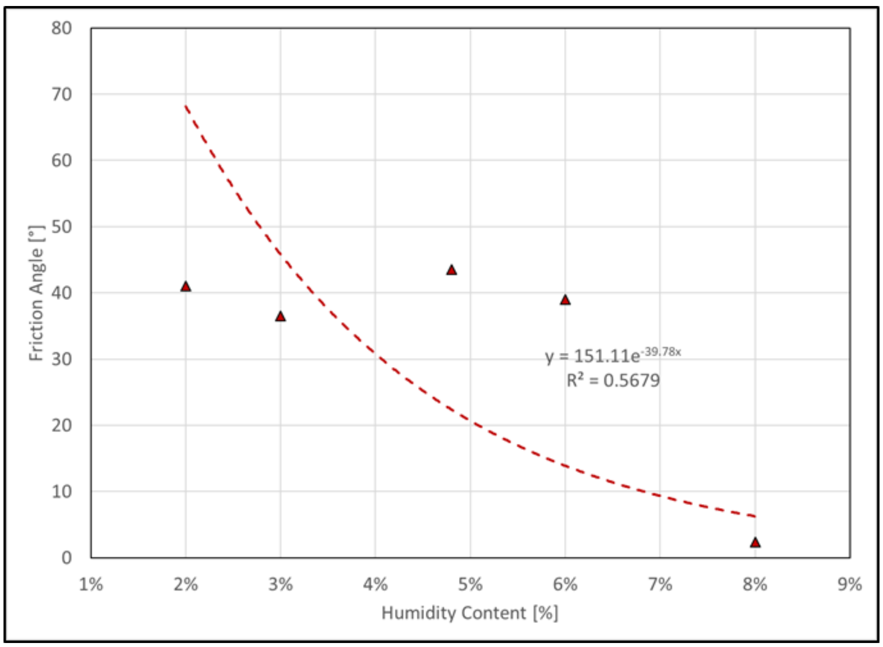
Figure 16-19: Humidity Content Test

A regression was performed based on the results of the triaxial compression tests, which allows the cohesion and internal friction angle (from the Mohr-Coulomb criterion) to be defined based on the moisture content of the material (Figure 16-20, Figure 16-21).



Source: Sierra Metals, Redco, 2020

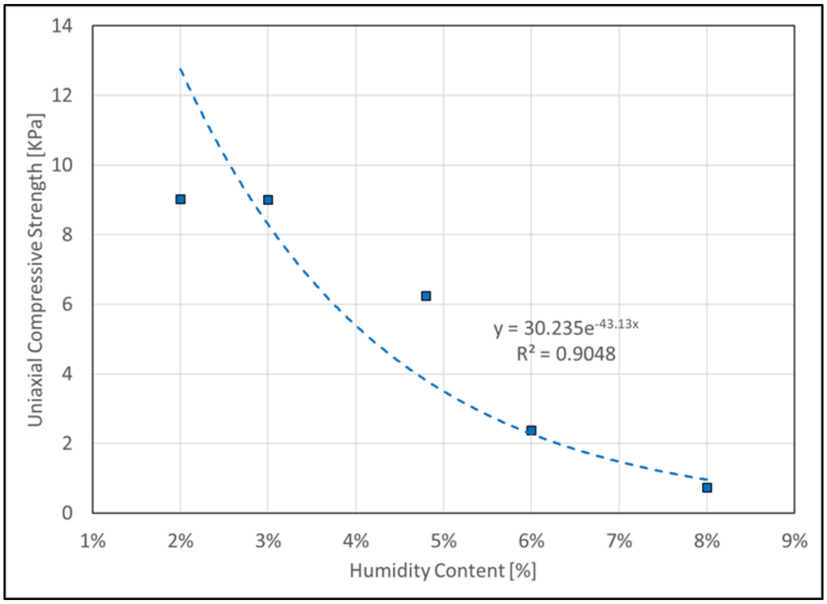
Figure 16-20: Cohesion vs Humidity (Mineralized Material)



Source: Sierra Metals, Redco, 2020

Figure 16-21: Internal Friction Angle vs Humidity (Mineralized Material)

In addition, unconfined uniaxial compressive tests were carried out for the mineralized material samples, according to the regression it is estimated that the UCS is 0.4 KPa for a moisture content of 10% which is a representative value for the Mina Central area (Figure 16-22).



Source: Sierra Metals, Redco, 2020

Figure 16-22: Uniaxial Compressive Strength vs Humidity (Mineralized Material)

The following describes the characterization parameters of the rock mass under study according to the defined domains. This information is supported by information from laboratory tests and observations of rock mass qualities identified in the underground mapping work.

For the limestone and intrusive rock domains, the Hoek and Brown criterion is used and for the mineralized material, because it is granular material, the Mohr Coulomb criterion is used. Table 16-13 and Table 16-14 show the rock strength parameters.

Table 16-13: Rock Mass Strength Parameters

	Footwall		Hangingwall	
Parameters	**Fresh Limestone**	**Breccia**	**Intrusive**	**Weathered Intrusive**
Unit Weight (MN/m^3)	2.7	2.7	2.6	2.6
UCS (MPa)	58	38	164	88
RMR_B(89)	54	43	53	47
GSI	49	38	48	42
D	0	0	0	0
mi	11	11	32	32
mb	1.8	1.2	4.9	4
s	0.0035	0.001	0.003	0.016
a	0.5	0.5	0.5	0.5
MR	500	500	425	425
Ei (Gpa)	29	19	70	37
Erm (Gpa)	8	3	19	7
v	0.3	0.3	0.2	0.2

Source: Sierra Metals, Redco, 2020

Table 16-14: Rock Mass Strength Parameters

	Mineralized Material	
Parameters	**Mina Central (10% moisture content)**	**Mascota and Cachi Cachi (18% moisture content)**
Cohesion (KPa)	0.24	0.02
Friction angle (°)	2.80	0.10

Source: Sierra Metals, Redco, 2020

Ground Control

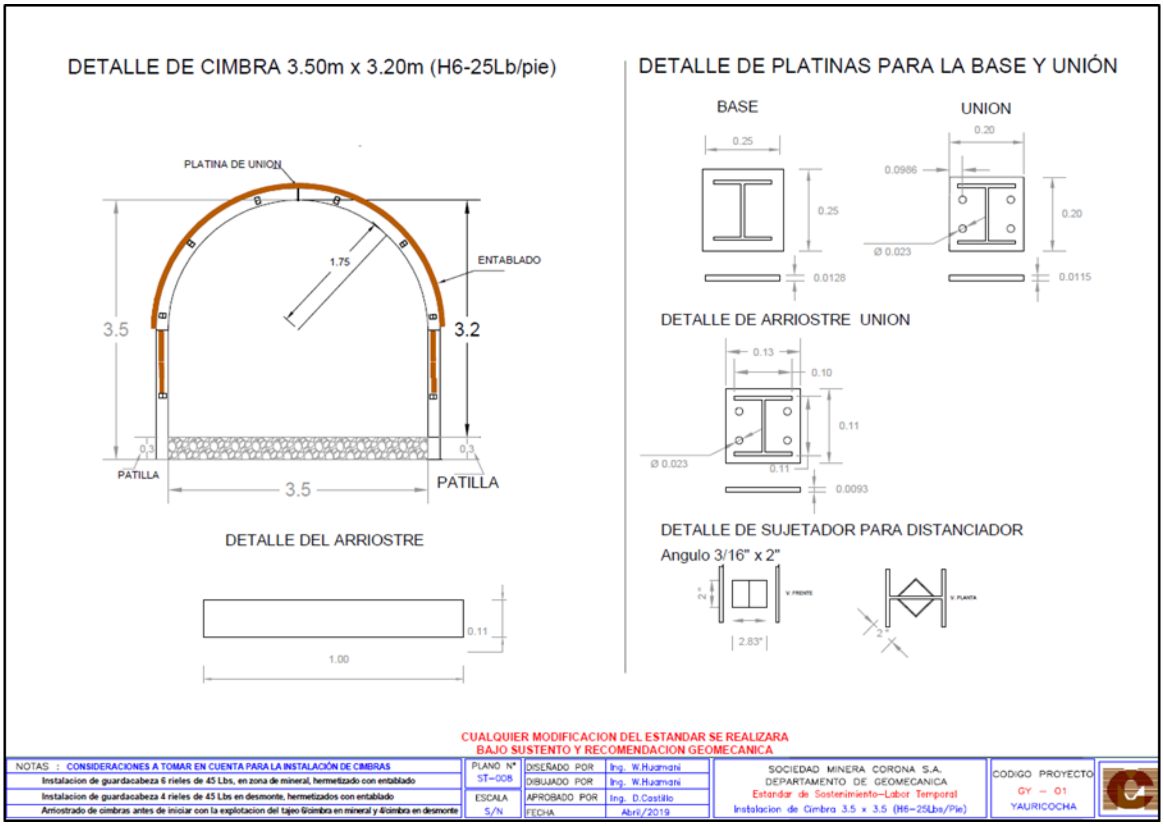
Corresponding to the categories of rock mass quality, the ground control management plans have a table of the ground support types (Figure 16-23). The ground support requirements are defined by development type, design life; temporary (<3 years) or permanent (>3 years), and mining method. Ground support for access development ranges from spot bolting using split sets in very good ground to steel sets, blocking and lagging for very poor ground.

TIPO DE SOSTENIMIENTO			
AVANCES (PREPARACIONES Y EXPLORACION Y DESARROLLO)		EXPLOTACION (TAJEO)	
TEMPORALES <= 3 años	PERMANENTES >3 años	CORTE Y RELLENO ASCENDENTE(CRA)	SUBLEVEL CAVING MECANIZADO(SLCM), SUBLEVEL CAVING CONVENCIONAL(SLCC)
Split Set y/o Swellex ocasional o puntual	Perno Helicoidal ocasional o puntual	—	—
Split Set y/o Swellex ocasional o puntual	Perno Helicoidal ocasional o puntual	—	—
Split set y/o Swellex sistem. 1.2 x 1.2m. ó malla ocasional	Perno Helicoidal sistematico espaciado segun eval. geomec.	SS y/o SW sistemático espaciado según evaluación Geomecánica	**Desmonte(Preparaciones):** Malla+SS y/o SW o cimbra H4 e=1.2m. **Zona Mineralizada:** Cimbra H6 e=1.0m
Split set y/o Swellex sistem.con malla 1.0 x 1.0m ó 1.20 x 1.20	Perno Helicoidal y malla electro soldada esp. 1.00 ó 1.20m	**Preparaciones(accesos) en desmonte:** SS y/o SW sist. **Tajeo:** SS y/o SW + malla	
SH e=5-10 cm y SS o SW esp. 1.0-1.2m ó cuadro e=1.2-1.50	Shotcrete e=5-10cm y PH sistem. y/o CB H4 e=1.2-1.5m	**SS y/o SW + malla o shotcrete e=5-10cm) o cuadros e=1.2-1.5m**	**Desmonte(Preparaciones):** Cimbra H4 e=1.2m. **Zona Mineralizada:** Cimbra H6 e=1.0m
CB H6 ó Cuadros e=1.2-1.5 ó SH e=10 cm+SS ó SW e=1.0-1.20	**Cimbras H4 e=1.0-1.2m**	CB H6 y/o Cuadros e=1.2-1.5m ó SH e=10 cm y SS o SW esp. 1.0-1.2m	
CB H6 y/o Cuadros e=0.5-1.0m	Cimbras H6 e=0.5-1.0m	CB H6 y/o Cuadros e=0.5-1.0m	**Mineral y desmonte:** Cimbra H6 e=0.50 a 1.0m

Source: Sierra Metals, 2020

Figure 16-23: Ground Support Types

Ground support design profiles for different ground categories and development types have been developed to accompany the ground control management plans. An example profile showing the mining cross-cut ground support is shown in Figure 16-24. Ground support installation and mining procedures also support these documents.



Source: Sierra Metals, 2020

Figure 16-24: Example of Ground Support Design Profile

Hydrogeological Conditions

Hydrogeological and hydrological information is available from multiple sources, including mine records and many investigations or data compilations by external consultants. Mine operations have compiled significant information on flow rates and field water quality parameters (e.g., color, pH, conductivity, temperature) across much of the mine and developed maps summarizing locations and data. Numerous hydrogeological and hydrological studies have also been completed by external consultants (Geologic, 2014, 2015; Hydro-Geo Consultores, 2010, 2012, 2016; Geoservice Ingenieria 2008, 2014, 2016; Helium, 2018). Data have been collected from underground observations, pump tests, tracer tests, and surface water features.

Hydrogeological Conceptual Model:

- Annual average precipitation of 1010 mm (measured at Yauricocha station);
- Runoff of 268 mm (27% of the total precipitation);
- Depth of infiltration of 265 mm (26% of the total precipitation); and
- Actual depth of the evapotranspiration of 477 mm (47% of the total precipitation).

Current Mine Inflow

Cumulative inflow into the mine was on the order of 100 L/s in 2017 (Helium, 2018). Inflow measurements have been collected at many locations (drainage drill holes and discrete inflows) and at different times, but data is somewhat inconsistent. Water enters the mine in widely distributed areas and drainage drill holes located on various levels.

Water comes from two sources:

1. Infiltration of water coming from fluvial precipitation through the subsidence zone that covers the mine; and
2. Discharge of underground waters from the east to the west (from the intrusive toward the cone of subsidence).

Infiltration related to subsidence includes flows into both the subsidence depressions themselves as well as tensional features associated with them. A diversion channel redirects a portion of runoff away from subsidence depressions but water that is not diverted can be expected to flow towards drawpoints through the subsidence zone. Lateral groundwater inflow into the subsidence zone also contributes.

Surface infiltration into the subsidence zone was estimated to be 11 L/s before 2015 and could increase to between 30 and 46 L/s by 2029 (Geologic, 2015).

Potential Future Mine Inflow

As mining advances, mine inflows can be expected to increase, at least in part due to increase in size of the subsidence cone.

- Surface inflows could increase by between 20 and 35 L/s by 2029 (Geologic, 2015; Geoservice, 2017); and
- Groundwater inflows were estimated to increase by up to 330 L/s when the mining reaches 3600 m elevation (Geologic, 2015).

Mitigation measures should continue to be considered to reduce inflow or at least control the way water enters and is controlled throughout the mine.

Future Mine Water Management Considerations

Current observations and analyses suggest that inflow to both the subsidence (caving) zone and the mine will increase as the mine expands. Mitigation and management efforts should continue to understand the distribution of water and value in efforts to control or reduce inflow. Uncontrolled water inflow can lead to a risk of mud rush events.

Past efforts have been made to control or reduce inflows. A large amount of data is available that could be used to understand the source of water, but it is currently not compiled in a manner to allow this to be easily done.

In the past, drainage tunnels and exploratory test drill holes have been completed in efforts to control or reduce inflow to mining areas. Drain holes were completed in the 920 and 870 levels in Antacaca Sur, 920 level in Antacaca, 920 and 970 levels in Catas and 870 and 920 levels in Rosaura. All of these water management features were oriented into the granodiorite to intercept flow before reaching the subsidence zone. Some of drillholes were later cemented to reduce inflows into mining zones.

During drilling, inflows were observed to decrease on the 820 and 870 levels, and post drilling decreasing inflows were observed on the 920 level. Inflows in Antacaca Sur and Rosaura have been reduced over time, but inflows appear to be increasing in Catas and Esperanza.

In conclusion, the mine has in the past, or currently, been able to manage water sufficiently to allow mining to proceed. As the mine expands, water inflows should be expected to increase. Mitigation efforts should continue to be assessed and tested, but operational management plans should continue to assume that inflows and mud rush potential will increase until such a time that the effectiveness of mitigation efforts can be proven, or decisions are made to address water-related risks through other management plans.

16.7 Stope Optimization

16.7.1 Dilution and Recovery Factor

Measured and Indicated Mineral Resources were converted to a mineable inventory by applying the appropriate modifying factors, as described herein, to the final MSO shapes created during the mine design process. The mining recovery and external dilution factors used in this report are based on historical Yauricocha data and are the factors used in the planning processes currently implemented at the site.

The in-situ tonnage and grade of each potential mining block is based on the resource block models. The dilution factor represents external dilution and range between 10% to 25% and varies based on mining method, geomechanical characteristics of the mineralized zone, and the amount of water present. These factors account for material mined from outside of the MSO shapes including overdraw of cave material and is in addition to any internal dilution.

Internal dilution is included within the MSO shapes generated and is therefore included in the in-situ tonnes and grades. External and internal dilution are assigned a zero grade. The mining recovery factors represents how much of the diluted stope material will reach the mill and ranges between 70% to 100% based on historical data and accounting for the mining method, geomechanical characteristics of the mineralized zone, and the amount of water present as this affects the mining recovery.

The generalized formula for calculating the reserve tonnage in each mining block is:

- Mineable Tonnes = (Tonnes) mining block * Mining Recovery % * (1 + Dilution %).

The generalized formula for calculating the mineable inventory grade is:

- Mineable Inventory Grade = (Resource Grade) mining block / (1 + Dilution %).

Table 16-15 lists the mining recovery and external dilution factors applied to each mineralized zone based on the mining method.

Table 16-15: Mining Recovery and Dilution Factors

Area	Zone	Mining Method	Mining Method Description	Mining Recovery (%)	External Dilution (%)
Mina Central	Catas	SLCM2	Mechanized Sub Level Caving – Some Water Present	80	20
	Antacaca	SLCM2	Mechanized Sub Level Caving – Some Water Present	80	20
	Rosaura	SLCM3	Mechanized Sub Level Caving – Water present	70	25
	Antacaca Sur	SLCM3	Mechanized Sub Level Caving – Water present	70	25
Esperanza	Esperanza	SLCM1	Mechanized Sub Level Caving – No Water Present	90	20
	Norte	SLCM2	Mechanized Sub Level Caving – Some Water Present	80	20
	Distal	SLCM1	Mechanized Sub Level Caving – No Water Present	90	20
Mascota	Oxide Ag-Pb	SLCM1	Mechanized Sub Level Caving – No Water Present	90	20
	Polymetallic (All)	CRAM	Mechanized Overhand Cut and Fill	100	10
Cuye	All	SLCM1	Mechanized Sub Level Caving – No Water Present	90	20
Cachi-Cachi	Angelita	SLCM2	Mechanized Sub Level Caving – Some Water Present	80	20
	Karlita	CRAM	Mechanized Overhand Cut and Fill	100	10
	Elissa	CRAM	Mechanized Overhand Cut and Fill	100	10
	Celia	SLCM2	Mechanized Sub Level Caving – Some Water Present	80	20
	Escondida	CRAM	Mechanized Overhand Cut and Fill	100	10
	Privatizadora	CRAM	Mechanized Overhand Cut and Fill	100	10
	Vanessa	CRAM	Mechanized Overhand Cut and Fill	100	10
	Yoselim	CRAM	Mechanized Overhand Cut and Fill	100	10

Area	Zone	Mining Method	Mining Method Description	Mining Recovery (%)	External Dilution (%)
	Carmencita	CRAM	Mechanized Overhand Cut and Fill	100	10
Cuerpos Pequeños	Gallito	CRAM	Mechanized Overhand Cut and Fill	100	10
	Oriental	CRAM	Mechanized Overhand Cut and Fill	100	10
	Occidental	CRAM	Mechanized Overhand Cut and Fill	100	10
	Contacto Sur Medio (TJ 6060)	CRAM	Mechanized Overhand Cut and Fill	100	10
	Contacto Sur Medio I (TJ 8167)	CRAM	Mechanized Overhand Cut and Fill	100	10
	Contacto Sur Medio II (TJ 1590)	CRAM	Mechanized Overhand Cut and Fill	100	10

Source: Sierra Metals, Redco, 2020

16.7.2 Net Smelter Return (NSR)

The mineral deposits at Yauricocha are polymetallic with copper, silver and gold metals contributing to the total value of mineralized material. A net smelter return (NSR) calculation was performed on each block model block taking into account the grade, metal price, metallurgical recovery and smelter terms. The smelter terms summarized for this report includes the applicable concentrate treatment charges, refining charges, deductions, price participation, and penalty element payments.

16.7.3 Metal Prices and Exchange Rate

The metal price assumptions are shown in Table 16-16 and are based on long-term consensus pricing. The metal price assumptions have been derived from CIBC Global Mining Group Consensus Commodity prices dated August 2020, as provided by Sierra Metals.

Table 16-16: Unit Value Metal Price Prices

Zn (US$/lb)	Ag (US$/oz)	Pb (US$/lb)	Cu (US$/lb)	Au (US$/oz)
1.07	20	0.91	3.05	1,541

Source: Sierra Metals, Redco, 2020

16.7.4 Metallurgical Recoveries

Metallurgical recoveries were provided by Sierra Metals and are based on projected recoveries resulting from an ongoing mill upgrade program.

Table 16-17 summarizes the metallurgical recoveries used in calculating the NSR factors.

Table 16-17: Metallurgical Recoveries

Process Recovery	Zn (%)	Ag (%)	Pb (%)	Cu (%)	Au (%)
Total Recovery (Polymetallic Feed)	**89.2**	**67.2**	**88.6**	**80.4**	**17.2**
Copper Concentrate	-	26.3	-	74.9	9.2
Lead Concentrate	-	40.9	88.6	5.5	8.0
Zinc Concentrate	89.2	-	-	-	-
Total Recovery (Lead Oxide Feed)	**-**	**50.5**	**64.6**	**-**	**52.9**
Lead Sulfide Concentrate	-	21.5	9.1	-	27.9
Lead Oxide Concentrate	-	29.1	55.5	-	25.1

Source: Sierra Metals, Redco, 2020

16.7.5 Net Smelter Return (NSR) Calculations

The parameters used in the NSR calculation are summarized in Table 16-18. An NSR value was calculated for each cell in the block models using these parameters. A second NSR field was also created where cells with a resource class of Inferred or undefined were assigned an NSR value of 0.

Table 16-18: NSR Calculation Parameters

NSR		
Parameter	**Unit**	**Value**
Metal Prices		
Zn Price	US$/lb	1.07
Ag Price	US$/oz	20.0
Pb Price	US$/lb	0.91
Cu Price	US$/lb	3.05
Au Price	US$/oz	1,541.00
Process Recoveries		
Copper Concentrate		
Au Metallurgic Recovery	%	9.2
Ag Metallurgic Recovery	%	26.3
Cu Metallurgic Recovery	%	74.9
Lead Concentrate		
Au Metallurgic Recovery	%	8.0
Ag Metallurgic Recovery	%	40.9
Pb Metallurgic Recovery	%	88.6
Cu Metallurgic Recovery	%	5.5
Zinc Concentrate		
Zn Metallurgic Recovery	%	89.2
Ag Metallurgic Recovery	%	9.2
Total		
Cu Metallurgic Recovery	%	80.4
Pb Metallurgic Recovery	%	88.6
Zn Metallurgic Recovery	%	89.2
Ag Metallurgic Recovery	%	76.4

NSR		
Parameter	**Unit**	**Value**
Au Metallurgic Recovery	%	17.2
Concentrate Grades		
Avg. Zn Concentrate	%	51.2
Avg. Pb Concentrate	%	57.8
Avg. Cu Concentrate	%	31.1
Avg. Au	oz/t	1.20
Avg. Au Pb Concentrate	oz/t	2.33
Avg. Au Cu Concentrate	oz/t	2.44
Avg. Ag	oz/t	11.83
Avg. Ag Zn Concentrate	oz/t	3.09
Avg. Ag Pb Concentrate	oz/t	36.86
Avg. Ag Cu Concentrate	oz/t	21.64
Moisture content	%	10.0
Selling Expenses		
Transport losses	%	0.5
Transportation	US$/wmt	28.00
Port	US$/wmt	0.00
Load	US$/wmt	0.00
Marketing	US$/dmt	0.00
Insurances	US$/wmt	0.00
Total	US$/dmt	30.96
Smelter Terms		
Copper Concentrate		
Minimum Deduction Au	g/t	0.50
Au Payability Factor	%	90.0
Minimum Deduction Ag	g/t	50.00
Ag Payability Factor	%	90.0
Minimum Deduction Cu	%	1.0
Cu Payability Factor	%	96.5
Lead Concentrate		
Minimum Deduction Au	g/t	1.00
Au Payability Factor	%	95.0
Minimum Deduction Ag	g/t	50.00
Ag Payability Factor	%	95.0
Minimum Deduction Pb	%	3.0
Pb Payability Factor	%	95.0
Zinc Concentrate		
Minimum Deduction Zn	%	8.0
Zn Payability Factor	%	85.0
Minimum Deduction Ag	oz/t	3.00
Ag Payability Factor	%	70.0
Treatment Charges/Refining Charges (TC/RC)		
Copper Concentrate		
Treatment Cost	US$/t-conc	150.00
Cu Refining Cost	US$/t	330.69
Ag Refining Cost	US$/oz	0.40
Au Refining Cost	US$/oz	10.00

NSR		
Parameter	**Unit**	**Value**
Lead Concentrate		
Treatment Cost	US$/t-conc	115.00
Ag Refining Cost	US$/oz	0.50
Au Refining Cost	US$/oz	15.00
Zinc Concentrate		
Treatment Cost	US$/t-conc	150.00
Ag Refining Cost	US$/oz	0.00
Net Smelter Return Factors		
Zn	US$/t/%	15.470
Ag	US$/t/gpt	0.393
Pb	US$/t/%	14.966
Cu	US$/t/%	45.572
Au	US$/t/gpt	7.803

Source: Sierra Metals, Redco, 2020

The resulting NSR equation coded into the block model was:

$$NSR=15.470\times Zn\ Grade+0.393\times Ag\ Grade+14.966\times Pb\ Grade+45.572\times Cu\ Grade+7.803\times Au\ Grade$$

16.7.6 Cut-off

The cut-off value calculation used by Sierra Metals in the proposed mine plan is based on historical information provided by Sierra Metals and considers reducing production costs associated with increased production (Table 16-19). Conceptual economic envelopes vary according to direct and indirect mining costs, processing costs, concentrate shipment and G&A costs.

Table 16-19: Operating Cost

Cost	Value
Mine Cost ($/t)	$34.42
Plant Cost ($/t)	$10.76
G & A	$9.81
Economic Cut Off ($/t)	$54.99

Source: Sierra Metals, Redco, 2020

The NSR value of each potential mining block was calculated and evaluated against economic cut-off values. The economic cut-off varies by mining method and mineralized zone, and includes direct and indirect mining costs, processing costs, and general and administrative (G&A) costs. Mining blocks with an average NSR value above the economic cut-off, that have defined access, and that are not isolated from mining areas, are classified as economic and included in the mineable inventory. The economic and marginal cut-offs used in this report are provided in Table 16-20.

Table 16-20: Economic Cut-Off Value by Mining Method (US$/t)

Mining Method	Mining (US$/t)	Processing (US$/t)	G&A (US$/t)	Total (US$/t)	Economic COV (US$/t)
SLCM1	34.42	10.76	9.81	54.99	55
SLCM2	36.29	10.76	9.81	56.87	57
SLCM3	37.01	10.76	9.81	57.59	58
CRAM1	44.63	10.76	9.81	65.21	65

Source: Sierra Metals, Redco, 2020

16.7.7 Stope Optimization

Stoping block shapes were constructed for each mineralized material zone and mining method identified using the Mineable Shape Optimizer (MSO) routine provided within the suite of Datamine™ Studio UG. MSO requires the input of several key parameters and then interrogates the resource block model against permutations of simplified mining shapes to outline a potentially economic Mineral Resource at a given cut-off value. The key MSO inputs for each mining method are outlined in Table 16-21.

Table 16-21: Stope Optimization Software Inputs

MSO Input	Sub-level Cave	Cut and Fill
Economic Cut-off value	US$55/t to US$58/t	US$65/t
Level spacing (floor to floor)	25 m	3 m
Stope length	4-200 m	3-50 m
Minimum mining width	4 m Fixed Width	2.5 m
Minimum waste pillar	2 m	3 m

Source: Sierra Metals, Redco, 2020

The tonnes and grade for each stope shape were tabulated in spreadsheets with mining recovery and dilution factors applied (dilution having zero grade), and then NSR values were calculated for the diluted and recovered material.

Blocks were classified as economic or waste based on the NSR value of the mining block and cut-off value for the area. The blocks were visually inspected and isolated blocks were identified and removed from the mineable inventory.

16.8 Mine Production

Yauricocha is an operating mine with a signification production history. Operations and production personnel are supported by a geology and engineering groups. The geology and engineering groups work in close collaboration and planning is conducted with care and diligence. Historical knowledge of the site is leveraged in the planning process.

Production targets at Yauricocha are based on historical performance and Table 16-22 shows reported mine production and mill tonnes processed between 2012 and 2020 (January to June inclusive).

Table 16-22: Reported Mine and Mill Production, 2012 to 2020

Category	2012	2013	2014	2015	2016	2017	2018	2019	2020*
Tonnes Mined	849,615	858,398	929,316	820,04	847,467	1,009,635	1,074,476	1,127,480	457,029
Tonnes Processed	872,869	837,496	890,91	829,805	897,169	1,023,491	1,106,649	1,092,410	483,508

Source: Sierra Metals, 2020

16.9 Mine Production Schedule

The base case Life of Mine (LOM) production and development schedule generated for the Yauricocha Mine based on 3,780 tpd (1.3 M tonnes per year) is shown in Table 16-24, and in Figure 16-25 and Figure 16-26. Typical mining rates of 3,780 tpd of mineralized material and 1,620 tpd of waste were applied as these are the rates the mine has been reportedly operating at in early 2020.

Sierra Metals prepared LOM production and development plans based on production rates ranging from the base case of 3,780 tpd to 7,500 tpd (Table 16-23) and these production schedules are financially evaluated in Section 22. Production schedules are based upon forward-looking information. This forward-looking information includes forecasts with material uncertainty which could cause actual results to differ materially from those presented herein.

Table 16-23: LOM Production Rates

Tonnes/Day	Tonnes/Year	Comments
3,780 tpd (base case)	1.3 M	Constant production rate through LOM *
5,500 tpd	2.0 M	Increases from 3,780 tpd to 5,500 tpd in 2024
6,500 tpd	2.4 M	Reaches 6,500 tpd in 2024
7,500 tpd	2.8 M	Reaches 7,500 tpd in 2024

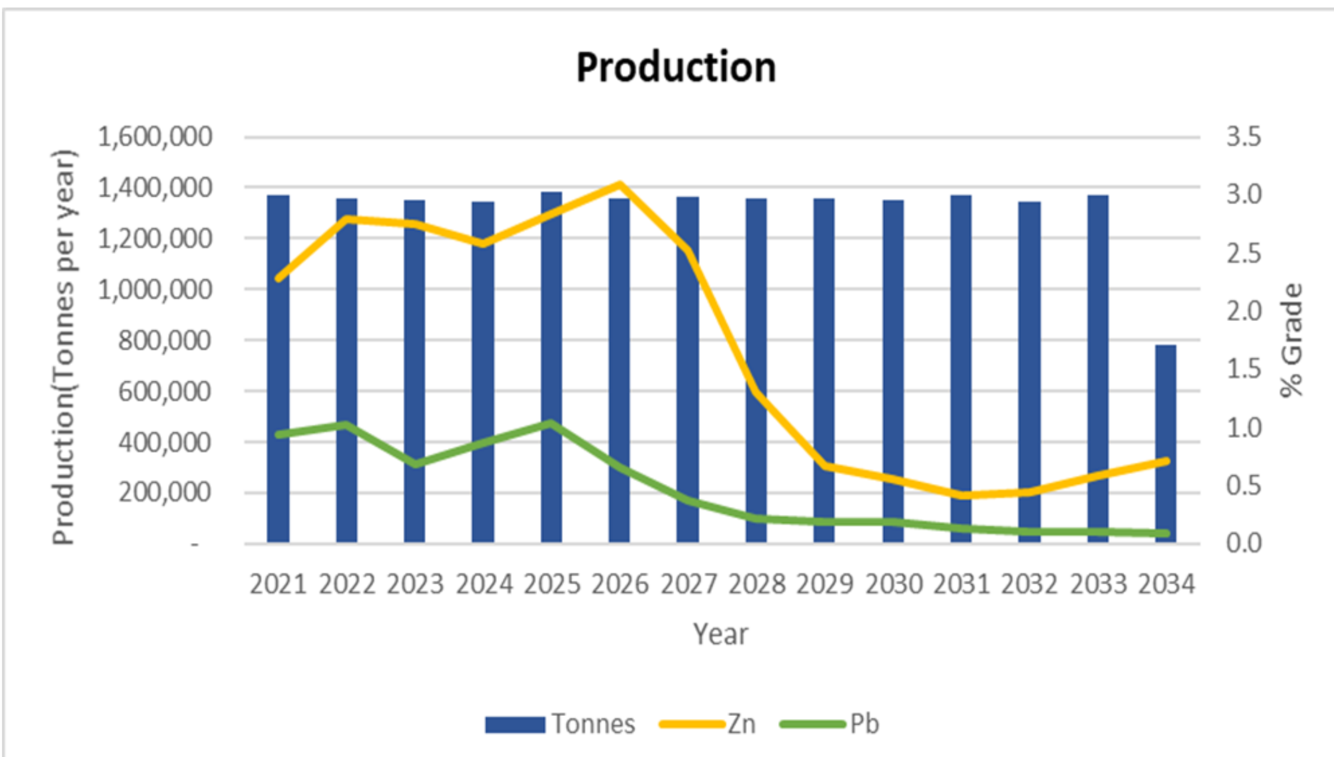
Source: Sierra Metals, Redco, 2020
Note: *3780 tpd used as the base case assumes that permit will be received to reach that level, which is in the initial process.

For the production rates higher than the base case, LOM production and development tables and figures are provided in Table 16-25, Table 16-26 and Table 16-27, and in Figure 16-27, Figure 16-28, Figure 16-29, Figure 16-30, Figure 16-31 and Figure 16-32.

Table 16-24: LOM Production Schedule for 3,780 Tonnes/Day

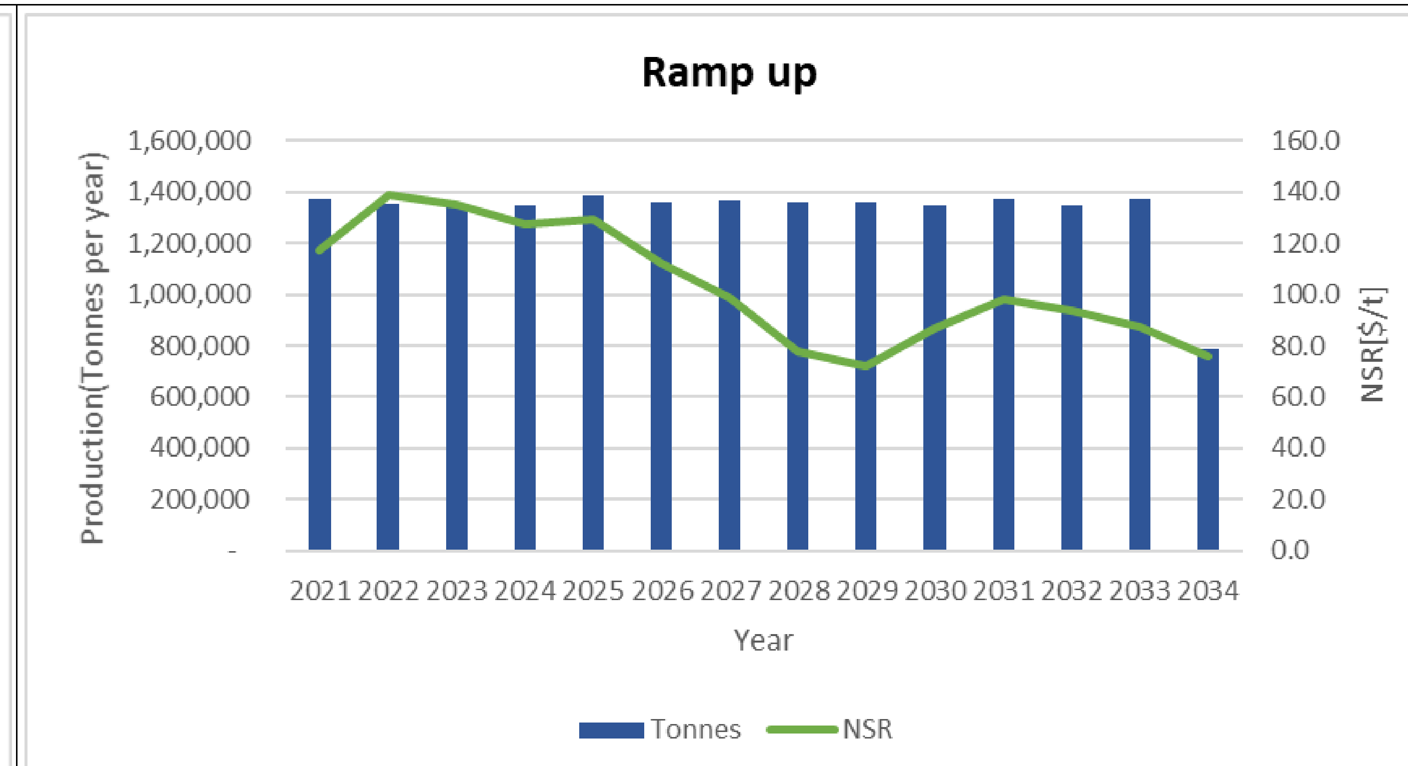
Production Mine	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Tonnes Mineralized Material	t	1,370,267	1,355,466	1,353,813	1,347,510	1,385,234	1,360,442	1,363,268	1,360,880	1,359,962	1,348,267	1,369,830	1,346,874	1,373,342	784,893	**18,480,047**
Tonnes Waste	t	442,885	459,242	458,707	456,670	468,863	460,850	461,763	460,991	460,694	456,914	463,884	456,464	465,019	-	**5,972,946**
Tonnes Total	t	1,813,151	1,814,708	1,812,520	1,804,180	1,854,096	1,821,291	1,825,031	1,821,871	1,820,656	1,805,181	1,833,714	1,803,338	1,838,361	784,893	**24,452,993**
Zn	%	2.3	2.8	2.8	2.6	2.8	3.1	2.5	1.3	0.7	0.6	0.42	0.44	0.59	0.71	**1.71**
Pb	%	0.9	1	0.7	0.9	1	0.7	0.4	0.2	0.2	0.2	0.13	0.11	0.11	0.09	**0.48**
Ag	g/t	51.3	58.9	47	44.7	47.5	39.8	34.3	29.9	22.9	21.5	19.91	18.25	16.99	18.46	**34.2**
Cu	%	1.1	1.3	1.5	1.3	1.2	0.9	0.9	0.9	1.1	1.5	1.79	1.71	1.53	1.23	**1.28**
Au	g/t	0.5	0.4	0.4	0.4	0.3	0.4	0.5	0.4	0.5	0.4	0.51	0.47	0.42	0.38	**0.42**
NSR	$/t	122.51	144.42	140.81	132.80	135.13	117.62	103.37	80.99	74.70	89.59	101.92	97.26	90.32	78.61	**108.78**
TPD	tpd	3,806	3,765	3,761	3,743	3,848	3,779	3,787	3,780	3,778	3,745	3,805	3,741	3,815	2,180	**3,713**

Source: Sierra Metals, Redco, 2020



Source: Sierra Metals, Redco

Figure 16-25: LOM Production – Tonnes per Year and %Grade



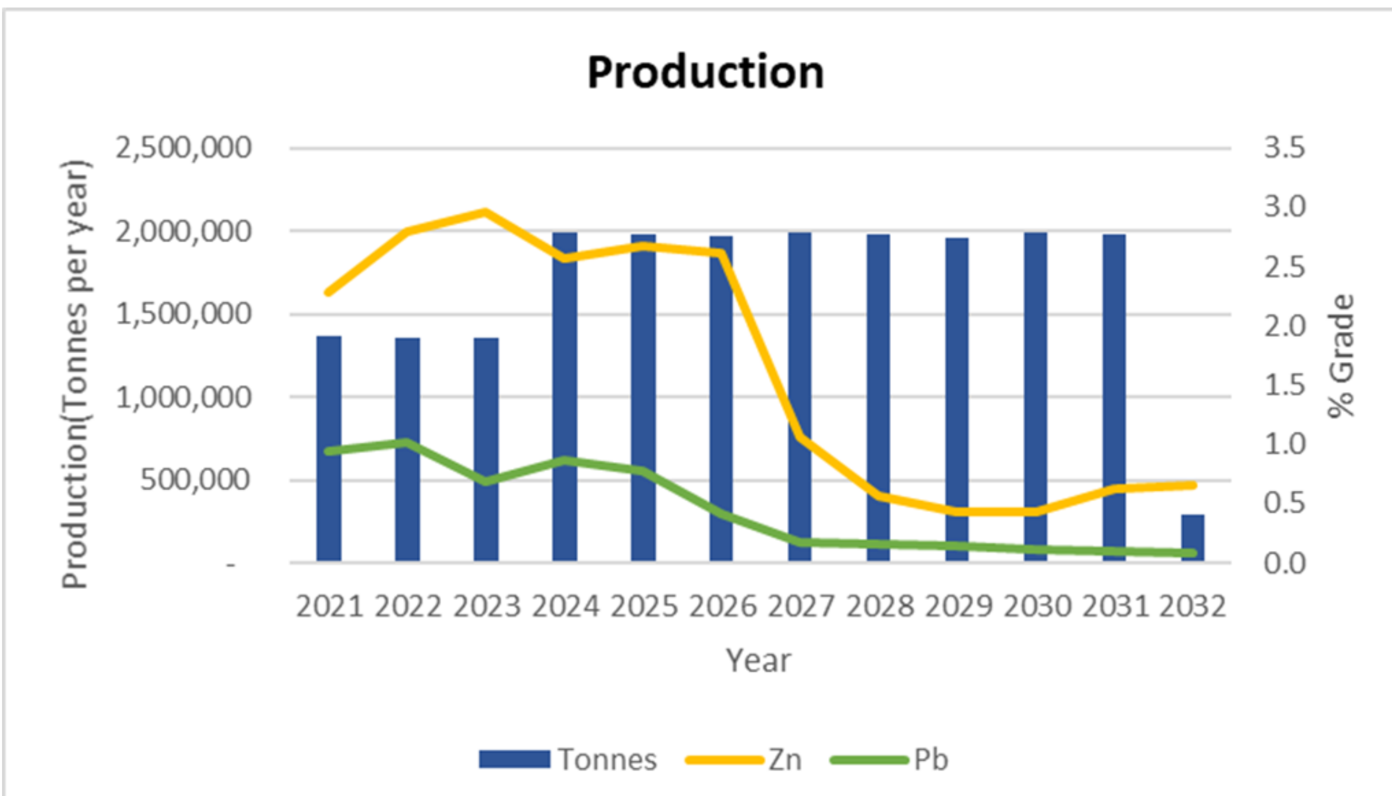
Source: Sierra Metals, Redco, 2020

Figure 16-26: LOM Production – Tonnes per Year and NSR

Table 16-25: LOM Production Schedule for 5,500 Tonnes/Day (5,500 tpd in 2024)

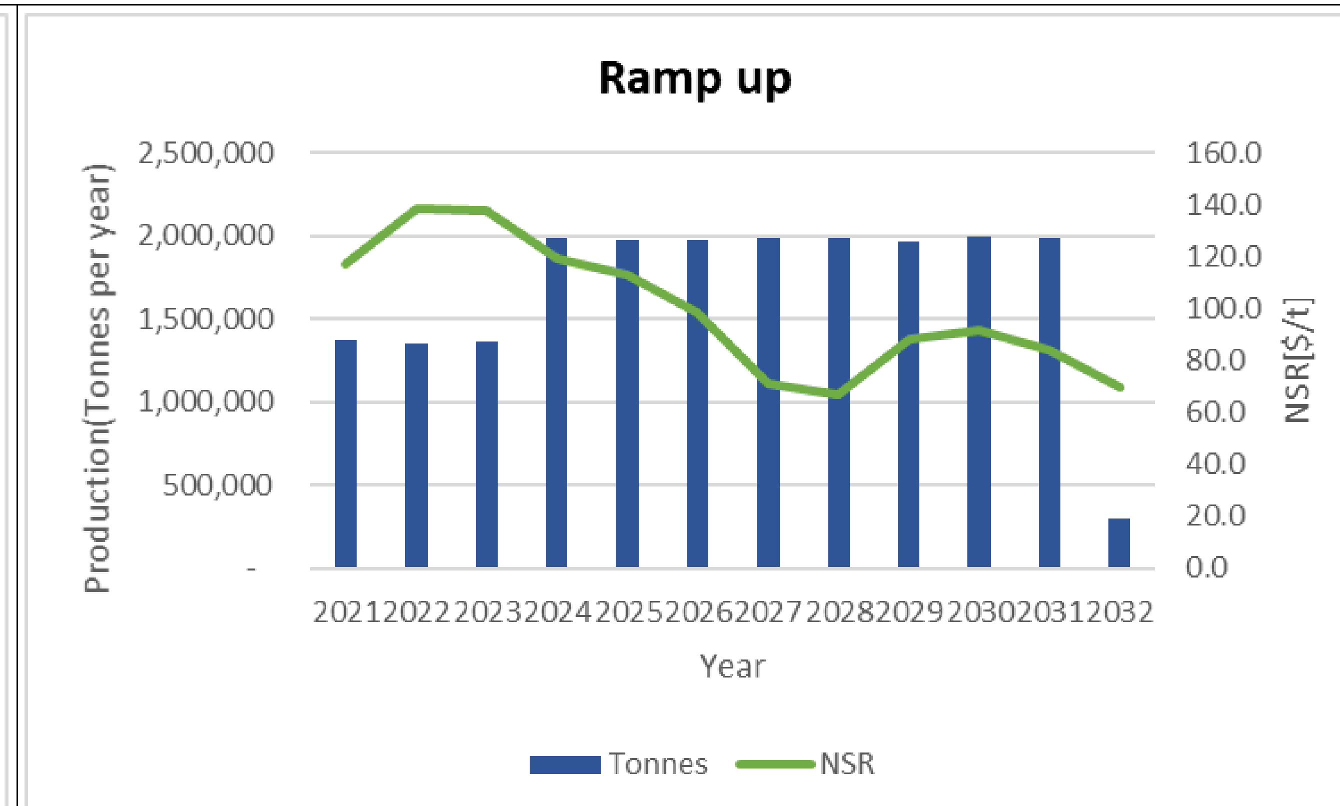
Production Mine	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Tonnes Mineralized Material	t	1,370,267	1,355,466	1,359,198	1,988,431	1,978,533	1,971,910	1,984,530	1,980,812	1,960,954	1,991,625	1,981,065	294,730	-	-	**20,217,519**
Tonnes Waste	t	442,885	485,731	486,937	642,682	639,483	637,342	641,421	640,219	633,801	643,714	640,301				**6,534,515**
Tonnes Total	t	1,813,151	1,841,197	1,846,135	2,631,112	2,618,016	2,609,252	2,625,951	2,621,032	2,594,755	2,635,339	2,621,366	294,730	-	-	**26,752,035**
Zn	%	2.3	2.8	3	2.6	2.7	2.6	1.1	0.6	0.4	0.4	0.63	0.66	-	-	**1.6**
Pb	%	0.9	1	0.7	0.9	0.8	0.4	0.2	0.2	0.1	0.1	0.1	0.09	-	-	**0.5**
Ag	g/t	51.3	58.9	47.7	42.7	40.1	34.6	26.3	19.8	19.8	17.7	17.23	17.9	-	-	**32.3**
Cu	%	1.1	1.3	1.4	1.2	1	0.9	0.9	1	1.6	1.7	1.45	1.12	-	-	**1.2**
Au	g/t	0.5	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.5	0.41	0.35	-	-	**0.4**
NSR	$/t	122.51	144.42	143.33	124.86	118.34	103.44	74.38	69.67	91.36	94.74	87.19	72.08	-	-	**103.49**
TPD	tpd	3,806	3,765	3,776	5,523	5,496	5,478	5,513	5,502	5,447	5,532	5,503	819	-	-	**5,084**

Source: Sierra Metals, Redco, 2020



Source: Sierra Metals, Redco, 2020

Figure 16-27: LOM Production – 5,500 Tonnes per Year and %Grade



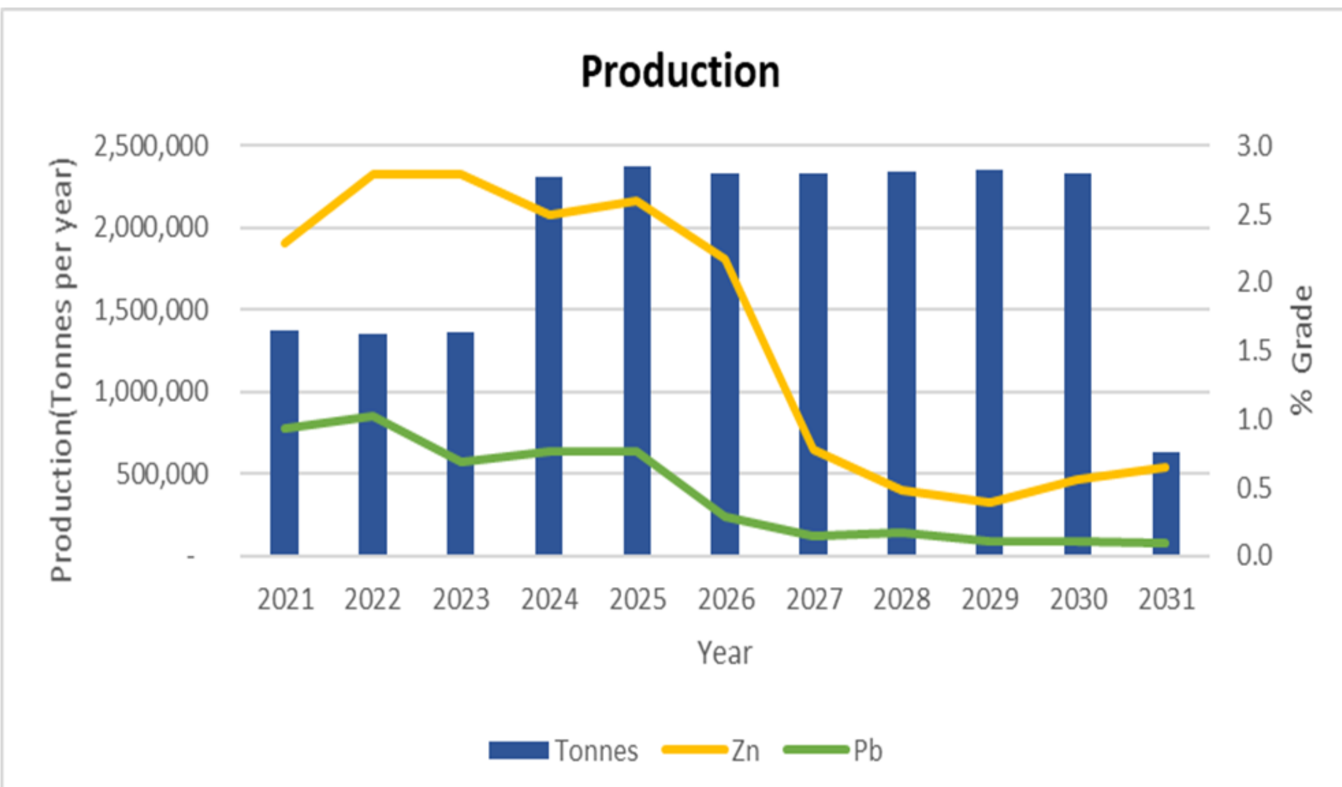
Source: Sierra Metals, Redco, 2020

Figure 16-28: LOM Production – 5,500 Tonnes per Year and NSR

Table 16-26: LOM Production Schedule for 6,500 Tonnes/Day (6,500 tpd in 2024)

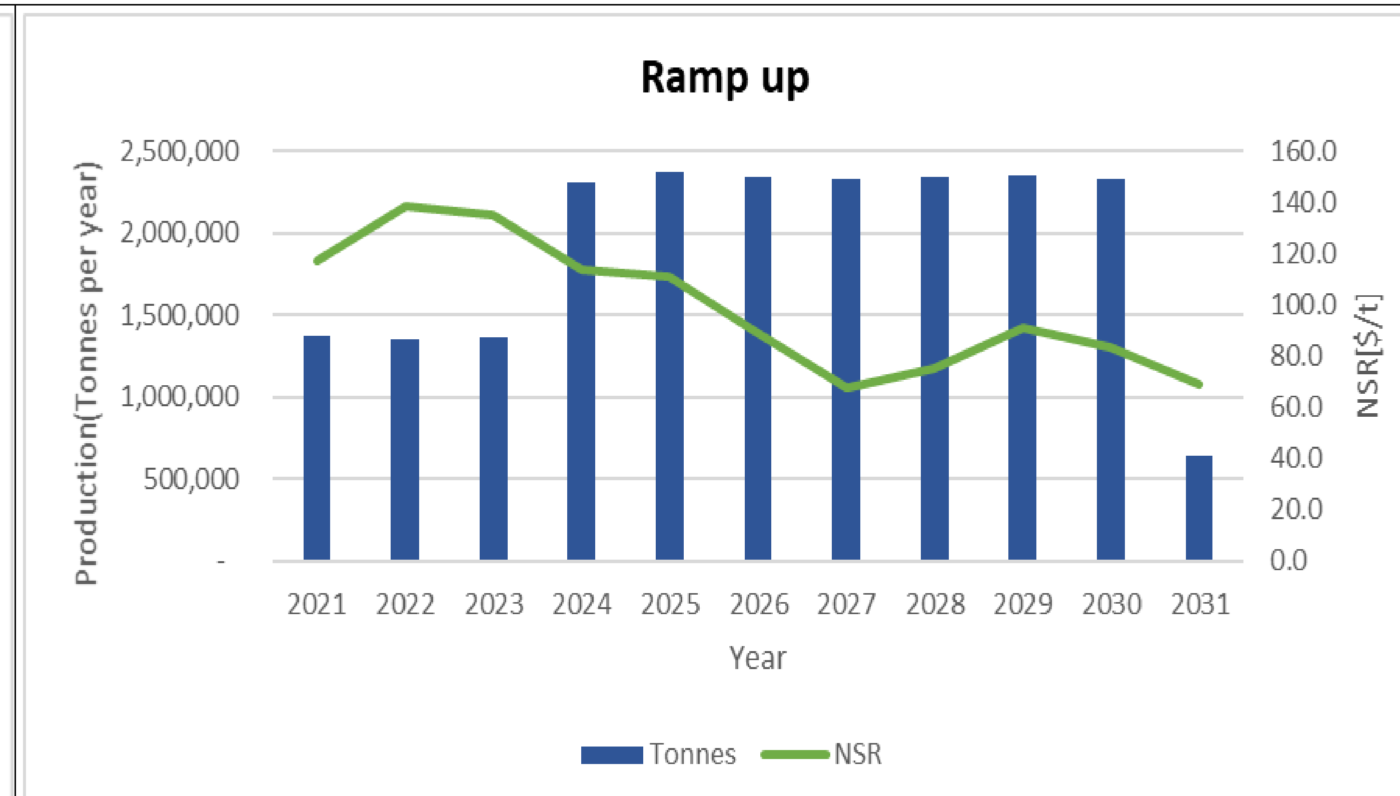
Production Mine	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Tonnes Mineralized Material	t	1,370,267	1,355,466	1,365,958	2,307,879	2,372,557	2,336,531	2,334,649	2,337,662	2,350,630	2,328,897	638,348	-	-	-	21,098,842
Tonnes Waste	t	442,885	541,261	544,652	745,931	766,835	755,191	754,583	755,557	759,748	752,724		-	-	-	6,819,368
Tonnes Total	t	1,813,151	1,896,728	1,910,611	3,053,809	3,139,392	3,091,722	3,089,232	3,093,219	3,110,378	3,081,621	638,348	-	-	-	27,918,210
Zn	%	2.3	2.8	2.8	2.5	2.6	2.2	0.8	0.5	0.4	0.6	0.64	-	-	-	1.6
Pb	%	0.9	1	0.7	0.8	0.8	0.3	0.1	0.2	0.1	0.1	0.09	-	-	-	0.4
Ag	%	51.3	58.9	46.9	39.8	40	30.3	23.7	19.5	18.1	16.4	17.71	-	-	-	31.5
Cu	%	1.1	1.3	1.4	1.1	1	0.9	1	1.3	1.7	1.5	1.11	-	-	-	1.2
Au	g/t	0.5	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.5	0.4	0.34	-	-	-	0.4
NSR	$/t	122.51	144.42	140.41	119.13	116.10	93.14	70.40	78.42	94.69	86.65	71.72	-	-	-	101.49
TPD	tpd	3,806	3,765	3,794	6,411	6,590	6,490	6,485	6,494	6,530	6,469	1,773	-	-	-	5,828

Source: Sierra Metals, Redco, 2020



Source: Sierra Metals, Redco, 2020

Figure 16-29: LOM Production – 6,500 Tonnes per Year and %Grade



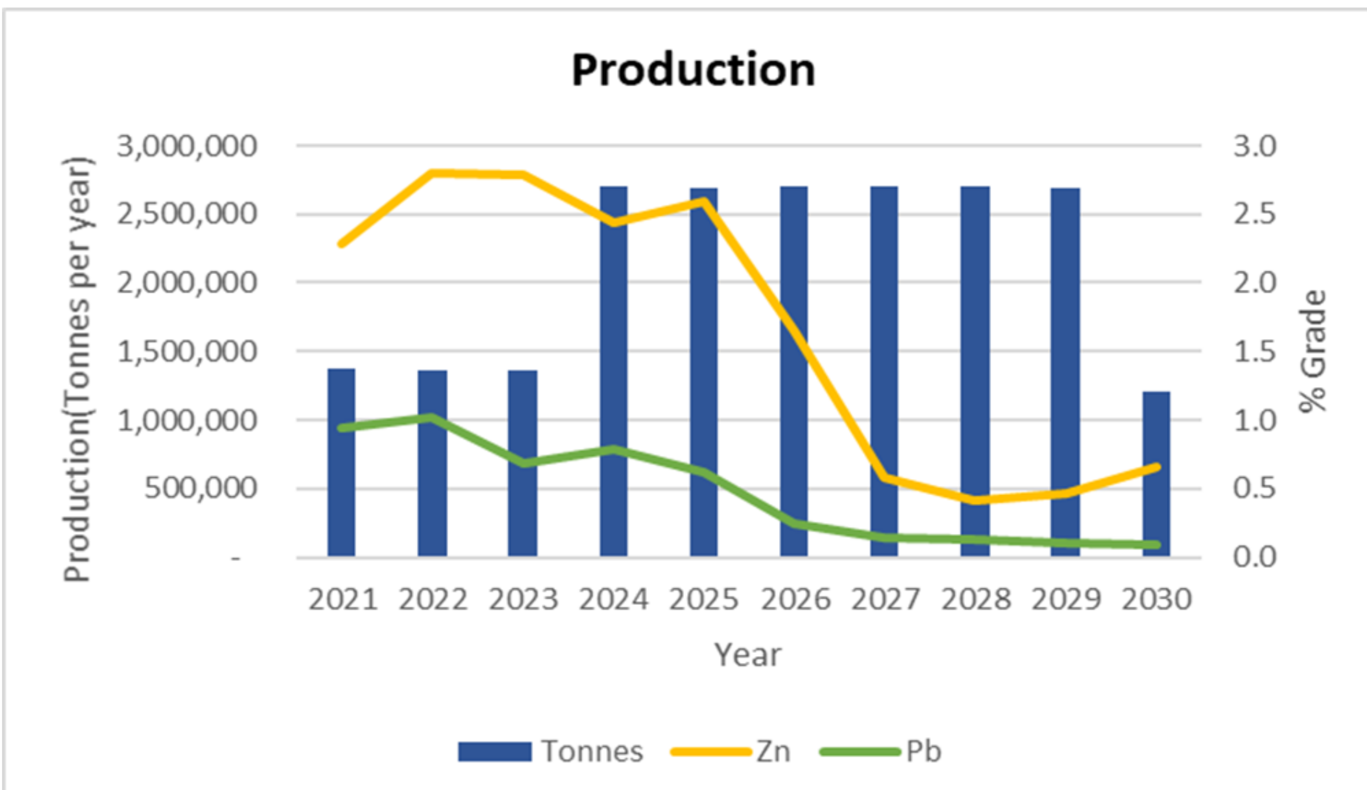
Source: Sierra Metals, Redco, 2020

Figure 16-30: LOM Production – 6,500 Tonnes per Year and NSR

Table 16-27: LOM Production Schedule for 7,500 Tonnes/Day (7,500 tpd in 2024)

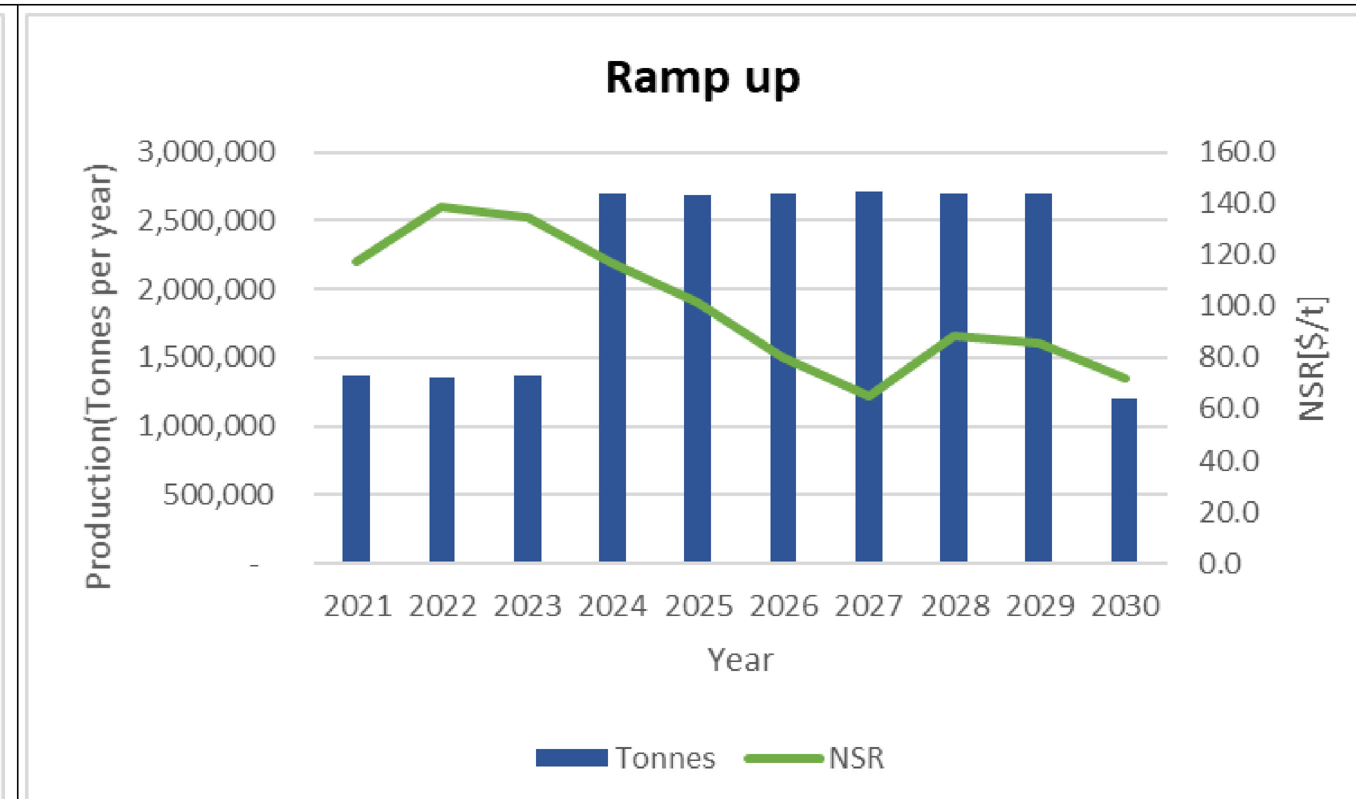
Production Mine	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Tonnes Mineralized Material	t	1,370,267	1,355,466	1,365,958	2,700,485	2,689,835	2,699,435	2,708,191	2,703,487	2,696,169	1,205,102	-	-	-	-	21,494,395
Tonnes Waste	t	442,885	632,852	636,243	872,825	869,383	872,486	875,316	873,796	871,430		-	-	-	-	6,947,215
Tonnes Total	t	1,813,151	1,988,318	2,002,201	3,573,310	3,559,218	3,571,921	3,583,507	3,577,283	3,567,599	1,205,102	-	-	-	-	28,441,611
Zn	%	2.3	2.8	2.8	2.4	2.6	1.6	0.6	0.4	0.5	0.7	-	-	-	-	1.6
Pb	%	0.9	1	0.7	0.8	0.6	0.2	0.1	0.1	0.1	0.1	-	-	-	-	0.4
Ag	%	51.3	58.9	46.9	41	36.7	28.4	19.6	19.1	16.5	17.3	-	-	-	-	31.2
Cu	%	1.1	1.3	1.4	1.2	0.9	0.9	1	1.6	1.5	1.2	-	-	-	-	1.2
Au	g/t	0.5	0.4	0.4	0.4	0.3	0.4	0.4	0.5	0.4	0.3	-	-	-	-	0.4
NSR	$/t	122.51	144.42	140.41	122.05	106.46	83.68	68.06	91.82	88.87	74.97	-	-	-	-	100.48
TPD	tpd	3,806	3,765	3,794	7,501	7,472	7,498	7,523	7,510	7,489	3,348	-	-	-	-	6,560

Source: Sierra Metals, Redco, 2020



Source: Sierra Metals, Redco, 2020

Figure 16-31: LOM Production – 7,500 Tonnes per Year and %Grade



Source: Sierra Metals, Redco, 2020

Figure 16-32: LOM Production – 7,500 Tonnes per Year and NSR

16.10 Mine Development

The mine design encompasses the main mining areas and includes two tunnels and three shafts for truck and personnel access:

- The Klepetko tunnel (3 m high x 3 m wide) and the Yauricocha tunnel (3.5 m x 3.5 m) are located on level 720 (haulage level). These tunnels are used for material handling directly to Chumpe plant.
- The three shafts in service are the Central shaft, the Mascota shaft, and the Cachi-Cachi shaft. The Yauricocha shaft is in construction currently. The shafts are typically used to move men and materials but can also move mineralized material and waste to the surface if necessary. These are also used to move mineralized material and waste from depth to the 720 level.

The distribution of the development in areas varies according to mining method as described in Section 16.2. However, the main tasks are:

- Ramps will have a typical cross-section of 4.5 m x 4.5 m (width x height), the cross-section is 4.0 m x 4.0 m in some areas;
- Access to mining areas such as bypasses and crosscuts will have cross-sectional dimensions of 3.0 m x 3.0 m or 3.5 m x 3.5 m (width x height);
- The ventilation raise bore holes have a typical cross section of 2.4 m x 2.4 m;
- The ventilation raise bore holes have a typical diameter of 1.8 m;
- Maximum ramp gradient of 12%, this is the same for access to cuts on OCF mining areas;
- Truck loading station and drains will be installed in the main accesses to the sublevels; and
- Trolley locomotive for loading, hauling and transportation.

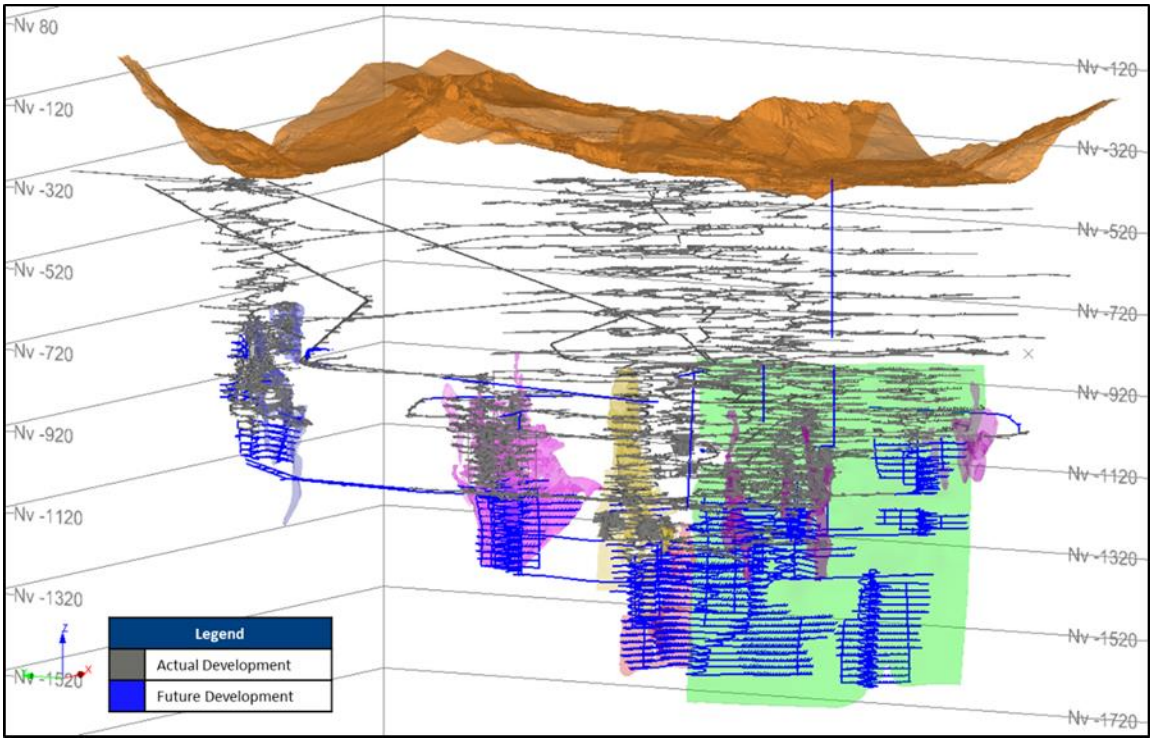
Sierra estimates that 116,751 m of combined horizontal and vertical development meters, are required to achieve the 3,780 tpd (base case) mine plan proposed in this PEA (Table 16-28).

Table 16-28: Development Meters in Mine Plan

Item	Meters
Horizontal	106,261
Vertical	10,490
Total	116,751

Source: Sierra Metals, Redco, 2020

Figure 16-33 shows the distribution of mine workings and mineralized areas, and the current and planned mine development.



Source: Sierra Metals, Redco, 2020

Figure 16-33: Mine Design Distribution of Mine Workings and Mineralized Areas

Table 16-29 to Table 16-40 show the opex development, capex development, and total development for the 3,780 tpd, 5,500 tpd, 6,500 tpd and 7,500 tpd mining plans respectively.

Table 16-29: LOM Development Schedule for 3,780 Tonnes/Day

Task Development	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Horizontal	m	7,879	8,170	8,161	8,124	8,341	8,199	8,215	8,201	8,196	8,129	8,253	8,121	8,273		106,261
Vertical	m	778	807	806	802	823	809	811	810	809	802	815	802	817		10,490
Total	m	8,657	8,977	8,966	8,926	9,165	9,008	9,026	9,011	9,005	8,931	9,067	8,922	9,090		116,751

Source: Sierra Metals, Redco, 2020

Table 16-30: LOM Preparation Schedule for 3,780 Tonnes/Day

Preparation (Opex)	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Total	m	6,148	6,082	6,074	6,046	6,215	6,104	6,117	6,106	6,102	6,049	6,146	6,043	6,162	3,522	82,915

Source: Sierra Metals, Redco, 2020

Table 16-31: LOM Waste Schedule for 3,780 Tonnes/Day

Waste	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Total	t	442,885	459,242	458,707	456,670	468,863	460,850	461,763	460,991	460,694	456,914	463,884	456,464	465,019		5,972,946

Source: Sierra Metals, Redco, 2020

Table 16-32: LOM Development Schedule for 5,500 Tonnes/Day

Task Development	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Horizontal	m	7,879	8,641	8,663	11,434	11,377	11,339	11,411	11,390	11,276	11,452	11,391				116,251
Vertical	m	778	853	855	1,129	1,123	1,119	1,126	1,124	1,113	1,131	1,125				11,476
Total	m	8,657	9,494	9,518	12,562	12,500	12,458	12,538	12,514	12,389	12,582	12,516				127,727

Source: Sierra Metals, Redco, 2020

Table 16-33: LOM Preparation Schedule for 5,500 Tonnes/Day

Preparation (Opex)	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Total	m	6,148	6,082	6,098	8,922	8,877	8,847	8,904	8,887	8,798	8,936	8,888	1,322			90,710

Source: Sierra Metals, Redco. 2020

Table 16-34: LOM Waste Schedule for 5,500 Tonnes/Day

Waste	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Total	t	442,885	485,731	486,937	642,682	639,483	637,342	641,421	640,219	633,801	643,714	640,301				6,534,515

Source: Sierra Metals, Redco, 2020

Table 16-35: LOM Development Schedule for 6,500 Tonnes/Day

Task Development	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Horizontal	m	7,879	9,629	9,690	13,270	13,642	13,435	13,424	13,442	13,516	13,391					121,319
Vertical	m	778	951	957	1,310	1,347	1,326	1,325	1,327	1,334	1,322					11,977
Total	m	8,657	10,580	10,646	14,580	14,989	14,761	14,750	14,769	14,850	14,713					133,295

Source: Sierra Metals, Redco, 2020

Table 16-36: LOM Preparation Schedule for 6,500 Tonnes/Day

Preparation (Opex)	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Total	m	6,148	6,082	6,129	10,355	10,645	10,483	10,475	10,488	10,547	10,449	2,864				94,665

Source: Sierra Metals, Redco, 2020

Table 16-37: LOM Waste Schedule for 6,500 Tonnes/Day

Waste	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Total	t	442,885	541,261	544,652	745,931	766,835	755,191	754,583	755,557	759,748	752,724					6,819,368

Source: Sierra Metals, Redco, 2020

Table 16-38: LOM Development Schedule for 7,500 Tonnes/Day

Task Development	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Horizontal	m	7,879	11,259	11,319	15,528	15,467	15,522	15,572	15,545	15,503						123,593
Vertical	m	778	1,111	1,117	1,533	1,527	1,532	1,537	1,535	1,530						12,201
Total	m	8,657	12,370	12,436	17,061	16,993	17,054	17,109	17,080	17,033						135,794

Source: Sierra Metals, Redco, 2020

Table 16-39: LOM Preparation Schedule for 7,500 Tonnes/Day

Preparation (Opex)	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Total	m	6,148	6,082	6,129	12,116	12,069	12,112	12,151	12,130	12,097	5,407					96,439

Source: Sierra Metals, Redco, 2020

Table 16-40: LOM Waste Schedule for 7,500 Tonnes/Day

Waste	Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Total	t	442,885	632,852	636,243	872,825	869,383	872,486	875,316	873,796	871,430						6,947,215

Source: Sierra Metals, Redco, 2020

16.11 Waste Storage

Currently, development waste material is hauled by LHD and placed into mined zones, resulting in an approximately 40% to 60% fill factor. Consideration should be given to investing in equipment to pack the waste rock into the stope to improve the fill factor and to increase the amount of underground storage capacity. Furthermore, the residual waste is carried by shaft to surface and placed in a waste storage.

For future development in Yauricocha, waste material will be hauled to mined out areas, especially in OCF for backfill; the remaining waste will be hauled by trolley locomotives at level 720 to surface and placed into a waste storage according to the waste schedule program. Further analysis of the development waste handling and storage strategy is required to increase the backfill factor. If the current mining methods are a viable solution to increasing the backfill factor, then there will be a positive benefit due to reduced transport costs.

16.12 Major Mining Equipment

A list of the major underground mining equipment currently used at Yauricocha Mine is included in Table 16-41.

Table 16-41: Current List of Major Underground Mining Equipment at Yauricocha

EQUIPMENT MINE OPERATION	Number of Units
JUMBO MUKI FF N° 1	1
JUMBO MUKI FF N° 3	1
JUMBO HAMMER BOLT N° 4	1
Total Jumbo Drill and Bolt	3
JUMBO LITTLE HAMMER, 1	1
JUMBO LITTLE HAMMER, 2	1
JUMBO LITTLE HAMMER, 3	1
JUMBO MK LHBP N° 2	1
JUMBO MK LHBP N° 4	1
JUMBO MK LHBP N° 5	1
JUMBO RDH	1
Total Jumbo Long Drills	7
SCOOP EST-2D 2,5 yd3	9
SCOOP LH 1,5 Yd3	2
SCOOP EST-2D 2,5 yd3	1
SCOOP TORO 151E 2,5 yd3	1
SCOOP JS-220 2,5 yd3	1
SCOOP EJC-145 3,5 yd3	1
SCOOP EJC-130 2,5 yd3	2
SCOOP ST-2D 2,5 yd3	1
SCOOP ST-2G 2,5 yd3	3
SCOOP R1300G 4,1 yd3	6

EQUIPMENT MINE OPERATION	Number of Units
SCOOP RDH 3,5 yd3	1
Total Scooptrams	28
Dumper 20 Ton	5
Total Dumpers	5
Service Truck	1
Service Truck	1
Service Truck	1
PBUS-20	1
PBUS-20	1
Mini Front Loader	5
Front Loader	1
Total Support Equipment	11
Total Equipment	54

Source: Sierra Metals, 2020

Equipment performance was estimated using operational performance data. The equipment performance was used to estimate the quantity of equipment required for the production and development plans. The maximum number of equipment required to meet the production plans is listed by year and shown in Table 16-42 to Table 16-46. The number of underground personnel required to operate the equipment is also listed for reference.

Table 16-42: Main Planned Underground Mining Equipment (3,780 tpd)

Equipment	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Jumbo Drill	6	6	6	6	7	6	6	6	6	6	6	6	6	4
Jumbo Radial	5	5	5	5	5	5	5	5	5	5	5	5	5	3
Jumbo Hammer Bolt N° 4	2	2	2	2	2	2	2	2	2	2	2	2	2	1
Scoop 3.5, Yd^3	6	7	7	6	6	6	6	6	6	6	6	6	6	3
Dumper	3	4	4	3	3	3	3	3	3	3	3	3	3	0
Front loader	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mixer Truck	3	3	3	3	4	3	3	3	3	3	3	3	3	0
Shotcrete Truck	3	3	3	3	4	3	3	3	3	3	3	3	3	0
Emulsion Loader	3	3	3	3	3	3	3	3	3	3	3	3	3	2
Personnel	452	448	447	445	457	449	450	449	449	445	452	445	454	259

Source: Sierra Metals, Redco, 2020

Table 16-43: Main Planned Underground Mining Equipment (5,500 tpd - 2024)

Equipment	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Jumbo Drill	6	7	7	9	9	9	9	9	9	9	9	0		
Jumbo Radial	5	5	5	7	7	7	7	7	7	7	7	2		
Jumbo Hammer Bolt N° 4	2	2	2	3	3	3	3	3	3	3	3	0		
Scoop 3.5, Yd^3	6	6	6	9	9	9	9	9	9	9	9	1		
Dumper	3	4	4	5	5	5	5	5	5	5	5	0		
Front loader	1	1	1	1	1	1	1	1	1	1	1	1		
Mixer Truck	3	4	4	5	5	5	5	5	5	5	5	0		
Shotcrete Truck	3	4	4	5	5	5	5	5	5	5	5	0		
Emulsion Loader	3	3	3	4	4	4	4	4	4	4	4	1		
Personnel	452	448	449	656	653	651	655	654	647	657	654	98		

Source: Sierra Metals, Redco, 2020

Table 16-44: Main Planned Underground Mining Equipment (6,500 tpd - 2024)

Equipment	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Jumbo Drill	6	7	7	10	10	10	10	10	10	10	0			
Jumbo Radial	5	5	5	9	9	9	9	9	9	9	3			
Jumbo Hammer Bolt N° 4	2	2	2	3	3	3	3	3	3	3	0			
Scoop 3.5, Yd^3	6	7	7	10	10	10	10	10	10	10	3			
Dumper	3	4	4	5	6	6	6	6	6	6	0			
Front loader	1	1	1	1	1	1	1	1	1	1	1			
Mixer Truck	3	4	4	5	5	5	5	5	5	5	0			
Shotcrete Truck	3	4	4	5	5	5	5	5	5	5	0			
Emulsion Loader	3	3	3	5	5	5	5	5	5	5	2			
Personnel	452	448	451	762	783	771	771	772	776	769	211			

Source: Sierra Metals, Redco, 2020

Table 16-45: Main Planned Underground Mining Equipment (7,500 tpd - 2024)

Equipment	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Jumbo Drill	6	9	9	12	12	12	12	12	12	0	0	0	0	4
Jumbo Radial	5	5	5	10	10	10	10	10	10	5	0	0	0	0
Jumbo Hammer Bolt N° 4	2	3	3	4	4	4	4	4	4	0	0	0	0	1
Scoop 3.5, Yd^3	6	7	7	12	12	12	12	12	12	4	0	0	0	0
Dumper	3	5	5	6	6	6	6	6	6	0	0	0	0	0
Front loader	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Mixer Truck	3	5	5	6	6	6	6	6	6	0	0	0	0	0
Shotcrete Truck	3	5	5	6	6	6	6	6	6	0	0	0	0	0
Emulsion Loader	3	3	3	5	5	5	5	5	5	3	0	0	0	0
Personnel	452	448	451	891	888	891	894	892	890	398	0	0	0	0

Source: Sierra Metals, Redco, 2020

Table 16-46: Production of Equipment and Person

Equipment	Unit	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Jumbo Drill	m/d	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Jumbo Radial	t/d	795	795	795	795	795	795	795	795	795	795	795	795	795	795
Jumbo Hammer Bolt N° 4	m/d	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Scoop 3.5, Yd^3	t/h	86	86	86	86	86	86	86	86	86	86	86	86	86	86
Dumper	t/h	42	42	42	42	42	42	42	42	42	42	42	42	42	42
Front loader	t/h	171	171	171	171	171	171	171	171	171	171	171	171	171	171
Mixer Truck	m/d	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Shotcrete	m/d	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Emulsion Loader	t/d	1,591	1,591	1,591	1,591	1,591	1,591	1,591	1,591	1,591	1,591	1,591	1,591	1,591	1,591
Personnel	t/person	8	8	8	8	8	8	8	8	8	8	8	8	8	8

Source: Sierra Metals, Redco, 2020

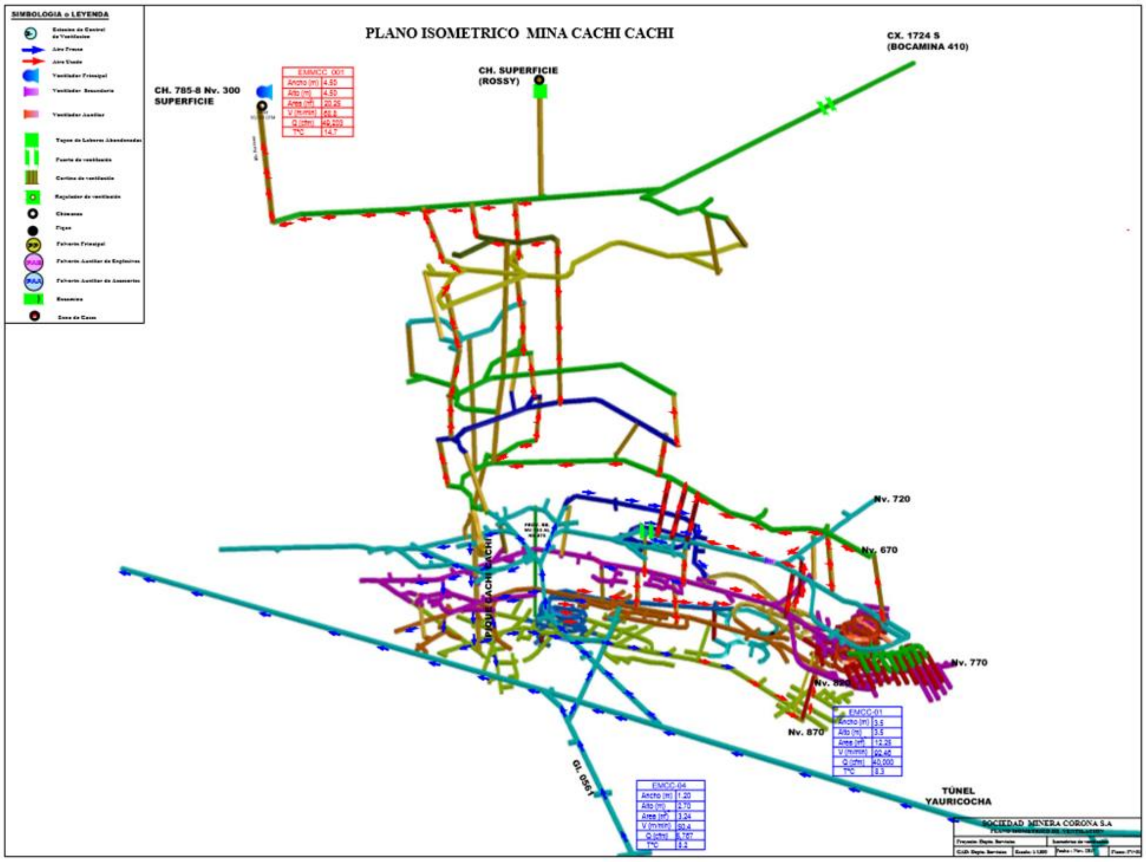
16.13 Ventilation

The underground mine has a ventilation system that supports the Cachi-Cachi mine and a separate ventilation system that supports the Central mine (Mina Central).

The ventilation system at Mina Central intakes air from the main decline, the Mascota shaft, Central shaft, Raise Bore #3, and the Klepetko tunnel. The intake air is approximately 159,000 cfm. The air exhausts through Raise Bore #2 and Raise Bore #1 by two primary fans located on surface. Air is pulled through the workings and routed with ventilation doors and booster fans to maintain air quality.

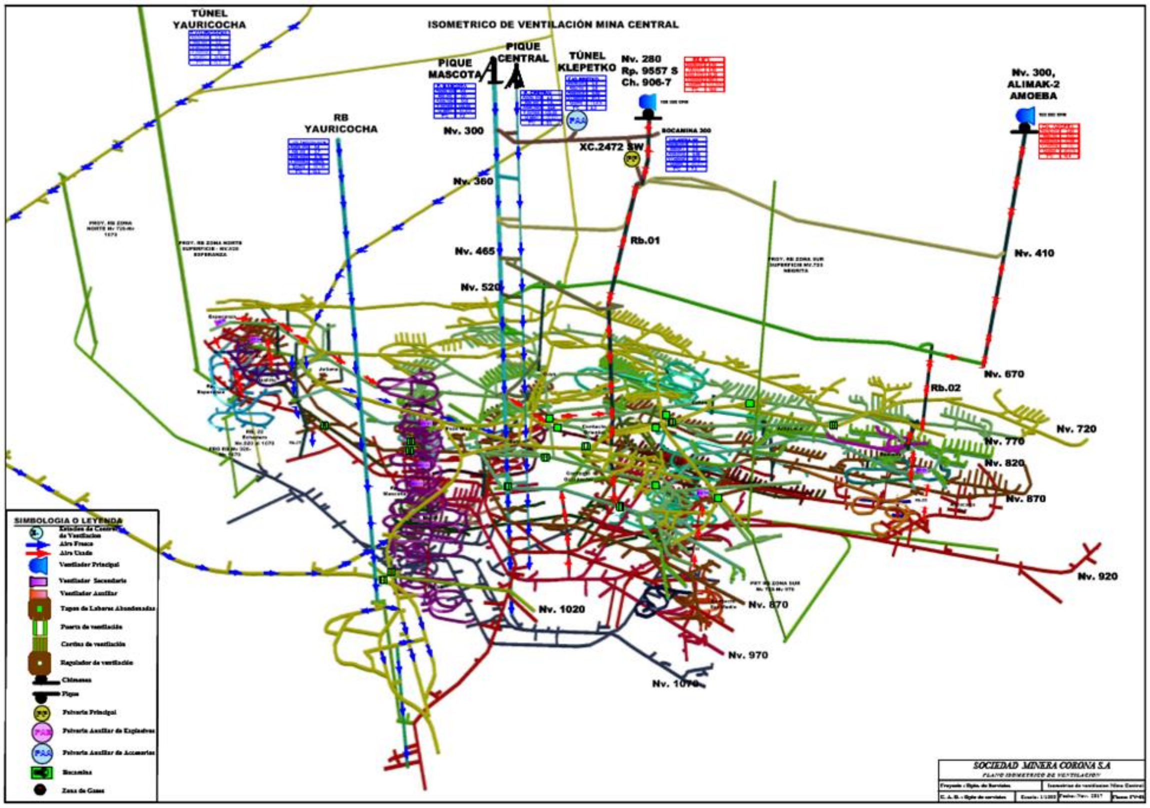
The ventilation system at Cachi-Cachi is an intake system that pulls fresh air through the Yauricocha tunnel and the main decline (Bocamina 410) at Cachi-Cachi. The air exhausts through three boreholes at the surface, Borehole (Chimenea) 919, the Rossy borehole, and the Raquelita borehole. A primary fan is located at Borehole 919 on the 300 level. The air moves into the mine through the main decline and down to the lower levels through the Cachi-Cachi shaft. The air is exhausted through vent raises and shafts to the surface. Ventilation doors are installed, and booster fans are used throughout the mine to maintain air quality.

The Yauricocha ventilation system is divided into three zones: Zone II, Zone III, and Zone V. The ventilation system of Zone II covers the 820 level to the 920 level for the mineralized zones Esperanza and Gallito. The ventilation system of Zone III covers the 720 level to the 920 level of the Cachi-Cachi Mine. The ventilation system of Zone V covers the 970 level to the 1170 level for the mining areas of Mascota, Catas, Antacaca, Rosaura, Antacaca Sur, CSM II and Butz. Figure 16-34 shows an isometric view of the Cachi-Cachi ventilation network (Zone III). Figure 16-35 shows an isometric view of the Mina Central ventilation network (Zones II and V).



Source: Sierra Metals, 2020

Figure 16-34: Zone III Ventilation Isometric View



Source: Sierra Metals, 2020

Figure 16-35: Zone II and Zone V Ventilation Isometric View

Fresh air is supplied to the mine workings through the Yauricocha tunnel, Mascota shaft, Central shaft, Klepetko tunnel, and through the 300 level.

Table 16-47 lists the mine intake and exhaust airway capacities.

Table 16-47: Yauricocha Mine Intake and Exhaust Airway Capacities

N°	Intake Airway	Volume (1) (cfm)
1	Yauricocha Tunnel	126,444
2	Klepetko Tunnel	75,702
3	Mascota Shaft	88,800
4	Central Shaft	73,830
6	Bocamina Level 300	42,912
	Total	**407,688**
N°	**Exhaust Airway**	**Volume (1) (cfm)**
1	Alimak Amoeba	63,044
2	Rb.01	116,728
3	Rb. Yauricocha	124,385
4	CH. Rossy Superficie	12,970
5	Ch.785-8 Nv.300	66,217
6	Bocamina Nv.410	41,641
	Total	**424,985**

Source: Sierra Metals, Redco, 2020
(1) Volumes are based on measured values and are not corrected for auto-compression or system calibration.

Table 16-48 shows the mine equipment used to determine the mine total airflow under the current operating scenario. Commonly used airflow requirement assumptions of 106 cfm/hp (0.05 m^3/s per hp) for equipment and 212 cfm/person (0.1 m^3/sec per person) for personnel were used, and the mineralized material production rate was based on 3,780 tpd.

Table 16-48: Ventilation Requirements for Equipment and Personnel (3,780 tonnes/day)

Item	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	4	300		68	81,048	38
Raptor/Jumbo	13	75		41	38,903	18
Scoop	7	185		59	75,802	36
Front loader	1	150		16	2,384	1
Mixer Truck	3	138		44	18,268	9
Shotcrete Truck	3	148		44	19,592	9
Emulsion Loader	3	100		45	13,508	6
Personnel	448		212		94,927	45
Total					**344,432**	**163**

Source: Sierra Metals, Redco, 2020

Using the base case LOM (3,780 tpd), a simplified ventilation model was prepared for the main mining areas. The maximum airflow through the mine was calculated by summing the airflow requirements of the equipment and personnel working in each zone at peak production. An additional 10% was then added for contingency (losses). It was assumed that all vehicles would be turned off when not in use for extended periods. Table 16-49 shows the ventilation requirements by year for the base case production rate of 3,780 tpd.

Table 16-49: Ventilation Requirements by Year (3,780 tpd)

2021	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	3	300		68	60,786	29
Raptor/Jumbo	13	75		41	38,903	18
Scoop	6	185		59	64,973	31
Front loader	1	150		16	2,384	1
Mixer Truck	3	138		44	18,268	9
Shotcrete Truck	3	148		44	19,592	9
Emulsion Loader	3	100		45	13,508	6
Personnel	452		212		95,774	45
Total + 10% Losses					345,607	163

Source: Sierra Metals, Redco, 2020

2022	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	4	300		68	81,048	38
Raptor/Jumbo	13	75		41	38,903	18
Scoop	7	185		59	75,802	36
Front loader	1	150		16	2,384	1
Mixer Truck	3	138		44	18,268	9
Shotcrete Truck	3	148		44	19,592	9
Emulsion Loader	3	100		45	13,508	6
Personnel	448		212		94,927	45
Total + 10% Losses					378,875	179

Source: Sierra Metals, Redco, 2020

2023	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	4	300		68	81,048	38
Raptor/Jumbo	13	75		41	38,903	18
Scoop	7	185		59	75,802	36
Front loader	1	150		16	2,384	1
Mixer Truck	3	138		44	18,268	9
Shotcrete Truck	3	148		44	19,592	9
Emulsion Loader	3	100		45	13,508	6
Personnel	447		212		94,715	45
Total + 10% Losses					378,642	179

Source: Sierra Metals, Redco, 2020

2024 - 2034	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	3	300		68	60,786	29
Raptor/Jumbo	14	75		41	42,854	20
Scoop	6	185		59	64,973	31
Front loader	1	150		16	2,384	1
Mixer Truck	4	138		44	24,358	11
Shotcrete Truck	4	148		44	26,123	12
Emulsion Loader	3	100		45	13,508	6
Personnel	457		212		96,834	46
Total + 10% Losses					365,001	172

Source: Sierra Metals, Redco, 2020

The ventilation requirements were also estimated (per year) for the production rates of 5,500 tpd, 6,500 tpd and 7,500 tpd and are shown in Table 16-50, Table 16-51 and Table 16-52.

Table 16-50: Ventilation Requirements by Year - Mine Production 5,500 tpd

2021	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	3	300		68	60,786	29
Raptor/Jumbo	12.8	75		41	38,903	18
Scoop	6	185		59	64,973	31
Front loader	1	150		16	2,384	1
Mixer Truck	3	138		44	18,268	9
Shotcrete Truck	3	148		44	19,592	9
Emulsion Loader	3	100		45	13,508	6
Personnel	452		212		95,774	45
Total + 10% Losses					345,607	163

Source: Sierra Metals, Redco, 2020

2022	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	4	300		68	81,048	38
Raptor/Jumbo	14.1	75		41	42,854	20
Scoop	6	185		59	64,973	31
Front loader	1	150		16	2,384	1
Mixer Truck	4	138		44	24,358	11
Shotcrete Truck	4	148		44	26,123	12
Emulsion Loader	3	100		45	13,508	6
Personnel	448		212		94,927	45
Total + 10% Losses					385,192	182

Source: Sierra Metals, Redco, 2020

2023	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	4	300		68	81,048	38
Raptor/Jumbo	14.1	75		41	42,854	20
Scoop	6	185		59	64,973	31
Front loader	1	150		16	2,384	1
Mixer Truck	4	138		44	24,358	11
Shotcrete Truck	4	148		44	26,123	12
Emulsion Loader	3	100		45	13,508	6
Personnel	449		212		95,139	45
Total + 10% Losses					385,425	182

Source: Sierra Metals, Redco, 2020

2024	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	5	300		68	101,310	48
Raptor/Jumbo	18.7	75		41	56,835	27
Scoop	9	185		59	97,460	46
Front loader	1	150		16	2,384	1
Mixer Truck	5	138		44	30,447	14
Shotcrete Truck	5	148		44	32,653	15
Emulsion Loader	4	100		45	18,011	9
Personnel	656		212		139,000	66
Total + 10% Losses					525,909	248

Source: Sierra Metals, Redco, 2020

2025 - 2032	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	5	300		67.5	101,310	48
Raptor/Jumbo	18.7	75		40.5	56,835	27
Scoop	9	185		58.5	97,460	46
Front loader	1	150		15.9	2,384	1
Mixer Truck	5	138		44.1	30,447	14
Shotcrete Truck	5	148		44.1	32,653	15
Emulsion Loader	4	100		45	18,011	9
Personnel	657		212		139,212	66
Total + 10% Losses					526,142	248

Source: Sierra Metals, Redco, 2020

Table 16-51: Ventilation Requirements by Year - Mine Production 6,500 tpd

2021	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	3	300		68	60,786	29
Raptor/Jumbo	12.8	75		41	38,903	18
Scoop	6	185		59	64,973	31
Front loader	1	150		16	2,384	1
Mixer Truck	3	138		44	18,268	9
Shotcrete Truck	3	148		44	19,592	9
Emulsion Loader	3	100		45	13,508	6
Personnel	452		212		95,774	45
Total + 10% Losses					345,607	163

Source: Sierra Metals, Redco, 2020

2022	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	4	300		68	81,048	38
Raptor/Jumbo	14.1	75		41	42,854	20
Scoop	7	185		59	75,802	36
Front loader	1	150		16	2,384	1
Mixer Truck	4	138		44	24,358	11
Shotcrete Truck	4	148		44	26,123	12
Emulsion Loader	3	100		45	13,508	6
Personnel	448		212		94,927	45
Total + 10% Losses					397,103	187

Source: Sierra Metals, Redco, 2020

2023	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	4	300		68	81,048	38
Raptor/Jumbo	14.1	75		41	42,854	20
Scoop	7	185		59	75,802	36
Front loader	1	150		16	2,384	1
Mixer Truck	4	138		44	24,358	11
Shotcrete Truck	4	148		44	26,123	12
Emulsion Loader	3	100		45	13,508	6
Personnel	451		212		95,562	45
Total + 10% Losses					397,803	188

Source: Sierra Metals, Redco, 2020

2024	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	5	300		68	101,310	48
Raptor/Jumbo	22	75		41	66,865	32
Scoop	10	185		59	108,289	51
Front loader	1	150		16	2,384	1
Mixer Truck	5	138		44	30,447	14
Shotcrete Truck	5	148		44	32,653	15
Emulsion Loader	5	100		45	22,513	11
Personnel	762		212		161,460	76
Total + 10% Losses					578,513	273

Source: Sierra Metals, Redco, 2020

2025 - 2031	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	6	300		68	121,572	57
Raptor/Jumbo	22	75		41	66,865	32
Scoop	10	185		59	108,289	51
Front loader	1	150		16	2,384	1
Mixer Truck	5	138		44	30,447	14
Shotcrete Truck	5	148		44	32,653	15
Emulsion Loader	5	100		45	22,513	11
Personnel	783		212		165,910	78
Total + 10% Losses					605,696	286

Source: Sierra Metals, Redco, 2020

Table 16-52: Ventilation Requirements by Year - Mine Production 7,500 tpd

2021	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	3	300		68	60,786	29
Raptor/Jumbo	13	75		41	38,903	18
Scoop	6	185		59	64,973	31
Front loader	1	150		16	2,384	1
Mixer Truck	3	138		44	18,268	9
Shotcrete Truck	3	148		44	19,592	9
Emulsion Loader	3	100		45	13,508	6
Personnel	452		212		95,774	45
Total + 10% Losses					345,607	163

Source: Sierra Metals, Redco, 2020

2022	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	5	300		68	101,310	48
Raptor/Jumbo	17	75		41	50,756	24
Scoop	7	185		59	75,802	36
Front loader	1	150		16	2,384	1
Mixer Truck	5	138		44	30,447	14
Shotcrete Truck	5	148		44	32,653	15
Emulsion Loader	3	100		45	13,508	6
Personnel	448		212		94,927	45
Total + 10% Losses					441,966	209

Source: Sierra Metals, Redco, 2020

2023	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	5	300		68	101,310	48
Raptor/Jumbo	17	75		41	50,756	24
Scoop	7	185		59	75,802	36
Front loader	1	150		16	2,384	1
Mixer Truck	5	138		44	30,447	14
Shotcrete Truck	5	148		44	32,653	15
Emulsion Loader	3	100		45	13,508	6
Personnel	451		212		95,562	45
Total + 10% Losses					442,665	209

Source: Sierra Metals, Redco, 2020

2024	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	6	300		68	121,572	57
Raptor/Jumbo	26	75		41	77,806	37
Scoop	12	185		59	129,947	61
Front loader	1	150		16	2,384	1
Mixer Truck	6	138		44	36,536	17
Shotcrete Truck	6	148		44	39,184	18
Emulsion Loader	5	100		45	22,513	11
Personnel	891		212		188,794	89
Total + 10% Losses					680,610	321

Source: Sierra Metals, Redco, 2020

2025 - 2026	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	6	300		68	121,572	57
Raptor/Jumbo	26	75		41	77,806	37
Scoop	12	185		59	129,947	61
Front loader	1	150		16	2,384	1
Mixer Truck	6	138		44	36,536	17
Shotcrete Truck	6	148		44	39,184	18
Emulsion Loader	5	100		45	22,513	11
Personnel	891		212		188,794	89
Total + 10% Losses					680,610	321

Source: Sierra Metals, Redco, 2020

2027 - 2030	Quantity	HP	CFM/pers	CFM/HP	Total (CFM)	Total (m^3/s)
Trucks	6	300		68	121,572	57
Raptor/Jumbo	26	75		41	77,806	37
Scoop	12	185		59	129,947	61
Front loader	1	150		16	2,384	1
Mixer Truck	6	138		44	36,536	17
Shotcrete Truck	6	148		44	39,184	18
Emulsion Loader	5	100		45	22,513	11
Personnel	894		212		189,430	89
Total + 10% Losses					681,309	322

Source: Sierra Metals, Redco, 2020

17 Recovery Methods

Yauricocha operates a conventional concentration process that includes two parallel circuits to process polymetallic sulphide and oxide mineralized material. Each circuit consists of a crushing stage, grinding, sequential differential flotation, concentrate dewatering, thickening and disposal of flotation tails. The Yauricocha plant currently produces three mineral concentrates: a lead sulfide concentrate, a copper sulfide concentrate, and a zinc concentrate.

In addition to the mineralized material supplied from its own mine, Yauricocha has been processing, and expects to continue processing, material from third-party sources whenever there is spare capacity in the processing facilities.

Recent improvements to the processing facilities include:

- Addition of one OK-50 flotation cell to increase Cu-Pb bulk flotation stage
- Installation of x-ray slurry analyzer for six streams: flotation feed, middling Zn feed, copper final concentrate, lead final concentrate, zinc final concentrate and final tailings
- Mechanical rod feeder for primary rod mill grinding for improved safety and production
- Installation of 5 DR-180 cells in the Second Zn Cleaning Flotation Stage; 4 DR-180 cells in the Third Zn Cleaning Flotation Stage in order to improve the Zn concentrate grade and to increase the nominal plant capacity up to 4000 t/d
- Installation of 10 DR-180 cells in the Bulk Cleaning Flotation Stage arranged in three banks, with which the flotation retention time is increased from 9 minutes to 17 minutes.
  - First Cleaning Flotation Stage (comprising 5 cells);
  - Second Cleaning Flotation Stage (comprising 3 cells); and
  - Third Cleaning Flotation Stage (comprising 2 cells).

17.1 Operational Results

Yauricocha's recent plant performance during the period January 2019 to June 2020 is presented in Table 17-1 and the historical plant performance is shown in Table 17-2.

Table 17-1: Mill Tonnage and Head Grades, January 2019 to June 2020

Period	Mineralized Material (tonnes)	Head Grade					
		Au (g/t)	Ag (g/t)	Pb (%)	Cu (%)	Zn (%)	As (%)
2020 Jun	78,080	0.63	61.10	1.49	1.02	3.72	0.13
2020 May	64,364	0.68	69.65	1.99	1.10	3.89	0.14
2020 Apr	60,090	0.53	69.69	1.43	1.57	2.74	0.14
2020 Mar	78,553	0.63	70.85	1.59	1.22	3.87	0.14
2020 Feb	103,764	0.66	66.01	1.60	1.09	3.81	0.14
2020 Jan	102,908	0.75	61.89	1.49	1.11	4.05	0.14
2019 Dec	110,939	0.70	59.33	1.47	1.22	3.99	0.13
2019 Nov	101,862	0.55	58.74	1.66	0.93	4.09	0.15
2019 Oct	108,900	0.56	62.27	1.52	1.01	4.07	0.13
2019 Sep	100,030	0.51	63.02	1.54	1.11	3.57	0.15
2019 Aug	106,988	0.59	66.77	1.82	1.14	3.94	0.14
2019 Jul	100,221	0.64	69.25	1.69	1.11	3.86	0.15
2019 Jun	99,588	0.55	68.84	1.80	1.09	3.58	0.13
2019 May	101,502	0.65	59.55	1.50	0.94	3.33	0.14
2019 Apr*	53,075	0.61	59.25	1.29	1.12	3.02	0.14
2019 Mar*	51,707	0.59	64.91	1.48	1.17	3.29	0
2019 Feb	88,010	0.59	63.08	1.28	1.06	3.57	0
2019 Jan	94,097	0.50	63.15	1.61	0.85	3.70	0
Total	**1,604,679**	**0.61**	**64.10**	**1.58**	**1.09**	**3.72**	**0.12**

Source: Sierra Metals, 2020
* production in March and April 2019 was affected by a strike at the mine.

Table 17-2: Yauricocha Polymetallic Circuit, 2013 to 2020* Performance

Period	Stream	Tonnes	Tonnes/day (@ 365 d/y)	Concentrate Grade					Metal Recovery				
				Au (g/t)	Ag (g/t)	Pb (%)	Cu (%)	Zn (%)	Au (%)	Ag (%)	Pb (%)	Cu (%)	Zn (%)
2013	Mineralized Material	641,268	1,757		83.0	1.5	0.7	4.1		100.0	100.0	100.0	100.0
	Cu Con.	12,728	35		1,058.0	2.8	23.2	6.4		25.2	3.7	70.6	3.1
	Pb Con.	14,258	39		1,300.0	53.4	1.8	5.9		34.7	80.0	6.3	3.2
	Zn Con.	45,412	124.4		122.0	0.6	1.0	50.8		10.4	3.0	10.8	88.7
2014	Mineralized Material	703,713	1,928		84.0	1.8	0.7	4.0		100.0	100.0	100.0	100.0
	Cu Con.	12,782	35		1,115.0	2.1	26.4	6.8		24.2	2.1	68.0	3.1
	Pb Con.	18,055	49		1,398.0	58.6	1.5	4.9		42.8	83.9	5.3	3.2
	Zn Con.	48,657	133		115.0	0.8	1.4	50.6		9.5	3.1	13.2	88.5
2015	Mineralized Material	618,460	1,694		79.0	1.6	0.6	3.4		100.0	100.0	100.0	100.0
	Cu Con.	8,145	22		1,278.0	2.3	27.8	4.1		21.4	1.8	65.3	1.6
	Pb Con.	14,463	40		1,656.0	59.5	1.1	4.3		49.3	85.7	4.7	2.9
	Zn Con.	37,587	103		91.0	0.6	1.2	50.7		7.1	2.1	13.4	90.1
2016	Mineralized Material	698,872	1,915	0.5	80.3	1.8	0.6	3.9	100.0	100.0	100.0	100.0	100.0
	Cu Con.	9,068	25	3.1	1362.6	2.1	26.3	6.8	8.1	22.0	1.5	61.3	2.3
	Pb Con.	18,014	49	1.7	1470.8	59.0	1.2	4.8	9.1	47.2	86.3	5.6	3.1
	Zn Con.	47,573	130	0.4	95.2	0.7	1.2	51.5	4.9	8.1	2.6	14.2	88.9
2017	Mineralized Material	966,138	2,647	0.6	66.0	1.5	0.7	3.9	100.0	100.0	100.0	100.0	100.0
	Cu Con.	16,412	45	2.7	920.5	2.4	26.9	7.6	8.4	23.7	2.8	67.3	3.3
	Pb Con.	21,731	60	1.8	1242.3	56.8	2.5	5.5	7.4	42.3	86.9	8.4	3.2
	Zn Con.	65,671	180	0.4	110.8	0.9	1.4	51.4	5.3	11.4	4.0	14.2	89.4
2018	Mineralized Material	985,679	2,700	0.6	58.4	1.3	0.9	3.8	100.0	100.0	100.0	100.0	100.0
	Cu Con.	21,940	60	2.2	677.4	2.3	28.1	7.5	8.4	25.8	3.8	70.1	4.4
	Pb Con.	20,146	55	2.2	1087.5	56.1	3.3	5.7	7.6	38.1	85.8	7.5	3.0
	Zn Con.	65,823	180	0.5	101.4	0.8	1.8	50.9	5.2	11.6	4.1	13.4	88.7
2019	Mineralized Material	1,092,410	2,993	0.6	63.9	1.6	1.1	3.7	100.0	100.0	100.0	100.0	100.0
	Cu Con.	30,931	85	2.3	593.9	1.8	29.4	6.0	11.0	26.3	3.2	76.9	4.6
	Pb Con.	26,574	73	2.1	1131.6	57.6	2.4	5.5	8.4	43.1	88.8	5.4	3.6
	Zn Con.	69,863	191	0.5	90.6	0.6	1.7	51.0	4.9	9.1	2.6	10.1	88.0
2020*	Mineralized Material	483,509	2,657	0.7	66.3	1.6	1.2	3.7	100.0	100.0	100.0	100.0	100.0
	Cu Con.	17,127	94	1.9	531.5	1.9	25.4	5.9	10.4	28.4	4.3	76.4	5.6
	Pb Con.	13,972	77	2.2	996.4	47.9	2.1	4.0	9.5	43.4	87.2	5.1	3.1
	Zn Con.	38,925	214	0.4	76.9	0.6	1.5	40.5	5.1	9.3	3.0	10.6	87.5

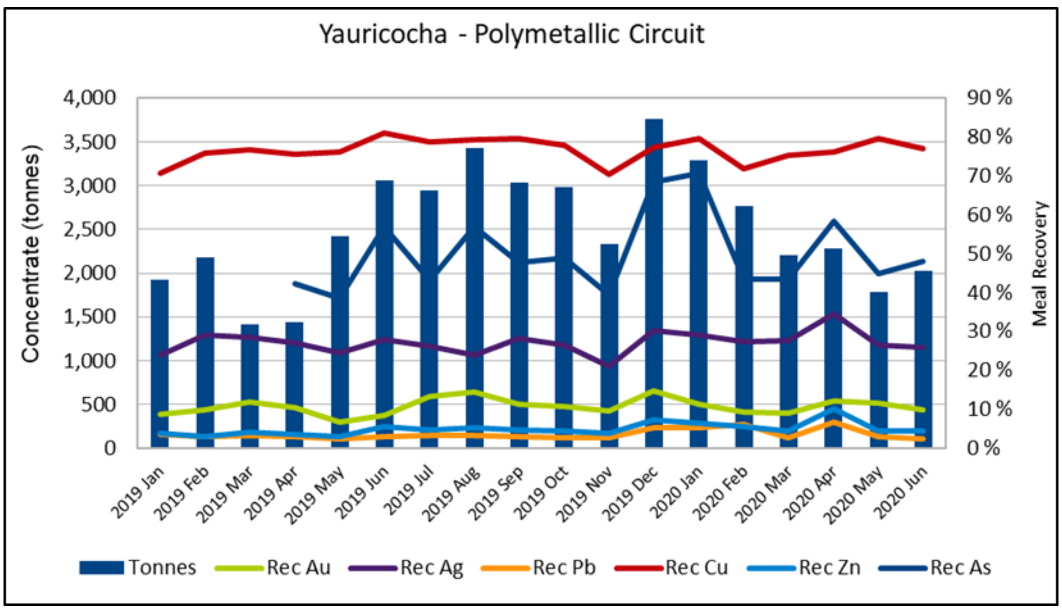
Source: Sierra Metals, 2020
* January to June 2020

The following observations are made:

- Mineralized material fed to the mill totalled 1,604,679 tonnes, or equivalent to a monthly average of 89,149 tonnes, and 2,972 tonnes of daily average throughput, which closely compares to Yauricocha's nominal plant capacity of 3,000 tpd.
- Fresh feed tonnage appears to show a seasonal fluctuation, with lower throughput at the beginning of each year's second quarter. This is likely due to the rainy season in the Andes' highlands where Yauricocha is located.
- Head grades appear reasonably consistent over the period with averages of 0.61 g/t Au, 64.1 g/t Ag, 1.58% Pb, 1.09% Cu, 3.72% Zn, and 0.12% As.

Yauricocha's overall concentrate production and metal recovery to concentrates is presented in Table 17-3 and Figure 17-1. The 18-month period from January 2019 to June 2020 shows a total concentrate production of 187,477 tonnes equivalent to approximately 347 tpd that is trucked offsite to a point of sale. The deportment of metals to concentrates (metal recovery) reached 24.5% Au, 79.4% Ag, 94.5% Pb, 92.3% Cu, 96.1% Zn, and 54.8% As.

Consistent with changes in the mineralized material throughput, concentrate production appears lower during the rainy season. Metal recoveries appear reasonably stable for all metals except for silver that suggest an upward trend towards 80% to 85% range by middle 2020. Arsenic, a deleterious element, showed a spike to 75% to 80% range in recovery in late 2019 and early 2020, but was brought back to its historical 50% range values afterwards.



Source: Sierra Metals, 2020

Figure 17-1: Yauricocha Mill Concentrate Production and Recoveries

17.2 Polymetallic Circuit

Yauricocha polymetallic circuit has a nominal capacity of 4,000 tpd. During the period of January 2019 to June 2020, zinc concentrate accounts for the largest concentrate tonnage produced from the polymetallic circuit with 101,230 tonnes or 55% of the total tonnage produced. Copper concentrate accounts for 24% or 42,285 tonnes produced. Lead concentrate accounts for 21% or 38,169 tonnes produced.

17.2.1 Copper Concentrate

The deportment of copper minerals to copper concentrate during the period of January 2019 to June 2020 achieved a 76.9% recovery; resulting in a concentrate grade averaging 29.7% Cu during the period; this grade is within the typical values of commercial concentrates in the industry.

It is likely that Yauricocha is paying penalties and receiving credits for the presence of other metals in its copper concentrate as follows:

- Pb, Zn are likely penalized.
- Arsenic is a deleterious element that grades in the 2% to 3% range and is therefore likely triggering penalties. Note that arsenic is preferably recovered with copper minerals into the copper concentrate at 45.3% recovery.
- In terms of precious metals, the gold content at approximately 2 g/t is in the lower end of what is typically paid by smelters and traders.
- Silver at approximately 606.5 g/t is a credit metal for this concentrate.

17.2.2 Lead Concentrate

The deportment of lead minerals to the lead concentrate during the period of January 2019 to June 2020 achieved an 88.3% recovery resulting in a concentrate grade of 57.6% Pb which falls within typical commercial quality. Copper and zinc are at values high enough to trigger penalties. Arsenic is under the penalty threshold. Gold content is low for a concentrate and as such may or may not trigger credit payment.

Silver is preferably deported to lead concentrate at 43.5% recovery and grading 933 g/t to 1,244 g/t is a credit metal for this concentrate.

17.2.3 Zinc Concentrate

The deportment of zinc minerals to the zinc concentrate during the period of January 2019 to June 2020 achieved an 87.9% recovery resulting in a concentrate grade of 50.7% Zn which falls within typical commercial quality. The presence of other base metals in the zinc concentrate is low enough that they may not trigger penalty payments. Arsenic grade is negligible at 0.05% and therefore not a cause of penalty payments. Gold grade at 0.48 g/t is below the level of credit payment. Silver recovery to zinc concentrate averaged 9.2% translating to 2.96 oz/tonne grade in concentrate and therefore a credit contributor to the value of the zinc concentrate.

17.3 Oxide Circuit

Yauricocha oxide circuit has a nominal capacity of 600 tpd and is currently underutilized due to the shortage of oxide minerals in the zones currently being mined. The oxide circuit's average throughput has consistently decreased (Table 17-3) from approximately 546 tpd in 2013, 512 tpd in 2014, 571 tpd in 2015, 342 tpd in 2016, 97.6 tpd in 2017 and 14.4 tpd in 2018. No oxide mineralized material processing is reported for the January 2019 to June 2020 period.

Silver deportment has varied significantly with the different oxide mineralized materials processed throughout the years in the oxide circuit. Silver was preferentially deported to the lead oxide concentrate in 2013 reaching a recovery of 37.4%.

During the year 2018, the behavior of silver did not show a marked preference reaching 25.9% recovery in the copper oxide concentrate. In 2018, gold preferably deported to the copper oxide concentrate reaching 18.8% and concentrate grade of 1.3 g/t Au.

Table 17-3: Yauricocha Oxide Circuit, 2013 to 2018 Performance

Period	Stream	Tonne	Tonnes/day (@365 d/y)	Concentrate grade					Recovery				
				Au (g/t)	Ag (g/t)	Pb (%)	Cu (%)	Zn (%)	Au (%)	Ag (%)	Pb (%)	Cu (%)	Zn (%)
2013	Mineralized Material	199,443	546.0		275.1	7.6	0.7	1.7		100.0	100.0	100.0	100.0
	Pb Ox Con.	19,756	54.0		1,037.8	46.6	0.8	2.7		37.4	60.7	12.0	15.5
	Cu Ox Con.	355	1.0		605.3	4.3	20.7	16.6		0.4	0.1	5.4	1.7
2014	Mineralized Material	186,701	512.0		222.3	8.5	0.7	1.6		100.0	100.0	100.0	100.0
	Pb Ox Con.	22,843	63.0		906.9	46.5	0.7	2		49.9	66.7	12.1	15.3
	Cu Ox Con.	970	3.0		340.1	10.7	18.6	1.9		0.8	0.7	13.2	0.6
2015	Mineralized Material	208,543	571.0		170.8	6.8	0.9	1.9		100.0	100.0	100.0	100.0
	Pb Ox Con.	20,459	56.0		843.9	44.8	0.9	2		48.5	64.8	10.0	10.1
	Cu Ox Con.	1,272	3.0		131.9	7.2	20.5	3.5		0.5	0.6	14.4	1.1
2016	Mineralized Material	124,867	342.0	0.9	144.2	6.0	1.1	2.5	100.0	100.0	100.0	100.0	100.0
	Pb Con.	2,513	7.0	11.7	1413.8	25.5	1.4	17.7	25.5	19.7	8.5	2.6	14.2
	Pb Ox Con.	9,648	26.0	3.1	554.8	42.5	1.3	2	26.2	29.7	54.4	9.1	6.1
	Cu Ox Con.	2,194	6.0	0.7	120.4	5.7	21.2	3.8	1.3	1.5	1.7	32.9	2.7
2017	Mineralized Material	35,635	97.6	0.4	54.1	1.0	4.1	2.8	100.0	100.0	100.0	100.0	100.0
	Cu Ox Con.	3,839	10.5	1.1	207.1	3.4	22.2	6.8	28.5	41.2	36.4	57.8	25.9
2018	Mineralized Material	5,263	14.4	0.6	70.6	1.7	4.7	5.6	100.0	100.0	100.0	100.0	100.0
	Cu Ox Con.	445	1.2	1.3	216.8	4.2	18.3	15.2	18.8	25.9	21.2	32.8	22.7

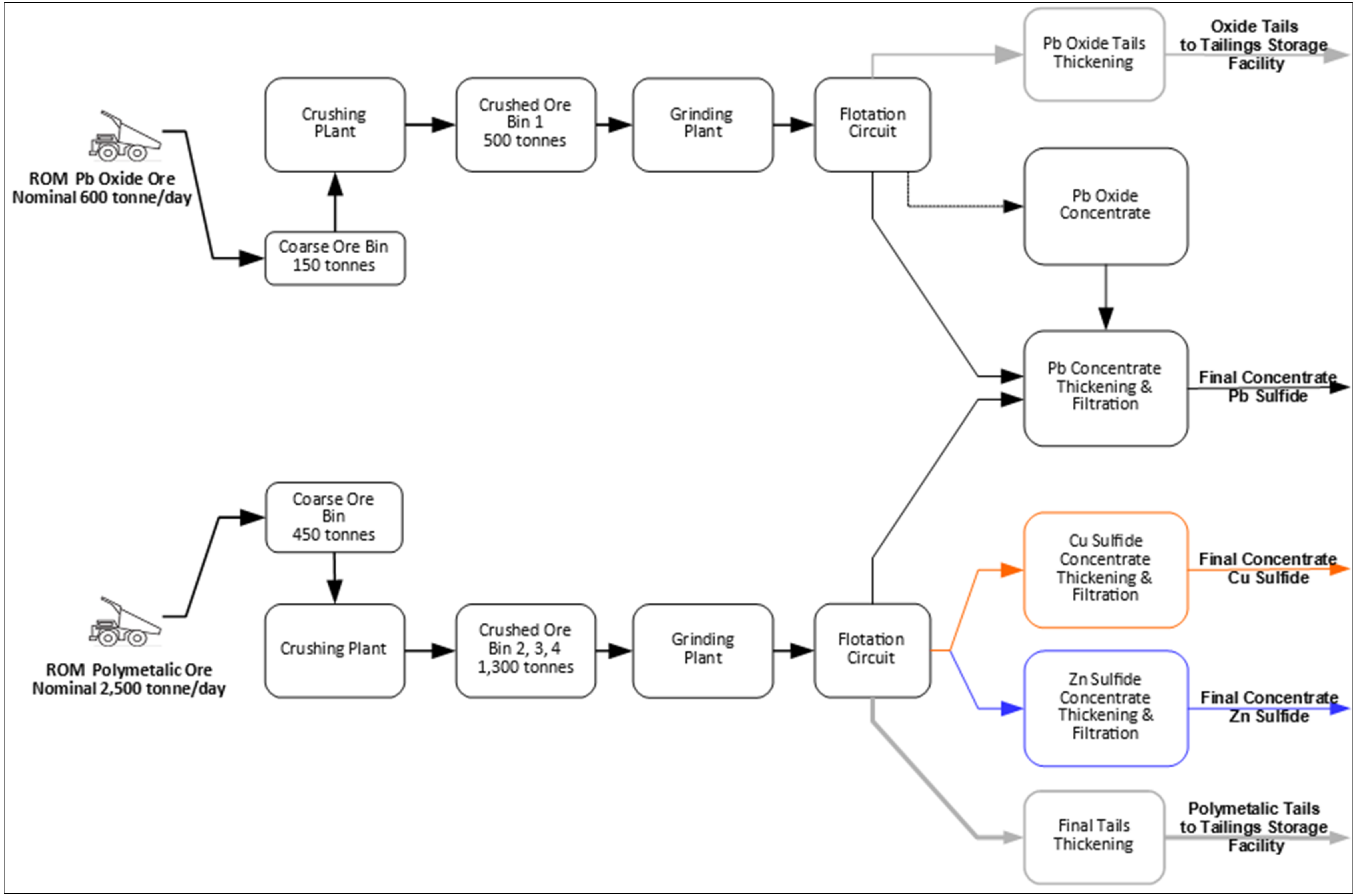
Source: Sierra Metals, 2020

The lead concentrate produced from the oxide circuit has consistently resulted in lead grade below typical market values; it also represents a small tonnage when compared to the lead sulfide concentrate produced from the polymetallic circuit. All lead concentrate streams are blended in a single concentrate thickener to become a single final lead sulfide concentrate stream.

17.4 Processing Methods

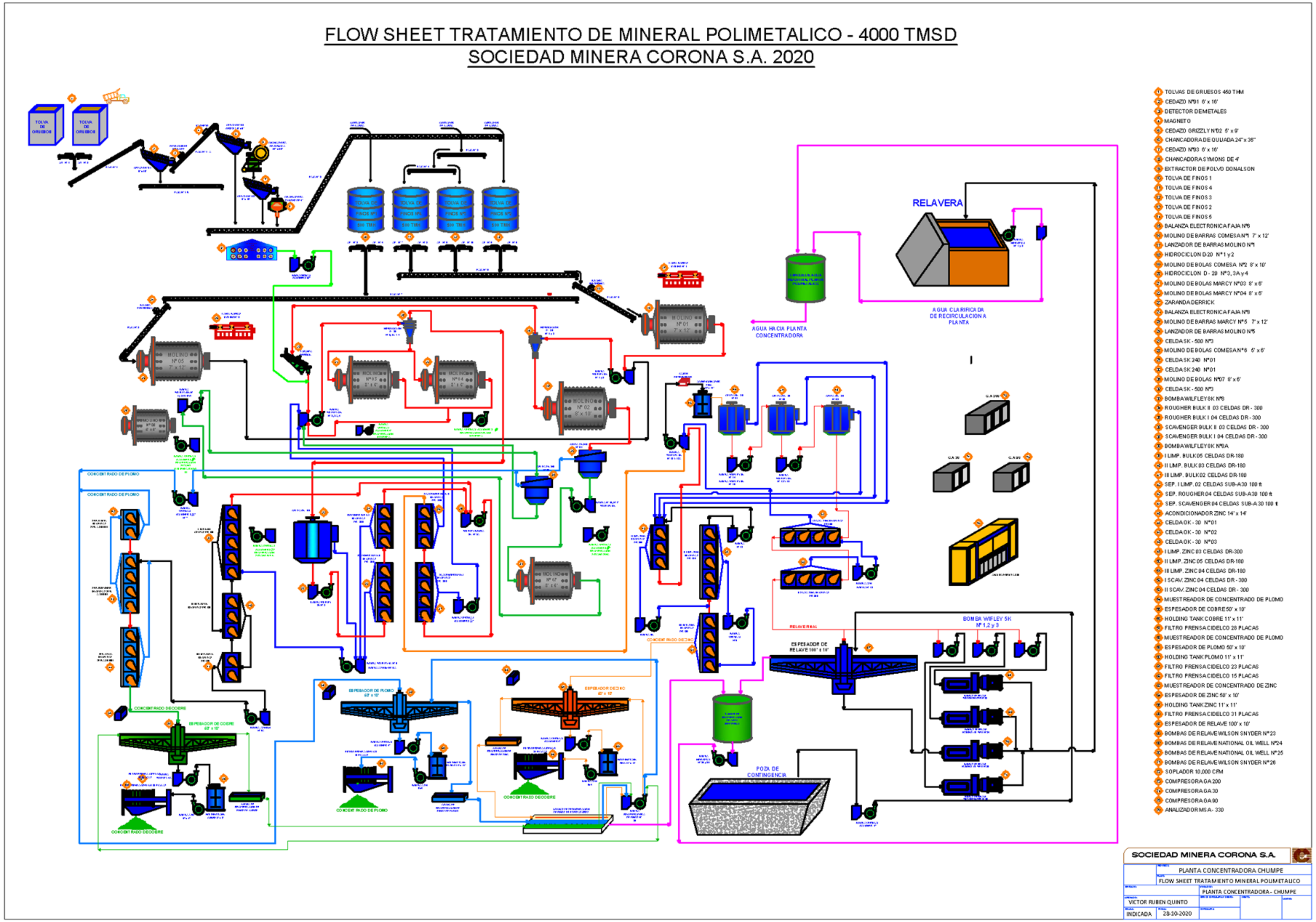
Yauricocha operates a conventional concentrator flowsheet. Mine trucks deliver polymetallic mineralized material and oxide mineralized material to their respective coarse mineralized material bins (Figure 17-2). The single crushing plant batches mineralized material that is delivered to dedicated mineralized material bins to each processing line. Each process line includes a grinding stage and a sequential differential flotation plant. Concentrate streams are diverted to a dedicated thickener that feeds a concentrate filter.

The detailed flowsheets for the polymetallic and oxide plants are presented in Figure 17-3 and Figure 17-4 respectively.



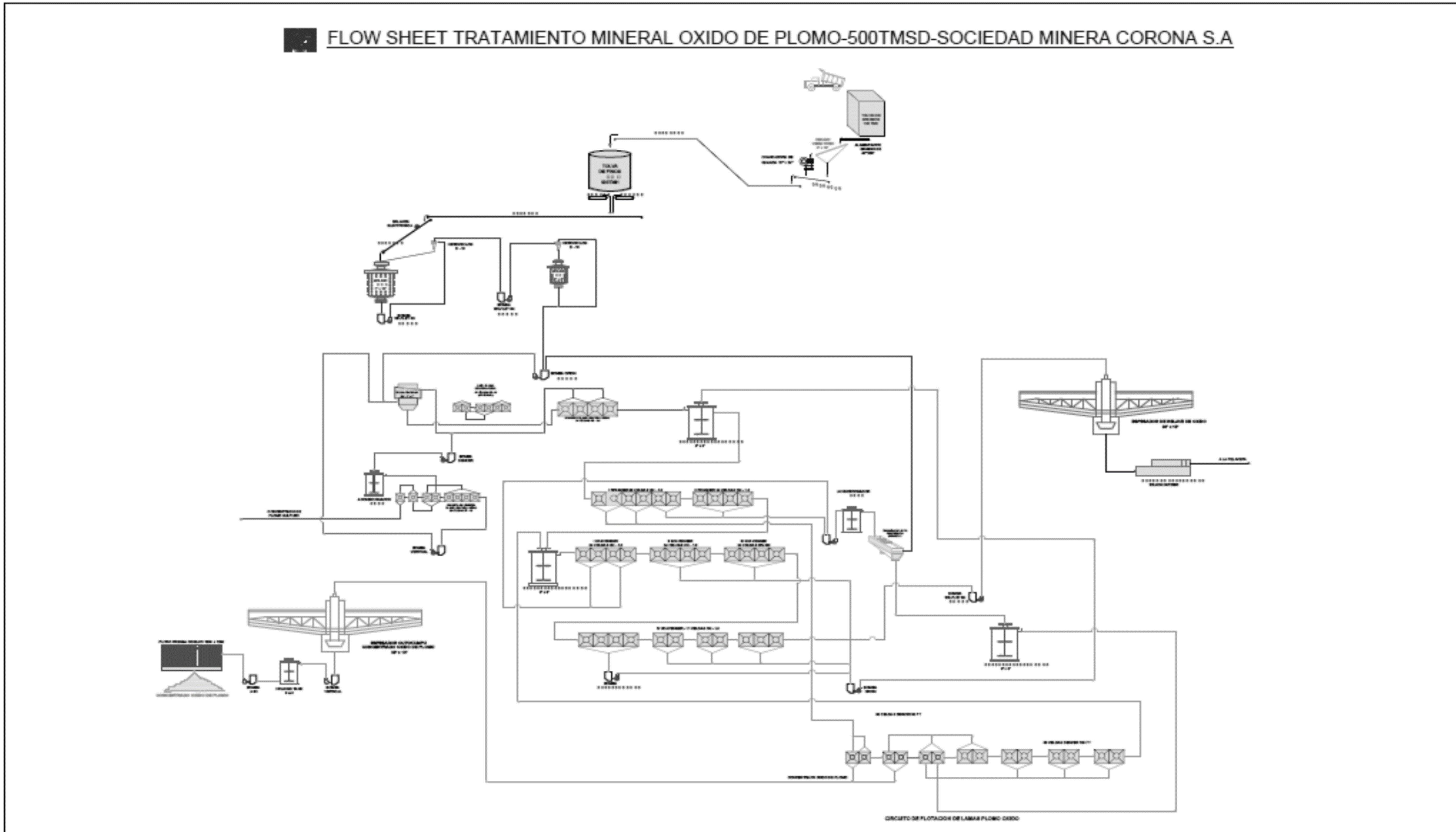
Source: Sierra metals, 2020

Figure 17-2: Yauricocha Block Flow Diagram



Source: Sierra Metals, 2020

Figure 17-3: Flowsheet Polymetallic Plant



Source: Sierra Metals, 2020

Figure 17-4: Flowsheet Oxide Plant

17.5 Plant Design and Equipment Characteristics

Yauricocha uses conventional concentration equipment and the operation is completely manual. An online x-ray analyzer is being installed that will allow for real-time control of the process. Both circuits have a flotation feed target of approximately P80 = 104 micrometres, which is monitored manually using a Marcy scale.

Yauricocha is increasing Pb-Cu bulk flotation time by installing one OK-50 flotation cell and replacing smaller, older cells in the zinc circuit. Overhaul of its concentrate thickener with torque monitoring and a rake positioning system is planned in 2020 to improve underflow slurry density and increase concentrate filtration capacity. Work continues to de-bottleneck the plant to maximize capacity.

Table 17-4 summarizes the major process equipment at the process facility.

Table 17-4: Yauricocha Plant, Major Process Equipment

Area	Equipment	Specification	# Units	kW
Crushing	Jaw crusher	10 inch x 24 inch	1	45
Oxide	Rod mill	7 ft x 12 ft	1	360
Oxide	Ball Mill	5 ft x 6 ft	1	63
Oxide	Flotation cell	7 ft x 7 ft	1	30
Oxide	Flotation cell	Denver 60	22	11
Oxide	Flotation cell	OK 1.5	33	22
Oxide	Flotation cell	SP 18	14	7
Oxide	Flotation cell	Denver 100	8	45
Oxide	Pb Ox Con. Thickener (Con. Cu)	50 ft x 10 ft	1	6
Oxide	Pb Ox Press filter (Con. Cu)	1,200 x 1,200	1	
Polymetallic	Jaw crusher	24” x 36”	1	45
Polymetallic	Cone crusher	4 ft	1	75
Polymetallic	Ball Mill	8 ft x 10 ft	1	360
Polymetallic	Ball Mill	8 ft x 6 ft	3	186
Polymetallic	Rod mill	7 ft x 12 ft	1	186
Polymetallic	Flotation cell	SK 240	2	
Polymetallic	Flotation cell	OK 30	3	
Polymetallic	Scavenger Flotation cell (Zn)	DR-300	8	238.6
Polymetallic	First Cleaning Flotation cell (Zn)	DR-300	3	89.5
Polymetallic	Second Cleaning Flotation cell (Zn)	DR-180	5	111.9
Polymetallic	Third Cleaning Flotation cell (Zn)	DR-180	4	89.5
Polymetallic	Column cell		1	
Polymetallic	Conditioner	14 ft x 14 ft	1	
Polymetallic	Flotation cell (Pb/Cu)	DR-180	10	223.7
Polymetallic	Flotation cell	Sub-A 30	12	45
Polymetallic	X-Ray Slurry Analyzer	Multi-Stream Analyzer 330	1	
Polymetallic	Cu Con. Thickener	30 ft x 10 ft	1	4
Polymetallic	Pb Con. Thickener	50 ft x 10 ft	1	1.11
Polymetallic	Zn Con. Thickener	50 ft x 10 ft	1	1.11
Polymetallic	Tails thickener	100 ft x 10 ft	1	
Polymetallic	Pb Press filter	1,200 mm x 1,200 mm	1	
Polymetallic	Zn Press filter	1,500 mm x 1,500 mm	1	

Source: Sierra Metals, 2020

17.6 Consumable Requirements

The consumables statistics for 2020 are presented in Table 17-5 for the polymetallic and oxide circuits. All consumables arrive to Yauricocha site on truck, mostly from Callao Port in Lima.

Table 17-5: Polymetallic and Oxide Circuits – Consumables

Plant	Item	kg/ton of Fresh Feed
Polymetallic	S04Zn	0.75
Polymetallic	NaCN	0.333
Polymetallic	Z-11	0.033
Polymetallic	Z-6	0
Polymetallic	MIBC	0.053
Polymetallic	FROTHER-70	0
Polymetallic	Lime	0.666
Polymetallic	CuSO4	0.566
Polymetallic	Sodium Metabisulfite	0.2
Polymetallic	Phosphate Monos.	0
Polymetallic	Z-14	0.033
Polymetallic	Sodium Dic.	0
Polymetallic	Zn Oxide	0.166
Polymetallic	Steel balls 1 ½” Ø	0.333
Polymetallic	Steel balls 2” Ø	0.466
Polymetallic	Steel rods 3” Ø	0.4
Oxide	Na2Si03	0
Oxide	A-31	0
Oxide	(NH4) S03	0
Oxide	S04Zn	0
Oxide	Diesel	0
Oxide	Z-14	0
Oxide	NaCN	0
Oxide	A 407	0
Oxide	CuS04	0
Oxide	MT-738	0
Oxide	A-404	0
Oxide	MIBC	0
Oxide	FROTHER-70	0
Oxide	Steel balls 1 ½ “Ø	0
Oxide	Steel balls 2” Ø	0
Oxide	Steel balls 3” Ø	0

Source: Sierra Metals, 2020

18 Project Infrastructure

The Project is a mature producing mine and mill and all required infrastructure is fully functional. The Project has highway access with two routes to support the Project's needs, and the regional capital Huancayo (population 340,000) is within 100 km. Personnel travel by bus to the site and are accommodated in one of four camps. There are currently approximately 1,700 personnel on-site with 500 employees and 1,200 contractors.

The on-site facilities include the processing plant, mine surface facilities, underground mine facilities, tailings storage facility (TSF), and support facilities. The processing facility includes unit processes such as crushing, grinding, flotation, dewatering and concentrate separation, concentrate storage, and thickening and tailings discharge lines to the TSF. The underground mine and surface facilities include headframes, hoist houses, shafts and winzes, ventilation structures, mine access tunnels, waste storage facilities, powder and detonator magazines, underground shops, and diesel fuel and lubrication storage. The support facilities include four accommodation camps where personnel live while on site, a laboratory, change houses and showers, cafeterias, school, medical facility, engineering and administrative buildings, and miscellaneous equipment and electrical shops to support the operations.

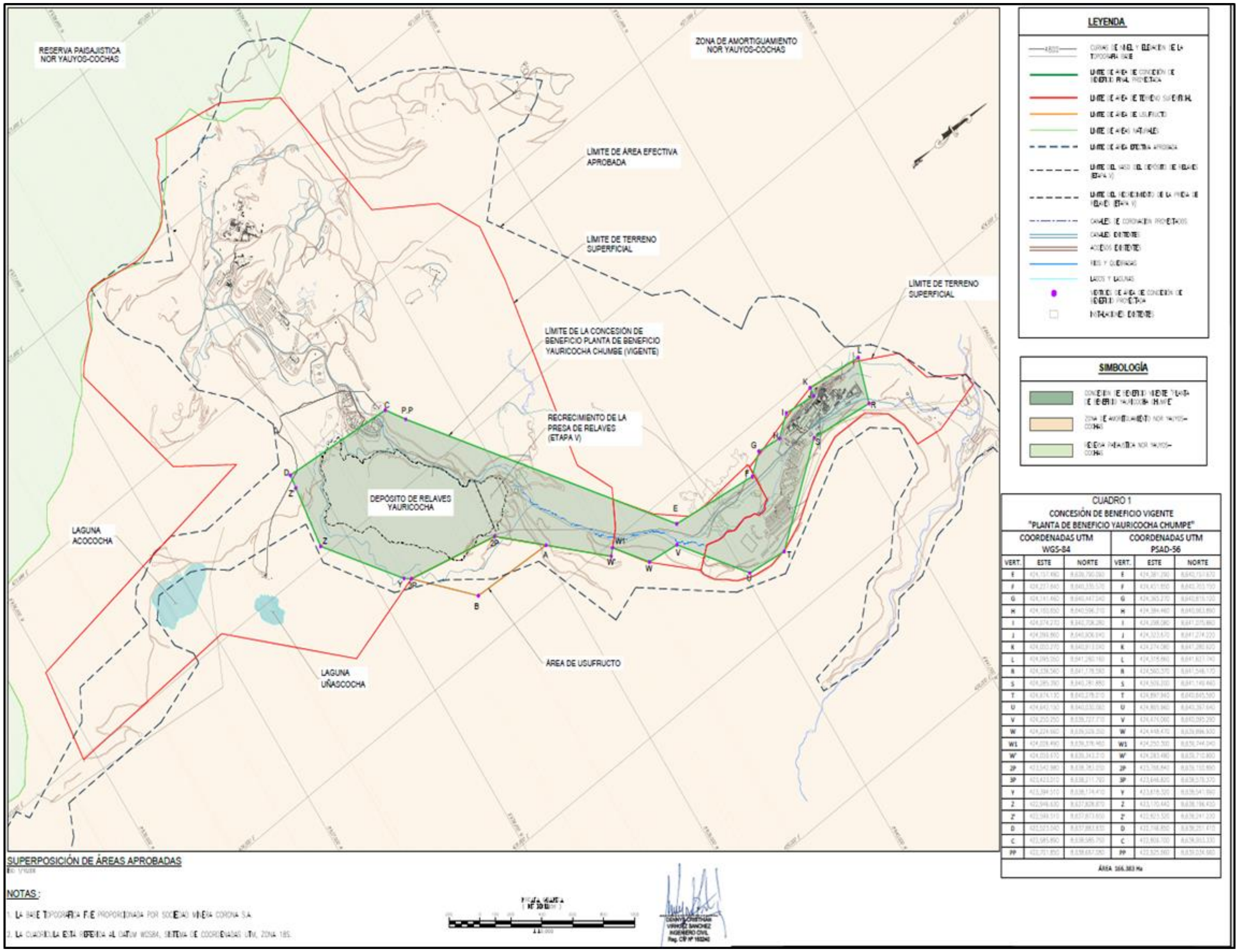
The site has existing water systems to manage the Project's water needs. Water is sourced from Ococha Lagoon, Cachi-Cachi underground mine, and recycle/overflow water from the TSF, depending on end use. Water treatment systems treat the raw water for use as potable water or for service water in the plant. Additional systems treat the wastewater for further consumption or discharge.

Energy for the site is available through electric power, compressed air, and diesel. The electric power is supplied by contract over an existing 69 kV line to the site substation. The power is distributed for use in the underground or at the processing facility. The current power load is 10.5 MVA with approximately 70% of this being used at the mine and the remainder at the mill and other facilities. The power system is planned to be expanded to approximately 14 MVA in 2020/2021. A compressed air system is used underground with an additional 149 kW compressor system being added, and diesel fuel is used in the mobile equipment and in the 895 kW backup electrical generator.

The site has permitted systems for the handling of waste including a TSF, waste rock storage facility, and systems to handle other miscellaneous wastes. The TSF has a capacity for 12 months at the current production levels. The TSF is being expanded with another lift in 2019/2020 to provide three more years of capacity. The three additional lift stages in total will provide the Project with approximately nine years of additional capacity. An on-site industrial landfill is used to dispose of the Project's solid and domestic waste. The Project collects waste oil, scrap metal, plastic, and paper which are recycled at off-site licensed facilities.

The site has an existing communications system that includes a fiber optic backbone with internet, telephone, and paging systems. The security on-site is managed through checkpoints at the main access road, processing plant, and at the camp entrances.

Logistics to the site are primarily by truck with the three primary concentrate products being shipped by 30 t trucks to customer locations in Peru. Materials and supplies needed for the Project's operation are procured in Lima and delivered by truck. A general location map showing the facilities is shown in Figure 18-1.

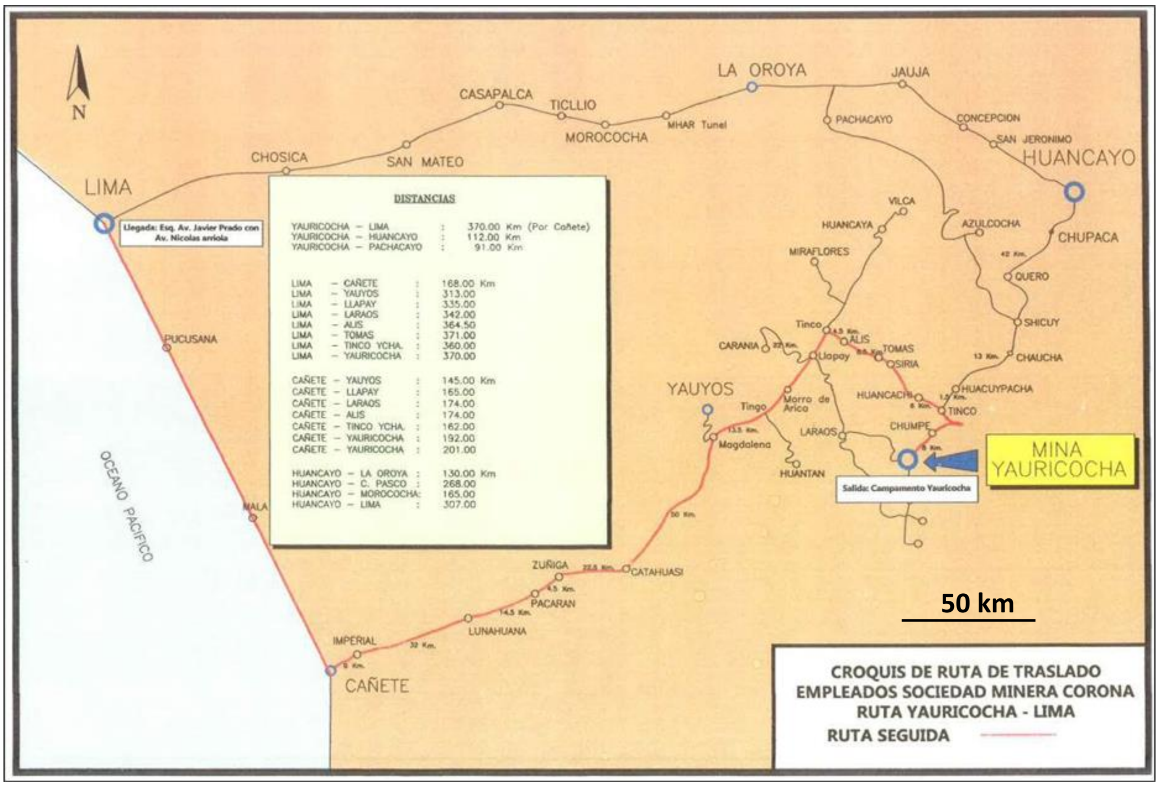


Source: Sierra Metals, 2020

Figure 18-1: Project Infrastructure Location

18.1 Access, Roads, and Local Communities

The Project site is remote in the mountains of Peru and is accessed by road from Lima on the Lima-Huancayo-Yauricocha Highway; this route is approximately 260 km long and the final section of the road is unpaved. A second access uses the paved Pan-American Highway from Lima for about 137 km, and then the old Pan-American Highway and the Cañete-Yauyos highway on to Yauricocha; this route is approximately 344 km. The site has developed several gravel secondary roads for access to the mine area (to the west), mill (to the east), and tailings areas (centrally located) as well other areas of the Project. Figure 18-2 shows the routes.



Source: Sierra Metals, 2020

Figure 18-2: Routes from Lima to the Project

The Pachacayo railway station is located approximately 100 km north of the Project.

The largest community nearest to the mine is Huancayo which is located approximately 100 km to the east-northeast. Huancayo, and the surrounding communities, have a combined population of approximately 340,000 people. Huancayo is the capital of the Junin Region of Peru.

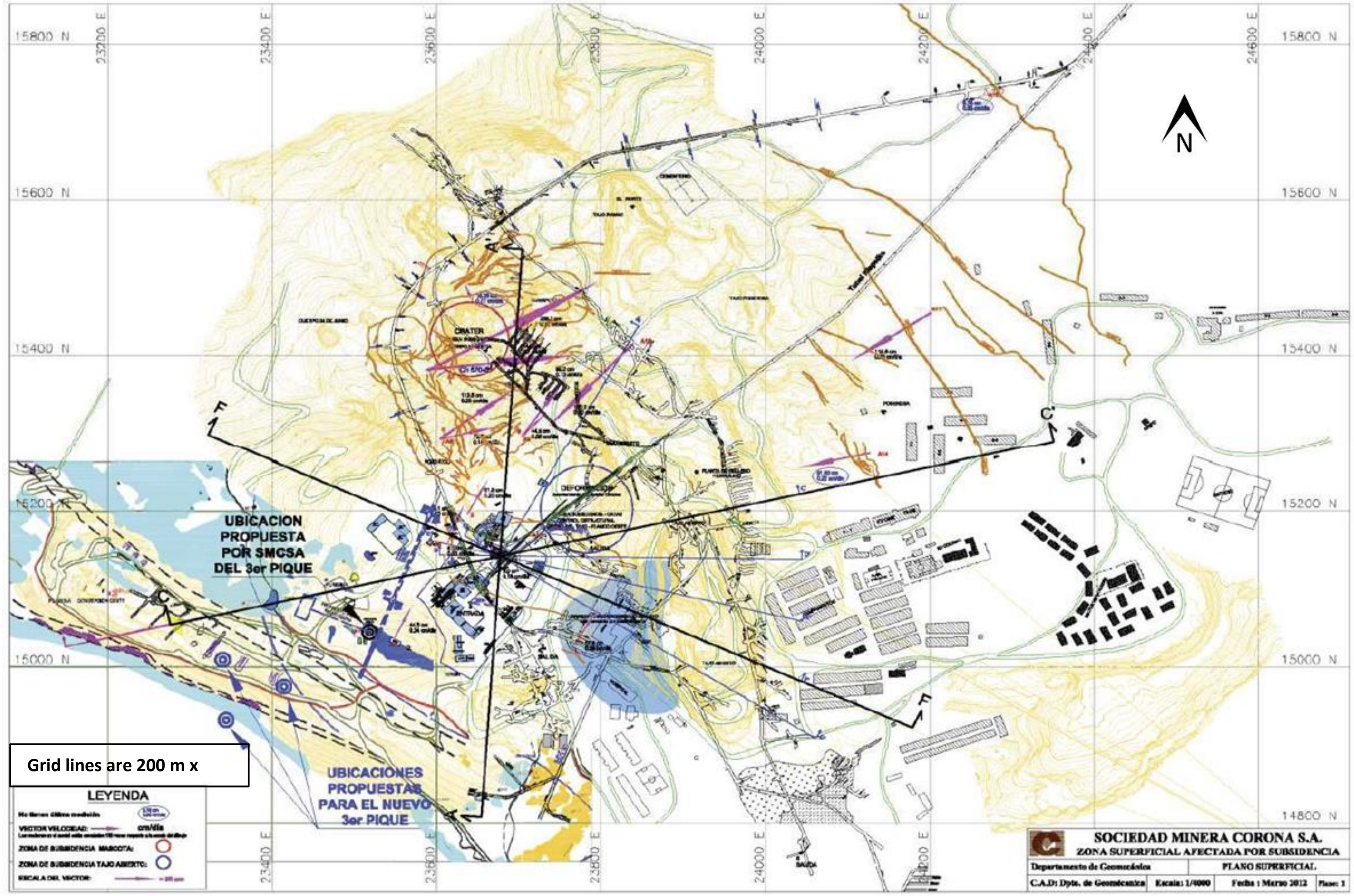
18.2 Process Support Facilities

A fully developed processing facility with required support facilities exists on-site and is discussed in detail in Section 17. The plant facility includes crushing, grinding, flotation, dewatering and concentrate separation, concentrate storage, and thickening and tailings discharge lines to the

TSF. The processing facility also has shops, sample laboratory, change house and shower, and engineering/administration facilities.

18.3 Mine Infrastructure – Surface and Underground

The mine surface facilities include the hoists and headframes that support the operation of the shafts on-site. Additionally, the change house and dry facilities, shops, engineering, and mine administrative facilities are in place. The mine area layout is shown in Figure 18-3.



Source: Sierra Metals, 2020

Figure 18-3: Mining Area Infrastructure

18.3.1 Underground Access and Haulage

The underground mine access is through existing shafts and tunnels. The site currently has three shafts in service: Central shaft, Mascota shaft and the Cachi-Cachi shaft. The new Yauricocha shaft is currently under construction.

The shafts are typically used to move men and materials but can also move mineralized material and waste to the surface if necessary. The shafts are also used to move mineralized material and waste from depth to the 720-haulage level where the material is then hauled by rail from underground tunnels to the surface. All mineralized material and waste hauling to the surface is currently moved through the tunnels only.

18.3.2 New Yauricocha Shaft

The new Yauricocha shaft is currently under construction and is expected to be commissioned by 2021. Shaft excavation work, including pulley chamber, above the service winch chamber with timber set installation, is now completed and the service winch has been commissioned for shaft sinking operations. Excavation of the incline rope raise was completed in May 2018 and the production hoist chamber work was completed in October 2019. Preparation for shaft sinking is ongoing with installation of a galloway and new winches for the galloway and Cryderman mucker installed. Installation of the 720-chute infrastructure and dump for sinking is also completed. Shaft sinking activities began in October 2017. The shaft will be sunk from 1097 level (past sinking depth) to the 1270 level (shaft bottom). One loading pocket is being constructed at the 1210 level. Hatch Engineering has completed the detailed engineering for the shaft material handling system. The Yauricocha shaft will utilize an 80,000 t/month capacity hoist that will be operated at 80% of capacity, and the shaft will handle both mineralized material and waste. The shaft is budgeted to cost US$31.2 million.

18.3.3 Central Shaft and Central Incline Shaft

The 810 m deep Central shaft services levels 970 to 690 and has a capacity of 74 t/h for mineralized material and 67 t/h for waste. The Central incline shaft is located between the 920 level and services down to the 1070 level. The Central incline shaft is a production shaft that utilizes a 200 HP winch that pulls three 1.5 t railcars between the levels. It is currently being rehabilitated from the 410 to 465 levels by a mining contractor, Gemin Mining Construction. The rehabilitation of the 1st phase is planned for completion by April 2021 and the second phase will be completed later in 2021. The reinforcement of this 1st phase consists of ring sets of reinforced concrete and H beams, shotcrete with bolts and mesh.

18.3.4 Mascota Shaft

The Mascota shaft is able to move 135 t/h of mineralized material and 110 t/h of waste. The 920 m deep Mascota shaft services the 1100 to 680 levels. The Mascota shaft utilizes a new Hepburn hoist and is able to move approximately 105,000 t/month to the 1430 level. Commissioning was completed in December 2016. The Mascota shaft timber sets were refurbished in 2018 with shaft timber sets cleaned of mineralized material and timber sets reinforced and any missing wall liners replaced. Additionally, the 1120 development drift was excavated in 2018 for shaft bottom clean up.

18.3.5 Cachi-Cachi Shaft

The Cachi-Cachi shaft provides access to the 870-level shaft bottom at 910 level and handles only Cachi-Cachi zone waste and mineralized material.

18.3.6 Subsidence in Central and Mascota Zones

The subsidence associated with the SLC extraction method currently impacts the central shaft, which is why it is in rehabilitation by a mining contractor, Gemin Mining Construction from the 410 to 465 levels as the 1st phase, and then will continue in 2021 to the 520 level.

There is constant monitoring of the deformation and inclination of the shaft with two inclinometers of 150 m each installed parallel to the axis of the shaft. Additionally, settlement and displacement vectors are superficially monitored with a TM50 Leica robotics equipment.

The Mascota Pique Impact has been eliminated to date; therefore, the surface winch has been relocated to level 720 where no subsidence impact has yet been shown.

18.3.7 Tunnel Haulage

The existing primary haulage is through the 4 km Klepetko tunnel (3 m high x 3 m wide) located on level 720. The haulage is achieved by 20 t electric trolley locomotive with cars of 3.1 to 4.5 m^3 size.

The new Yauricocha tunnel excavation (3.5 m x 3.5 m) was completed from the surface (Chumpe) in April 2017. The tunnel is 4.7 km in length and accesses the mine at the 720 level. The tunnel was added to increase the flexibility of haulage and to de-bottleneck haulage that previously could only occur out of the Klepetko tunnel. The new Yauricocha tunnel also serves as a ventilation conduit. The tunnel infrastructure was installed with tunnel commissioning and close out was completed in December 2018. The Project costs were US$4.85 million.

18.3.8 Ventilation

The underground mine has a ventilation system that supports the Cachi-Cachi mine and a separate ventilation system that supports the Central mine.

The ventilation system at Cachi-Cachi is an intake system that pulls fresh air through the Klepetko tunnel and the main decline (Bocamina 410) at Cachi-Cachi. The air exhausts through three boreholes at the surface, Borehole (Chimera) 919, the Rossy borehole, and the Raquelita borehole. A SIVA 139 HP primary fan is located at Borehole 919 (level 300) and pulls approximately 50,000 cfm. The air moves into the mine through the main decline and down to lower levels of the mine through the shaft to where production is in progress, then the air is exhausted through vent raises and shafts to the surface. Ventilation doors are installed, and booster fans are used throughout the mine to maintain air volume and quality.

The ventilation system at the Central mine intakes air from the Central mine main decline, the Mascota and Central shafts, Raise Bore #3, and the Klepetko tunnel. The intake air is approximately 159,000 cfm. The air exhausts through Raise Bore #2 and Raise Bore #1. The primary fans are located at these locations with a Joy 180 HP fan at Raise Bore #1 and a Joy 200 HP fan at Raise Bore #2. Air is pulled through the workings and routed with ventilation doors and booster fans to maintain air volume and quality.

18.4 Additional Support Facilities

Project employees live on-site in four accommodation camps, plus a hotel, with total accommodation facilities for approximately 2,000 people. The camps include the supervisory camp, the mill camp, and the mining camp that also houses mining contractors. There are approximately 2,000 people (700 employees/1,300 contractors) currently working on the site. The camps include, dining facilities, exercise facilities, and housing facilities.

Other general facilities include engineering and geology, safety, and environmental offices and buildings. A health clinic on-site is staffed by a National Health Service doctor. There are additional underground shops, explosives and detonator magazines, and fuel and oil storage facilities.

The construction of a new cafeteria is underway and a delay in the construction was due to the Covid pandemic; however, the project, which to date is 45% complete, will be completed in 2021 at an estimated cost of US$3.0 million.

18.5 Water Systems

18.5.1 Water Supply

Water is sourced from Uñascocha Lake, Acococha Lagoon, Mishquipuquio Spring, the Klepetko tunnel and recycle/overflow water from the TSF, depending on end use. The location of the two lakes can be seen in Figure 18-1. The quality of water and general use is summarized in Table 18-1.

Table 18-1: Makeup Water Source and Use

Source	Volume (L/sec)	Use
Acococha Lagoon	4	Mining compressor and offices: 1.5 L/sec
		Yauricocha Camp: 1.5 L/sec
Mishquipuquio Spring	2	Chumpe Camp: 1.5 L/sec
Klepetko Tunnel	40	Concentrator Plant: 1.3 L/sec

Source: Sierra Metals, 2020

18.5.2 Potable Water

Water is sourced from Ocococha Lake and treated by the on-site water treatment systems for potable water consumption. There are two potable water plants on the site. At Chumpe, there is a conventionally operated multimedia filter plant (40 µm – gravel, sand) with 5 µm filters and cleaning of the water by hypochlorite. The system operates at 1.3 L/sec. At Yauricocha, a physical sedimentation stage is used, followed by treatment with hypochlorite. The system operates at 2 L/sec.

18.5.3 Service Water

Service water is used primarily at the Chumpe mill and small quantities are used for dust control on the mine surface operations. The service water is sourced from the Cachi-Cachi underground mine and delivered through the Klepetko tunnel. Additional service water is obtained from the TSF facilities. If these sources require supplementation, additional water is obtained from the Uñascocha and Ocococha lakes.

18.5.4 Water Treatment

Wastewater from the Chumpe mill and the mine is treated at the Klepetko wastewater treatment plant. The plant has a capacity of 1,000 L/sec. The treated effluent is re-used in the mill with excess discharged to the Chumpe River. Sludge generated by the treatment plant is placed in the TSF. Domestic wastewater from the camps is treated by one of the two wastewater treatment plants. The plants have a total capacity of 1.7 L/sec.

18.6 Energy Supply and Distribution

18.6.1 Power Supply and Distribution

The current total electrical load for the Project is 10.8 MVA. The primary power is provided through Sistema Interconectado Nacional (SINAC) to the Oroya Substation. A three phase, 60 hertz, 69 kV power line owned and operated by Statkraft (SN Power Peru S.A.) through its subsidiary, Electroandes S.A., delivers electricity from the Oroya Substation to the Project substation at Chumpe. Power is delivered at 69 kV line voltage to the mine and processing plant substations and approximately 4.8 MVA is supplied to the mine, 5.3 MVA is supplied to the processing plant and 0.7 MVA is supplied to the camp.

The powerlines to the plant and mine were upgraded in 2017 to 69 KV to provide more reliable power supply to the Project. Additional load is planned and some of the additional load occurred in 2017 including the addition of a hoist, raise bore equipment, diamond drilling equipment. The load will increase by approximately 1 MVA due to the installation of the pumping system in mine and will increase by a further 2 MVA for additional hoist capacity to be installed in 2021. A 0.5 MVA increase at the plant occurred in 2019 due to the addition of a 372.5 kW tailings pump. The additional load will be addressed by installation of transformers to increase the capacity of the mine to 9.5 MVA and the plant to 6 MVA. The power supply can be met by the existing 69 kV power system.

Statkraft owns, operates, and is responsible for maintenance of the Chumpe substation. 895 kW of backup generation is available through a CAT 3512B backup generator. The Project completed the addition of a 12.6 kV overhead ring line that allows the mine backup generator to be used for emergency loads in the processing plant and the Cachi-Cachi Zone. The Project has a 10-year power supply contract that was signed in November of 2013 and runs through October 2023.

18.6.2 Compressed Air

The mine uses compressed air for powering air chutes, drilling equipment, small pumps, and miscellaneous tools. The system includes compressors and tanks at the surface with piping distributing the compressed air throughout the mine. A 149 kW Compressor was added in 2018 to improve the compressed air system.

The mill has a smaller compressed air system for control air and miscellaneous tools.

18.6.3 Fuel

The Project has diesel storage tanks on-site that store fuel for use in surface mining equipment and can be transferred to the underground fuel storage facilities. These tanks have been in use for a number of years and there are two sets of fuel tanks with a total capacity of approximately 104,000 L. The first group of tanks is located at the Chumpe plant and have a total capacity of just over 68,000 L. The Chumpe tanks provide approximately 30 days of fuel supply at an average consumption of 2,100 L/d. The second set of four tanks is located near the Yauricocha Mine and has a total capacity of approximately 36,000 L. Approximately 5,700 L/d are used from the mine tanks that provide approximately six days of storage.

Fuel is purchased from vendors in Huancayo and transported to the site by truck. The 2020 fuel cost is approximately US$2.91/gal. Table 18-2 and Table 18-3 show storage capacities of the two fuel storage areas.

Table 18-2: Chumpe Diesel Storage Capacity (US Gallons and Litres)

Chumpe Location	US Gallons	Litres
Tank 01	3,384	12,810
Tank 02	1,127	4,266
Tank 03	2,230	8,441
Tank 04	2,230	8,441
Tank 05	3,064	11,598
Tank 06	6,000	22,712
Total Chumpe Capacity	**18,035**	**68,270**

Source: Sierra Metals, 2020

Table 18-3: Yauricocha Location Diesel Storage Capacity (US Gallons and Litres)

Yauricocha Location	US Gallons	Litres
Tank 07	4,354	16,482
Tank 08	1,643	6,219
Tank 09	1,457	5,515
Tank 10	2,042	7,730
Total Yauricocha Capacity	**9,496**	**35,946**

Source: Sierra Metals, 2020

18.7 Tailings Management Area

Tailings from the Chumpe mill are stored in on-site tailings facilities. The tailings undergo flocculation and settling and are then processed through a thickener and piped to the existing permitted TSF. The dam up to Stage 7 has a capacity of 7,773 km^3. Currently, the construction of Stage 5 Phase 1 (4531 masl) has been completed for a capacity of 1,003 km^3. The construction of Phase 2 of Stage 5 (4533 masl) is to be restarted in November 2020, continuing with Stage 6 in 2021 and Stage 7 in 2022. Table 18-4 shows some of the parameters of the Stage 5 expansion.

Table 18-4: Tailings Storage Facility (Stage 5 Expansion)

Description	Phase 1
Berm level	4,529.00 masl
Level of storage	4,526.00 masl
Projected level of final berm (Phase 1)	4,531.00 masl
Maximum storage level	4,528.50 masl
Freeboard	2.50 m
Berm width	8.00 m
Upstream slope	vertical
Downstream slope	2.5H:1V
Volume of dam fill material	382,837.71 m^3
Horizontal projection area of the TSF	408,747.09 m^2
Volume of stored tailings material	1,003,937.46 m^3
Horizontal projection area of dike footprint	25,177.83 m^2
Growth Phases (Stage 5)	Phase 01: 4,531 masl
	Phase 02: 4,533 masl
Additional life of TSF - Phase 01	1.47 years
Description	**Phase 2**
Berm level - Stage 4	4,529.00 masl
Maximum tailings level – prior to Stage 4	4,526.00 masl
Projected level of final berm (Phase 2)	4,533.00 masl
Maximum storage level	4,531.50 masl
Freeboard	1.50 m
Berm width	8.00 m
Upstream slope	Vertical
Downstream slope	2.5 H:1V
Horizontal projection area of the TSF	430,812.39 m^2
Volume of stored tailings material	2,262,507.46 m^3
Horizontal projection area of dike footprint	32,745.31 m^2
Volume of dam fill material	383,006.70 m^3

18.7.1 Expansion of TSF (Stage 5 and 6)

Sierra engaged Geoservice Ingenieria (GI) to design the TSF expansion for Stages 5 to 7 with a priority on Stage 5, which will resume Phase 2 in November 2020. SRK didn't undertake a review of the designs. GI was contracted in 2013 by Sierra Metals to design approximately 10 years of additional capacity. The future tailings storage for the Project will incorporate three additional 4 m raises to the existing TSF. The three raises are called Stage 5, 6, and 7. GI reviewed the previous design study by Klohn Crippen Berger (April 2009) and the GI report from October 2013. A topography surface was provided by Sierra in 2013. GI reviewed the site hydrology, geology, hydrogeology, seismic risk, and designed the TSF facility raises.

The TSF key design elements are summarized in Table 18-5.

Table 18-5: Yauricocha Key Design Elements for TSF Expansion Stages 5, 6, and 7

Design Item	Units	Stage 5	Stage 6	Stage 7
Altitude of crest, previous stage	masl	4,529	4,533	4,537
Maximum altitude of tailings, previous stage	masl	4,526	4,531	4,535
Height of extra elevation, this stage	m	4	4	4
Altitude of crest, this stage	masl	4,533	4,567	4,541
Maximum level of storage	masl	4,531.50	4,535	4,539
Freeboard	m	1.5	2	2
Width of crest	m	8	8	8
Length of Dam	m	305	372	425
Inclination of Upstream	grade	Vertical (strengthened ground)	Vertical (strengthened ground)	Vertical (strengthened ground)
Inclination Downstream	grade	2.5H: 1.0V	2.5H: 1.0V	2.5H: 1.0V
Volume of excavation/conformation	m^3 excavation/ m^3 fill	13,170 / 383,006.7	13,170 / 386,006.7	13,170 / 383,006.7
Storage	m^3/t	2,046,385 / 2,864,939	1,789,140/ 2,504,796	1,930,550/ 2,702,770
Useful Life	years - (months)	3.22 (38.6)	2.82 (33.8 months)	3.04 (36.5)

Source: Sierra Metals, 2020

The designs of Stages 5, 6, and 7 yield a total storage of approximately 5.8 Mm^3 or 8.1 Mt of tailings, which yields approximately nine years of storage at the projected annual tailings deposition rate of 780,000 m^3/y and an average tailings density of 1.4 t/m^3.

Table 18-6 summarizes the results of the study and projected direct capital cost of the raises.

Table 18-6: Yauricocha Summary Design Results for TSF Expansion Stages 5, 6, and 7

Stage	Volume (m^3)	Capacity (t)	Years	Direct Capital Cost (US$)	Unit Cost per Ton Tailings (US$/t)
5	2,046,385	2,864,939	3.2	$3,736,749	$1.30
6	1,789,140	2,504,796	2.8	$1,958,392	$0.78
7	1,930,550	2,702,770	3	$2,493,605	$0.92
Total	**5,766,075**	**8,072,505**	**9.1**	**$8,188,747**	**$1.01**

Source: Sierra Metals, 2020

18.8 Waste Rock Storage

Waste rock generated by the Project is used as backfill underground with the remainder transported to the surface, primarily through the Klepetko tunnel. There is an existing 1.2 Mm^3 waste rock storage area on the surface, and in historic open pits, that are proximate to the shaft area that will be backfilled as a reclamation requirement. Some development material will be hoisted through the shafts to backfill the pit. The trucking of waste from the plant location into an open pit is ongoing with 2018 tonnage of 454,528 t, 434,006 t in 2019 and 150,369 t from January to June 30, 2020.

There is a borrow area on site for general construction purposes and to support tailings construction.

18.9 Other Waste Handling

Two on-site landfills are used to dispose of the Project industrial and sanitary waste. The Project collects waste oil, scrap metal, plastic, and paper which are recycled at off-site facilities.

18.10 Logistics

Materials and supplies needed for the Project operation are procured in Lima and delivered by truck. Labor is bussed to the site on the existing highways and roads from Lima or Huancayo.

The concentrates produced by the Project are transported overland by 30 t trucks to the refinery. Costs for transportation, insurance, and related charges are included in the treatment costs for concentrates. The concentrates are processed by a smelter in Peru with treatment and refining charges agreed to in advance under annual contracts.

18.11 Off-Site Infrastructure and Logistics Requirements

The Project has no off-site infrastructure of significance and the five concentrate products are trucked to customer locations in Peru. The products consist of lead sulfide concentrate, copper concentrate (polymetallic), zinc concentrate, and lead oxide concentrate.

18.12 Communications and Security

The site has an existing communications system that includes local internet, a fiber optic backbone, a telephone system, and an underground telephone system. A paging system is also available at the plant and mine.

There are security checkpoints at the main access road, the mill site, and at the camp entrance.

19 Market Studies and Contracts

Yauricocha is a polymetallic operation that currently produces lead, zinc and copper concentrates, which are sold to various smelters with slightly different specifications. Yauricocha currently holds contracts for the provision of its various concentrates, these contracts were not reviewed by SRK, but their terms were included in the provided technical economic model. The terms appear reasonable and in line with similar operations SRK is familiar with. No material concentrate contract changes are expected in the foreseeable future.

The payable metals produced from the Yauricocha concentrates are zinc, copper, silver, lead and gold. These commodities are traded on various metals exchanges. Long term (LT) metal prices were provided by Sierra Metals and have been derived from the August 2020 CIBC Global Mining Group Analyst Consensus Commodity Price Forecast.

In SRK's opinion the prices used are reasonable for the statement of Mineral Resources. The metal price assumptions are presented in Table 19-1.

Table 19-1: Metal Price Forecast

Metal	Unit	2020	2021	2022	2023	LT
Au	$/oz	1,755	1,907	1,782	1,737	1,541
Ag	$/oz	19.83	24.12	22.22	22.47	20
Cu	$/lb	2.65	2.86	2.89	2.93	3.05
Pb	$/lb	0.82	0.87	0.89	0.9	0.91
Zn	$/lb	0.94	0.99	1.04	1.04	1.07

Source: CIBC Global Mining Group, Analyst Consensus Commodity Price Forecast, August 2020

Metal price forecasts are based upon forward-looking information. This forward-looking information includes forecasts with material uncertainty which could cause actual results to differ materially from those presented herein.

20 Environmental Studies, Permitting, and Social or Community Impact

20.1 Required Permits and Status

20.1.1 Required Permits

Sierra has all relevant permits required for the current mining and metallurgical operations to support a processing rate of 3,000 t/d. The current regulation allows the operation to have a 5% additional as an average through the year, which allows the operation to process a maximum average of 3,150 tpd. These permits include operating licenses for the plant as well as for the waste disposal facility (tailings dam), mining and process concessions, capacity extension permits, exploration permits and their extensions, water use license, discharge permits, sanitary treatment plants permit, and environmental management instruments, among others.

Sierra also has an Environmental Management Plan and a Community Relations Plan, both approved in the current 2019 Environmental Impact Assessment (EIA). Among the relevant permits, the following are highlighted:

- Land ownership titles;
- Public registrations (SUNARP) of:
  - Process concession;
  - Mining concession;
  - Constitution of “Acumulación Yauricocha”; and
  - Land ownership and Records owned property (land surface) and lease.
- 2016 water rights; and
- 2019 EIA.

20.1.2 State of Approved Permits

Table 20-1 lists Sierra’s permits and licenses which has been prepared based on reports of the Ministry of Energy and Mines (MINEM), Public Registry of Mining (current INGEMMET), National Water Authority (ANA), National Public Registry Authority (SUNARP), General Directorate of Environmental Health (DIGESA), notary and information provided by Sierra.

The following permits were not available for review:

- Mine ventilation permits;
- 2019 Closure Plan financial guarantee accreditation;
- 2019 mining concessions proof of payment; and
- 2019 processing concession proof of payment.

Table 20-1: Approved Operation and Closure Permits

Date	Expiry date	Status	Issued By	Permits/Licensees	Document
Environmental Management Instruments					
Plan de Adecuación y Manejo Ambiental (PAMA), Informe Técnico Sustentatorio (ITS) and Environmental Impact Assessment (EIA)					
1/13/1997		Valid	MINEM	Approval of the PAMA (*Plan de Adecuación y Manejo Ambiental*), Environmental Adjustment and Management Program of the Yauricocha Production Unit of CENTROMIN located in the district of Alis, province of Yauyos and department of Lima	Directorate Resolution N° 015-97-EM/DGM
5/23/2002		Valid	MINEM	Approval of the modification of the implementation of the PAMA of the Yauricocha Production Unit by CENTROMIN	Directorate Resolution N° 159-2002-EM-DGAA
2/8/2007		Valid	MINEM	Approval of the implementation of the PAMA “Yauricocha" Administrative Economic Unit by Sierra.	Directorate Resolution N° 031-2007-MINEM- DGM Report N° 963-2006-MINEM-DGM-FMI-MA
6/9/2015		Valid	MINEM	Conformity of the Supporting Technical Report (ITS, *Informe Técnico Sustentatorio*) to the PAMA for "Expanding the capacity of the Processing Plant Chumpe of the Accumulated Yauricocha Unit from 2500 to 3000 TMD", presented by Sierra.	Directorate Resolution N° 242-2015-MINEM-DGAAM Report N° 503-2015-MINEM.DGAAM-DNAM-DGAM-D
11/12/2015		Valid	MINEM	Conformity of the second Supporting Technical Report (ITS) to the PAMA for "Technological improvement of the domestic wastewater treatment system " PAMA Accumulation Unit Yauricocha presented by Sierra.	Directorate Resolution N° 486-2015-MINEM-DGAAM Report N° 936-2015-MINEM-DGAAM-DNAM-DGAM-D
7/3/2017		Valid	MINEM	Approval of the third amendment of the ITS to the PAMA for “Addition of new equipment and infrastructure in the Chumpe concentrator plant process” of the Yauricocha Mining Unit, presented by Sierra	Directorate Resolution N° 176-2017-MINEM-DGAAM Report N° 288-2017-MINEM-DGAAM-DNAM-DGAM-D
4/5/2019		Valid	MINEM	ITS 4 from PAMA presented by Sociedad Minera Corona S.A.	Directorate Resolution N° 051-2019/MEM-DGAAM Report N° 174-2019/MEM-DGAAM-DEAM-DGAM
6/17/2019		Valid	MINEM	DIA approval for Yauricocha regional exploration activities.	Directorate Resolution N° 091-2019/MINEM-DGAAM Report N° 301-2019/MINEM-DGAAM-DEAM-DGAM
2/11/2019		Valid	SENACE	EIA for update of mining components, presented by Sociedad Minera Corona S.A.	Directorate Resolution N° 028-2019-SENACE-PE/DEAR Report N° 126-2019/SENACE-PE-DEAR
7/7/2020		Valid	SENACE	Conformity of the Supporting Technical Report (ITS, *Informe Técnico Sustentatorio*) to the EIA for disposal of waste in the mine.	Directorate Resolution N° 078-2020/SENACE-PE/DEAR Report N° 399-2020/SENACE-PE/DEAR

Date	Expiry date	Status	Issued By	Permits/Licensees	Document
Environmental Management Instruments					
Mine Closure Plan					
8/24/2009		Valid	MINEM	Approval of the Mine Closure Plan (PCM) at feasibility level of the Yauricocha Mining Unit, presented by Sierra	Directorate Resolution N° 258-2009-MINEM- AAM Report N° 999-2009-MINEM-AAM-CAH-MES-ABR
12/17/2013		Valid	MINEM	Approval of the Yauricocha Mining Unit Mine Closure Plan Update, presented by Sierra	Directorate Resolution N° 495-2013-MINEM- AAM Report N° 1683-2013-MINEM-AAM-MPC-RPP-ADB-LRM
1/8/2016		Valid	MINEM	Approval of the amendment of the Closure Plan of the Yauricocha Mining Unit, presented by Sierra	Directorate Resolution N° 002-2016-MINEM-DGAAM Report N° 021-2016-MINEM-DGAAM-DNAM-DGAM-PC
1/15/2016	1/17/2017	Expired	Sierra	Proof of payment for Mine Closure Plan guarantee. Amount 14'346,816.00 USD-Period 2016	Report N° 2570612
2/28/2017		Valid	MINEM	Approval of the second amendment of the Closure Plan of the Yauricocha Mining Unit, presented by Sierra	Directorate Resolution N° 063-2017-MINEM-DGAAM Report N° 112-2017-MINEM-DGAAM-DNAM-DGAM-PC
12/29/2016	1/17/2018	Valid	Sierra	Proof of payment for Mine Closure Plan guarantee. Amount $14,458,801.00 USD (2017)	Report N° 2669957
9/1/2020		Valid	MINEM	Approval of the Second Update of the Mine Closure Plan of the Yauricocha Mining Unit, presented by Sierra	Directorate Resolution N° 111-2020-MINEM-DGAAM Report N° 339-2020-MINEM-DGAAM-DEAM-DGAM

Date	Expiry Date	Status	Issued By	Permits/Licensees	Document
Mineral Process Concession					
4/18/1996		Expired	MINEM	Definite authorization to operate the "Yauricocha Chumpe Processing Plant" at an installed capacity of 1350 TMD, CENTROMIN	Report N°164-96-EM-DGM-DPDM
9/4/2008		Valid	MINEM	Authorization to operate the "Yauricocha Chumpe Processing Plant", including an additional lead circuit and expanding its capacity to 2010 TMD, Sierra	Resolution N° 549-2008-MINEM-DGM-V Report N° 178-2008-MINEM-DGM-DTM-PB
9/16/2009		Valid	MINEM	Authorization to raise the Yauricocha tailings deposit dam crest by an additional 20 m in 4 stages, Sierra	Resolution N° 714-2009-MINEM-DGM-V Report 242-2009-MINEM-DGM-DTM-PB
7/14/2010		Valid	MINEM	Authorization to operate the Mill No. 4 (8' x 10') and the amendment of the "Yauricocha Chumpe" Benefit Concession to the expanded capacity of 2500 TMD, Sierra	Resolution N°279-2010-MINEM-DGM-V Report N° 207-2010-MINEM-DGM-DTM-PB
3/4/2011		Valid	MINEM	Operating license for the Ball Mill (5' x 6') for regrinding, installed in "Yauricocha Chumpe Processing Plant, Sierra	Resolution N°088-2011-MINEM-DGM-V Report N° 075-2011-MINEM-DGM-DTM-PB
4/3/2012		Valid	MINEM	Authorization to operate the "Yauricocha" tailings deposit up to 4519 m in altitude (second stage) with a free board of 2 m, Sierra	Resolution N° 112-2012-MINEM-DGM-V Report N° 112-2012-MINEM-DGM-DTM-PB
4/29/2014		Valid	MINEM	Authorization to operate the raised "Yauricocha- Chumpe" tailings deposit up to 4522 m in altitude, Sierra	Resolution N° 0159-2014-MINEM-DGM-V Report N° 128-2014-MINEM-DGM-DTM-PB
8/3/2015		Valid	MINEM	Authorization to operate the raised "Yauricocha- Chumpe" tailings deposit up to 4524 m in altitude (third stage)	Resolution N° 0344-2015-MINEM-DGM-V Report N° 240-2015-MINEM-DGM-DTM-PB
10/14/2015		Valid	MINEM	Authorization to build, implement equipment and operate the Chumpe Process Plant Extension Project 2500 to 3000 TMD of the "Yauricocha Chumpe" benefit concession, Sierra	Resolution N° 0460-2015-MINEM-DGM-MV Report N° 326-2015-MINEM-DGM-DTM-PB
8/29/2017		Valid	MINEM	Approval of the extension of the "Yauricocha Chumpe" benefit concession area. It was increased by 17,887 Ha. Also, authorization to build and operate civil and electromechanical works of the new equipment and auxiliary facilities of the "Yauricocha Chumpe" benefit concession	Resolution N° 0366-2017-MEM-DGM Report N° 229-2017-MEM-DGM-DTM-PB
Land Ownership					
--	12/21/2021	Valid	Sierra	Vílchez Yucra family (way of passage and installations)	--
--	3/7/2022	Valid	Sierra	Varillas Vílchez family (56 ha for mining use)	--
--	7/31/2037	Valid	Sierra	San Lorenzo de Altis Community (696,6630 ha for mining use)	--

Date	Expiry Date	Status	Issued By	Permits/Licensees	Document
Land Ownership					
--	Indefinite	Valid	Sierra	Mineral processing concession: Yauricocha Chumpe processing plant (148.5 ha for mining use and an authorized capacity for 2500 TMD)	
--	Indefinite	Valid	Sierra	Mining concession: “Acumulación Yauricocha” (18,777.9238 ha for mining use)	--
Water: Use, Discharge and Sanitation Facilities					
2004		Valid		Water use license for population purposes in the Yauricocha Production Unit, whose collection point is the Laguna Acococha – Uñascocha	Administrative resolution N°249-2004-GR-LP- DRA-MOC
2003		Valid		Water use license for population purposes in the Yauricocha Production Unit whose collection point is the Huacuypacha spring	Administrative resolution N° 1355-2003-AG/DRA-LC/ATDR-MOC
2004		Valid		Water use license for industrial purposes in the Yauricocha Production Unit, whose collection point is the Klepetko Tunnel.	Administrative resolution N° 042-2004-AG/DRA-LC/ATDR-MOC
2017	1/31/2021	Valid		Authorization for the discharge of mine water from the Yauricocha Production Unit.	Administrative resolution N° 217-2017-ANA/DGCRH

The Environmental Adequation and Management Program (PAMA), as established by the Supreme Decree Nº 016-93-EM, was the first environmental management tool that was created for mines and metallurgical operations existing before 1994 to adopt technological advances and / or alternative measures to comply with maximum permissible limits for effluent discharge and emissions of mining and metallurgical activities. Since then, many environmental regulations have been enacted updating and/or replacing older regulations. The environmental certification for mining activities was transferred from the Ministry of Mining and Energy to the Ministry of Environment; specifically, to the National Service for Environmental Certification (SENACE) effective December 28, 2015.

Though Sierra has updated its environmental baseline and adjusted its monitoring program by its Supporting Technical Report to the PAMA "Expanding the capacity of the Processing Plant Chumpe of the Accumulated Yauricocha Unit from 2500 to 3000 TMD" (Geoservice Ambiental S.A.C., ITS approved by Directorate Resolution N° 242-2015-MINEM-DGAAM), an important gap existed with reference to environmental and social impact assessment as referred to by the actual environmental protection and management regulation for operating, profit, general labor and mining storage activities (Supreme Decree N° 040-2014-EM, 11/12/2014); this was mostly covered by the approval of the EIA on February 11, 2019.

In addition, Sierra has two Supporting Technical Reports which authorize the construction of the technological improvement of the domestic wastewater treatment system and the addition of new equipment and infrastructure in the Chumpe concentrator plant process. This last Supporting Technical Report (ITS) was approved in 2017 by Directorate Resolution N° 176-2017-MINEM-DGAAM.

Sierra applied to SENACE to start the evaluation process of the “Environmental Impact Study of the Metallurgical Mining Components Update Project” (Geoservice Ambiental S.A.C., 2017) within the framework of the Supreme Decree N° 016-1993-EM, as this study was initiated before the enforcement of the D.S N° 040-2014-EM and in application of an exceptional procedure established by it. The EIA approval was obtained on February 11, 2019.

In addition, the Peruvian environmental legislation contemplates that mine owners perform several studies to adjust to these new regulations, such as:

- Environmental Quality Standards Compliance for Soils (Estudio de Calidad Ambiental-ECA de Suelos). Sierra submitted this study to MINEM in compliance with the Supreme Decree N° 002-2014-MINAM, with register N° 2488477 (04/10/2015).
- Adequation plan for the liquid effluents discharge permissible limits (Plan Integral para la Adecuación e Implementación de sus actividades a los Límites Permisibles para la descarga de efluentes líquidos). Sierra submitted this study to MINEM in compliance with the Supreme Decree N° 015-2015-MINAM, with register N° 2706233 (19/05/2017).
- Deposition to the Department of Environmental Mining l Affairs (DGAAM), and Environmental Enforcement Agency (OEFA) of the activities and/or processes and/or extensions and/or existing components to regularize (Declaración Jurada de los componentes por Regularizar).

- In compliance with the Supreme Decree Nº 040-2015-EM all those activities, extensions, and/or components that have not been included in any Environmental Management Instrument had to be declared. Sierra did not declare any component. The submittal of this type of study is not available at present.
- Detailed Technical Memorandum (MTD). In compliance with the Supreme Decree Nº 040-2015-EM, an MTD had to be submitted for all those activities, extensions, and/or components declared to be regularized to sworn statements mentioned above. Once the MTD has been approved, these components must be integrated into an Environmental and Social Impact Assessment or Environmental and Social Impact Assessment. As no components have been declared to be regularized, no MTD had to be presented.

In those operations where the PAMA is the main environmental management permit, this has the category of an environmental certification similar to an environmental impact assessment and therefore is subject of the presentation of the updated environmental impact study as established by the Supreme Decree N° 019-2009-MINAM. The Supreme Decree N° 040-2014-EM, in its First and Second Supplementary Final Provisions, regulates the integration and updating of the environmental impact assessment with the objective that each operating unit shall only have one updated environmental management tool. So, currently, the Environmental certifications for the Yauricocha operation are the PAMA, the EIA, and the ITS modifying specific aspects of both.

As mentioned above, the Yauricocha operation, as a part of the expansion plan, submitted a detailed EIA to SENACE, including updated baselines, social and environmental impact assessments including water, air and noise modeling among others for the targeted scenarios, and the corresponding Management Plans. This report also includes an archaeological survey report for the certificate of nonexistence of archaeological remains (CIRA, certificado de inexistencia de restos arqueologicos), The EIA was approved on February 11, 2019.

20.2 Environmental Study Results

Sierra has updated, its environmental base line and environmental monitoring program according to current regulation through different environmental permits and documents. These documents are mainly ITS to the initial PAMA, followed by the approval of an EIA (2019) and an ITS approved in July 2020. The site has also submitted other documents such as the Water Standards Adequation Plan, the Soils Contaminated sites, and approved other significant documents such as the Closure Plan (September 2020)

The current monitoring plan is the one included in the EIA approved in February 2019, which is implemented by the site. The EIA includes different information encompassing multiple disciplines in the Baseline. From those, the following could be noted:

- Land use capacity - Soils are suitable for cold climate grassland and protection.
- Actual land use - Is limited to urban (private or government), natural pastures and unproductive land.

- Wetlands – No specific reference was made to wetlands while these are likely to be present in the area and are protected in Peru; Currently the site has no impact in these types of formations.
- Soil quality - 32 samples from disturbed areas were analyzed and the results compared to the environmental quality standards for soil (Supreme Decree N° 002-2013-MINAM): arsenic, cadmium, lead and total petroleum hydrocarbons (TPH) exceed the environmental standards, as well as to a lesser extent also: benzene, xylene, naphthalene, toluene and ethylbenzene; This indicates that the area where the site operates is a mineralized area with high levels of metals identified since the baseline.
- Geology - There is predominantly sedimentary rock such as sand-, silt- and claystone, conglomerates, limestones, and dolomites.
- Biology - Terrestrial biology has been assessed in a dry and a wet season:
  - Flora - 12 species were identified listed as protected by Supreme Decree N° 043-2006-AG, among which categorized as Critical Endangered (CR): Ephedra rupestris, and as Endangered (EN): Nototriche tovari, as well as three species belonging to the CITES category II;
  - Birds - Four species were identified listed as protected by Supreme Decree N° 004-2014-MINAGRI, among which categorized as Endangered (EN): Vultur gryphus (Condor), seven species in the IUCN Red List and four species belonging to the CITES category I and II;
  - Mammals - Two species were identified listed as protected by Supreme Decree N° 004-2014-MINAGRI, among which categorized as Endangered (EN): Puma concolor (Puma), Vicugna (Vicuña) and two species belonging to the CITES; and
  - Reptiles and amphibians - Three endemic species were identified (gender: Lioalemus), but none is listed as protected.
- Hydrobiology - Indicates that in both wet and dry season for most monitoring stations the diatom pollution tolerance index IDG results in moderated polluted water (eutrophication), while the EPT and BMWP indicate in wet season bad water quality with presence of organic matter and in the dry season good water quality with presence of trout (Onchorynchus mykiss). In some, trout elevated concentrations of mercury and cadmium were found while in others retention of P, Na, Mg, K and Ca. Successive regular monitoring should be performed in the same five surface water quality monitoring stations for phytoplankton, zooplankton, benthos, periphyton and nekton.
- Hydrology - The Yauricocha project is in eight micro-watersheds belonging to the Alis and Laraos rivers sub-watersheds which include mountain tops with elevations as high as 4,800 and 5,300 meters above sea level.
- Springs - The water of the Laraopuquio and Quilcasa springs are slightly acidic while the water from the Chumpe 1 spring exceeds the environmental quality standards for copper, lead and manganese according to the Supreme Decree N° 002-2008-MINAM, category 3 (irrigation of tall and short stem crops and animal's beverage).

- Surface water quality monitoring - Monthly monitoring is performed in five monitoring stations: M-2, M-4 (707), PM-11, PM-12 and PM13, and quarterly reported to the MINEM. The water quality analysis is performed for those parameters for which national environmental quality standards have been established as for category 3 - subcategory D1 irrigation of tall and short stem crops and D2 animal's beverage (Supreme Decree N° 002-2008-MINAM Supreme Decree N° 015-2015-MINAM). The First Quarter 2016 Environmental Monitoring Report (Equas, March 2016) indicates that the water quality of the Chumpe creek does not comply with the category 3 in the in PM-11 for low dissolved oxygen concentration and in PM-12 and PM-13 for high manganese concentrations while the water quality in the Tinco River complies with the category 3.

- Underground water quality monitoring - Quarterly monitoring is performed in seven monitoring stations: DR-01-13, DR-02-13, DR-03-13, PB-01-13, PB-02-13, PB-03-13, and PT-01-13. The report indicates that the variables to be monitored are: pH, temperature, electrical conductivity, Dissolved oxygen, flow, grease and oils, CN-wad, CrVI, DBO, mercury, bicarbonates, carbonates, fluorides, chlorides, DQO, thermotolerant coliforms and total coliforms, e.coli, enterococci, helminths, phenols, phosphates, nitrates, nitrites, S.A.A.M., sulfur, sulfates, and as total metals: Al, Sb, As, Ba, Bi, Bo, Cd, Ce, Co, Cu, Cr, Sn, P, Fe, Li, Mg, Mn, Mo, Ni, Ag, Pb, Se, Na, Ta, Ti, Va, Zn. As no national environmental quality standards have been set for underground water, the water quality analysis is performed as for those parameters for which surface water national environmental quality standards have been set (category 3 - subcategory D1 irrigation of tall and short stem crops). Quarterly reports are sent to the authority as required in the Environmental Management Plan – EMP.

- Effluent water quality - Monitoring is performed monthly, in one monitoring station: V-1 (705) and its quality is compared to Supreme Decree N° 010-2010-MINAM. Current Environmental Monitoring Report show that the effluent water quality complies with the maximum permissible limits for effluent discharge of metallurgical mining activities.

- Air quality - Bi-quaternary monitoring is performed in two monitoring stations: CA-01 (704) and CA-02, leeward from the processing plant and windward from the Chumpe mining camp respectively in accordance with Supreme Decree N° 003-2008-MINAM and Supreme Decree N° 074-2001-PCM.

- Noise: Bi-quaternary monitoring is performed in three monitoring stations: R-1, R-2, and R-3 in accordance with Supreme Decree N° 085-2003-PCM.

- Soil quality monitoring - Quaternary monitoring is performed in three monitoring stations: MI-01-UY, MI-03-UY and MI-06-UY and the results are compared with the environmental quality standards for soil, Supreme Decree N° 002-2013-MINAM. The monitoring results show that MI-01-UY and MI-03-UY comply with the environmental quality standards for soil, while MI-06-UY exceeds the environmental quality standards for soil concentrations of arsenic and lead.

- Hence, to enable a proper environmental evaluation monitoring should be reported over a longer period.

20.3 Environmental Aspects

Data and information for this section is based on the successive environmental permits submitted and approved by the authority, as explained in the previous sections. The most recent environmental permit is the Yauricocha EIA approved in February 2019. This section describes the main activities at the site related to the mineralized material extraction and processing.

The Yauricocha Mine is an underground mine operated by the method of OCF stoping to extract its polymetallic mineralized material (sulfides) of lead, silver, copper, zinc and iron and lead silver oxide mineralized material.

- Mineralized material transport - The mineralized material is transported from the Klepetko tunnel to the hopper of the Chumpe mineral processing plant.
- Waste rock - Waste rock is hauled through the two mine gates and stored in the waste rock dump at Chumpe or inside the mine. Currently the waste rock dump at Chumpe has 489,500 m^3 additional capacity as approved in the latest Closure Plan (September 2019). The site has additional 17 waste rock dumps facilities which have no additional capacity and are under closure. The current Closure Plan and following updates consider two types of covers for the closure for the waste rock dumps. The covers are designed for non-acid rock drainage generating material (NAG) and for potential acid rock drainage generating material (PAG). There is currently no comprehensive study on potential ARD available to review as to whether the different waste rock dumps are NPAG or PAG. However, the site has planned to conduct additional studies during 2021-2022 to 1) develop a Geochemistry baseline with the already mined materials and 2) develop a set of tests for the current mineralized material. To prevent rainfall runoff from getting into contact with the waste rock, the site has constructed diversion canals and plans to implement additional ones as described in the closure plan.
- Mineralized material processing - The mineralized material is processed in the Chumpe mineral processing plant has two separate flotation circuits:
  - One to process polymetallic mineralized material; and
  - Another to process the lead and silver oxide mineralized material.

  The process is conventional with stages of crushing, grinding, regrinding, selective flotation, and filtration, dispatch of concentrates and transport, and tailings storage.
- Tailings - The tailings deposit is located at an elevation of 360 m and 2.6 km upstream of the existing processing plant and several camps and installations, in the location that was the Yauricocha Lake, however the waterbody was occupied in the early stages of the operation, several decades ago. The current tailings dam was built with compacted granular material of intrusive and metamorphic origin. The design considers growing the crest in five stages.
- According to the reports N° 1683-2013-MEM-AAM/MPC/RPP/ADB/LRM and N° 503-2015-MEM-DGAAM/DNAM/DGAM/D the global stability is stable under static and pseudo static conditions. Sierra has obtained the authorization to operate the fifth stage of the tailings deposit, which has been divided in two substages. The first one (5-1) has been already

constructed and finalizing permits, and currently the site is ready to start the construction of the 5-2 stage. Phase 5-1 provides the capacity to store 2,864,939 additional tonnes. The initial PAMA and early versions of the closure plan update indicate that the tailings are considered PAG, as tailings deposited from 1979 to 1988 contains 31.4% of pyrite and tailings deposited from 1989 to 1996 contains 17.6% pyrite. No additional recent data and no comprehensive study on the mineralogical composition and drainage quality in the short, medium and long term were available to review in order to have a better understanding of the tailings geochemical-physical characteristics and its environmental implications. As mentioned in previous section, the site is planning further studies to determine whether this assumption is correct and additional measures will need to be taken for final closure of the facility.

- Regarding water management:
    - Water in the tailings pond is mainly composed of water from the tailings pulp, direct and rainfall; the clarified water from the tailings pond is pumped to tanks and returned to the processing plant by gravity, closing the circuit;
    - Filtrations are captured by a system of underdrains and sent towards the underdrain sump and pool for recirculation; and
    - Channels on the right and left of the tailings deposit capture the rainfall runoff preventing them to enter in contact with the tailings. Further expansions of the tailing's facility will follow the same design.
- Regarding its management and control, Sierra monitors the design parameters, the physical stability by piezometers installed in the tailings dam, and the cleaning of the rainfall runoff channels.

- Domestic and industrial solid waste - Sierra operates a landfill for domestic wastes and has warehouses for temporary storage of recyclable waste. Recyclable non-hazardous solid waste and hazardous solid waste are delivered to an authorized company, complying with the Regulations of the General Law of Solid Waste.
- Effluent, surface and groundwater management and control:
    - Mine water - The mine water from the Klepetko tunnel is collected in a channel and directed to the water treatment plant at Chumpe where it is physically treated by adding lime and flocculants.
    - Sewage control - Sierra operates three domestic sewage treatment plants called PTARD (the Spanish acronym) for residual domestic wastewater treatment plant:
        - One with a capacity of 17 m^3/day, installed in the area Chumpe, and another with a capacity of 40 m^3/day, installed in the La Esperanza areas, operate by activated sludge and multiple aeration. The treated water seeps into the subsoil. Nowadays, in the ITS (Geoservice Ambiental S.A.C., 2017), ITS Report N° 288-2017-MEM/DGAAM/DNAM/DGAM/D, Sierra indicate the replacement of these two PTARD for one PTARD with capacity of 50 m^3/day,

- One with a capacity of 100 m^3/day, installed in the Chumpe area, operates by means of sequential biological reactors. The treated water is incorporated in the mineral processing plant (zero effluent).
  - Surface water quality control - Monthly monitoring of water for quarterly reporting to the MINEM and ANA includes verification of the compliance with Maximum Permissible Limits (Supreme Decree N°010- 2010-MINAM) and Environmental Quality Standards for Water (Supreme Decree N° 002- 2008-MINAM, as amended by Supreme Decree N° 015-2015-MINAM); and
  - Groundwater quality control - Quarterly is monitored by nine piezometers.
- Emissions and dust control:
  - Bi-quaternary monitoring two monitoring stations: one leeward from the processing plant and the other windward from the Chumpe mining camp; and
  - Dust prevention by wetting the road surfaces (dirt roads) during the dry season (vehicle traffic).

The following tables (Table 20-2, Table 20-3, Table 20-4) describe the current Environmental Monitoring program, as described in the current approved EIA.

Table 20-2: Air Quality Monitoring (EIA extract)

Station	Description	Location UTM, WGS 84, Zona 18		Regulation
		Este	Norte	
CA-01(704)	Sotavento de la planta concentradora Chumpe	424264	8641159	Supreme decree N° 003-2017-MINAM
CA-02	Barlovento del campamento Chumpe	424469	8640080	
CA-03	Barlovento Relleno Sanitario	422046	8639278	
CA-06	Barlovento Deposito de Relaves	422776	8637816	
CA-06-b	Centro Poblado Tinco	424848	8641704	

Source: EIA 2019

Table 20-3: Environmental Noise Monitoring (EIA extract)

Station	Description	Location UTM, WGS 84, Zona 18		Regulation
		Este	Norte	
R-1	Pie de la catarata de la Quebrada Chumpe	424464	8641381	Supreme decree Nº 085-2003-PCM
R-2	Ex estadio Chumpe, a 100 del campamento Chumpe	424469	8640080	
R-3	Parte alta del patio Winche, sobre el tajo Cculle	421377	8638782	
R-4	Al lado sur del depósito de relaves Yauricocha	422776	8637816	
R-6-b	Centro Poblado Tinco	424848	8641704	

Source: EIA 2019

Table 20-4: Water Quality Monitoring (EIA extract)

Station	Description	Location UTM, WGS 84, Zona 18		Regulation
		Este	Norte	
M-2	Rio Tinco, 100m aguas arriba del vertimiento V-1 (705)	4244581	8641772	Decreto Supremo Nº 004-2017- MINAM
M-4 (707)	Río Tinco, 150m aguas abajo del vertimiento V-1 (705)	424487	8641837	
PM-11	Quebrada Chumpe aguas arriba de la planta de beneficio	424373	8640006	
PM-12	Quebrada Chumpe (200m antes de desembocar al Río Tinco)	424673	8641583	
PM-13	Rio Tinco (70m aguas arriba de la desembocadura de la quebrada Chumpe)	424920	8641735	
PM-14	Poza de captación Chumpe (casa de bombas)	424153	8640718	Decreto Supremo Nº 004-2017-MINAM
PMZI-01*	50 m aguas arriba de la descarga del efluente EF-ZI (Río Rodiana)	427196	8 63 0610	Decreto Supremo Nº 004-2017-MINAM
PMZI-02*	100 m aguas abajo de la descarga del efluente EF-ZI (Río Rodiana)	427081	8 63 0638	

Source: EIA 2019

20.4 Operating and Post Closure Requirements and Plans

Sierra has a closure plan with three approved amendments:

- Yauricocha Mine Unit Closure Plan, approved by Directorate Resolution N°258-2009-MEM/AAM (08/24/2009) and Report N°999-2009-MEM-AAM/CAH/ MES/ABR.

- Yauricocha Mine Unit Closure Plan Update, approved by Directorate Resolution N°495-2013-MEM-AAM (12/13/2013) and Report N°1683-2013-MEM-AAM/ MPC/ RPP/ADB/LRM.
- Yauricocha Mine Unit Closure Plan Modification, approved by Directorate Resolution N°002-2016-MEM-DGAAM (01/08/2016) and Report N°021-2016-MEM-DGAAM/DNAM/DGAM/ PC.
- Yauricocha Mine Unit Second Amendment of the Closure Plan, approved by Directorate Resolution N°063-2017-MEM-DGAAM (02/09/2017) and Report N° 112-2017-MEM-DGAAM/DNAM/DGAM/ PC.
- Second update of the Closure Plan of the Yauricocha Mining Unit approved by Management Resolution No. 111-2020-MINEM-DGAAM (09/01/2020) and Report No. 339-2020-MINEM-DGAAM / DEAM / DGAM.

In 2007, a first feasibility-level Closure Plan for the Yauricocha Mining Unit was developed by CESEL S.A. following the requirements of the Peruvian legislation for mine closure, "Ley de Cierre de Minas", Law N° 28090 and its Regulation, Supreme Decree N° 033-2005-EM and its amendments Supreme Decree N° 035-2006-EM and Supreme Decree N° 045-2006-EM. and based on the content recommended by the DGAAM in the Guideline for Preparation of Mine Closure Plans approved by Resolution R.D. N° 130-2006-AAM, dated April 2006.

This Closure Plan considers eight areas as follows: Central, Cachi-Cachi, Éxito, El Paso, Ipillo, Chumpe, Yauricocha and Florida.

In 2012, pursuant to Peruvian regulations, the Mine Closure Plan was updated by Geoservice Ingeniería S.A.C. and approved in 2013.

In 2015 and in 2017, the time schedule of the Closure Plan has been modified in accordance with the mine's life by its Closure Plan modification and second amendment, respectively.

Finally, last version of an update was approved in September 2020, including the modifications approved in the EIA 2019.

20.5 Post-Performance Reclamation Bonds

In January 2021, the bank's guarantee will be renewed for compliance with the Second Update of the Closure Plan of the Yauricocha Mining Unit (approved by Management Resolution No. 111-2020-MINEM-DGAAM) for US $ 18,357,305.

The current update of the Closure Plan designates that the mining operator must register the guarantee for variable annuities the first days of each year, in a manner that the total amount required for the final and subsequent closing is recorded in January 2028 as shown in Table 20-5.

Table 20-5: Closure Plan – Annual Calendar for Guarantee Payment

Year	Annual	Accumulated	Situation
2020		13,418,970	Constituted
2021	-392,599	13,811,569	to constitute
2022	-450,262	14,261,831	to constitute
2023	-520,938	14,782,769	to constitute
2024	-611,174	15,393,943	to constitute
2025	-734,063	16,128,006	to constitute
2026	-922,342	17,050,348	to constitute
2027	1,306,957	18,357,305	to constitute

Note: The amount includes tax (VAT, 18%)
Source: Report Nº 033-2020-MINEM-DGM/DTM/PCM

20.6 Social and Community

Sierra maintains a relationship with the communities of San Lorenzo de Alis, Huancachi, Santo Domingo de Laraos, Tomas and Tinco, and have subscribed to various agreements with those communities. The company assists with various projects but have not subscribed to any agreement as Santo Domingo de Laraos do no permit developing mining activities in their community. Currently, the company has a Community Relations Plan approved in the latest EIA (February 2019). The main activities are shown in Table 20-6.

Table 20-6: Community Engagement Activities

Plan	Program	Subprogram /Activity
Community Relations Plan	Communications and Consultation Plan	Implementation of Permanent Information offices, located in Alis and Tinco
		Workshops and Information Meetings
	Economic and Productive Development Program	Local capacities development subprogram
		Local acquisition subprogram
		Acquisition of products and services
	Social Development Program	Education subprogram
		Health support subprogram
		Agriculture, cattle, local tourism, infrastructure and innovations program
		Local employment subprogram
	Preservation and Support of Local Culture	Tourism subprogram
		Local cultural heritage conservation subprogram
		Technical support to local authorities on efficient use of mining canon
		Effective communications
		Environmental participative monitoring

Source: Sierra Metals, 2020

20.7 Mine Closure

This section has been prepared based on the Yauricocha Mine Unit Closure Plan Update´s Report N°1683-2013-MEM-AAM/MPC/RPP/ADB/LRM, the Second Amendment of the Closure Plan, approved by Directorate Resolution N°063-2017-MEM-DGAAM (02/08/2017) and Report N° 112-2017-MEM-DGAAM/DNAM/DGAM/ PC, and the second update of the closure Plan approved under DR N° 339-2020/MINEM-DGAAM-DEAM-DGAM on September 2020. .

Sierra is committed to perform progressive closure activities starting in 2019 and finishing in 2027, final closure in a span of two years and post-closure in five years (this latter is the minimum period required to achieve physical, geochemical and hydrological stability of the area occupied by the mining unit as per Peruvian legislation).

The mine closure objective is to recover conditions like pre-mining conditions and/or uses compatible with the surrounding environmental conditions.

Specific objectives are:

- Human health and safety - Ensure public health and safety implementing measures to eliminate risks such as pollution caused by acid rock drainage or waste, that could be transported to populated areas by water or wind.
- Physical stability - Implement environmental and technical measures to maintain physical stability of the mining components in the short, medium and long term (including mine entrances, chimneys, waste rock dumps, tailings deposits, etc.) that must withstand seismic and hydrological extraordinary events;
- Geochemical stability - Implement measures to maintain chemical stability of the mining components in the short, medium and long term (including mine entrances, chimneys, waste rock dumps, tailings deposits, etc.) that must withstand ordinary and hydrological extraordinary hydrological events.
- Land use - Implement measures to enhance post-mining beneficial land use, restoring gradually soil fertility for agriculture, livestock, landscape and / or recreational use, considering the topographical conformation and integration into the landscape.
- Water use - Implement measures in the Production Unit Acumulación Yauricocha to prevent contamination of superficial and underground water, and focusing on restoring those water bodies, which have been potentially affected, by means of a strategic recovery for post-mining use.

20.8 Reclamation Measures During Operations and Project Closure

20.8.1 Reclamation Measures During Operations and Project Closure

The Second update of the Closure Plan (2020) considers:

- Incorporating new mining components that were approved by the Directorate Resolution N° 028-2019-SENACE-PE-DEAR;
- Include all of the closing activities aligned with the EIA 2019;
- Include the improvement of central pit stability through the construction of a buttress (489000 m^3); and
- Reprogramming the progressive, final and post closures schedules.

20.8.2 Temporary Closure

In case of a temporary closure (for a period less than three years), ordered or not by the competent authority, Sierra will develop a detailed care and maintenance plan considering future operations and evaluating the social impacts associated with it.

The temporary closure considers:

- Remove and save mobile equipment;
- Demolition, salvage, and disposal - not applicable during temporary closure;
- Physical stability - maintain mine entrances, chimneys, tailing deposit, waste rock dumps, and infrastructure;
- Geochemical stability - maintain tailings deposit and waste rock dumps sedimentation ponds to capture any drainage;
- Hydrological stability - maintain canals and ditches in an operative state;
- Landform - profiling the outer slope of the tailing deposit; and
- Social programs - mitigate impacts on local employment and local development implementing the following programs:
  - Communication, culture, and participation program;
  - Environmental education and training program;
  - Health and responsible environmental management program; and
  - Citizenship: leadership, institutional strengthening, and project transfers program.

The following preventive measures will be adopted:

- Communicate to DGAAM any temporary closure program (indicating the causes);

- Final closure must be made if the closure needs to be prolonged over three years;
- Designate responsibilities for the safety and cleanliness of the facilities;
- Instruct the surrounding population on risk related to temporary closed facilities;
- Seal all areas that are potentially dangerous to the environment and the population, placing signs and symbols that indicate their danger for containing materials that could affect the environment;
- Perform facility inspections and establish a periodic schedule to perform the necessary maintenances (including wind erosion and sediment transport control, channels, ditches, and sediment ponds), safety and environmental inspections, water quality monitoring and progressive reclamation monitoring;
- Perform safety inspections to prevent risks associated to the physical stability of underground workings and surfaces exposed to weathering, such as tailings deposits slopes; and
- Implement measurements to prevent accidents (environmental or public) by:
  - implementing security berms;
  - blocking accesses to mine entrances; and
  - profiling slopes if needed.

20.8.3 Progressive Closure

Progressive closure is performed simultaneously during operation and considers the following:

- Dismantling - All materials in disuse will be dismantled;
- Demolition, salvage, and disposal - Not applicable during progressive closure;
- Physical stability:
  - Open pits in disuse - the Mascota, Juliana, Pawac and Poderosa pits will be partially filled with surrounding waste rock and pit slopes will be stabilized by benching and the Central, Amoeba and Maritza pits will be closed.
  - Mine entrances - four mine entrances will be closed by a masonry wall without drainage, and in one land forming using waste rock and a proper cover will be applied (Type 2, see geochemical stability).
  - Waste rock dumps:
    - Waste rock from the Mascota, Juliana and Triada dumps will be removed to the Central pit;
    - Waste rock from the Mariela dump will be removed to the Central pit and Mariela mine entrance;

  - Waste rock from the Pawac dump will be removed to the Pawac pit;
  - Waste rock from the Poderosa dump will be removed to the Poderosa pit; and
  - The passive Triada waste rock dump and the Cachi-Cachi waste rock dump will be stabilized and covered.

- Geochemical stability - implementing covers considering the material to be covered (i.e. its mineralogy, net neutralization potential, presence of acid drainage, granulometry, topography and slopes) considering two types:
  - Type 1, to cover non-acid generating materials: 0.20 m of organic material, revegetated; and
  - Type 2 to cover acid generating materials: 0.20 m of organic material, overlaying a layer of 0.20 m draining material, overlaying a layer of 0.20 m clay material, overlaying a 0.20 m thick layer of limestone; and revegetated.
- Hydrological stability - implementing collector channels considering two types:
  - Type 1 - trapezoidal masonry channel with base and height of 0.50 m and 0.50 m and slope of 1H: 2V (flow 0.45 m3/sec); and
  - Type 2 - trapezoidal masonry channel with base and height of 0.60 m and 0.65 m and slope of 1H: 2V (flow 0.90 m3/sec).
- Landform - consist of leveling, re-contouring and organic soil coverage;
- Revegetation - planting native grasses such as *Stipa ichu* and *Calamagrostis sp*; and
- Social programs - programs are designed year by year considering the following topics:
  - Education;
  - Healthcare;
  - Local sustainable development;
  - Basic infrastructure;
  - Institutional and capabilities empowerment; and
  - Culture promotions.

Table 20-7 lists components that have been closed as of October 2013 (as per report N°1683-2013-MEM-AAM/MPC/ RPP/ADB/LRM), and February 2017 (as per report N°112-2017-MEM-AAM/MPC/ RPP/ADB/LRM).

Table 20-7: Closed Components

Type	Component	Description
Mine		
Open pit	Central mine	24 de Junio Open pit [(1)]
		Cuye Open pit [(1)]
		Poderosa Open pit [(1)]
	Éxito mine	Éxito Open pit [(1)]
Mine entrance	Central mine	Level 260 Mine entrance 6565-NW (Mascota)
		Level 300 Mine entrance 247-49-NW [(2)] (Tajo Central)
		Level 360 Mine entrance 4554-NW [(2)] (Tajo Central)
		Level 360 Mine entrance 1523-SW [(2)] (Tajo Central)
		Level 360 Mine entrance 1287-S [(2)] (Tajo Central)
		Level 260 Mine entrance 5460-S (Juliana)
		Level 230 Mine entrance 2575-N (Mariela)
		Level 230 Mine entrance 8047-NW (Mascota)
		Level 210 Mine entrance 6050-NE (Carmencita)
	Éxito mine	Level 300 Mine entrance Rampa 7052-N
	El Paso mine	Level 250 Mine entrance 3522-NW
		Level 210 Mine entrance 4010-NW
Chimneys	Central mine	Chimneys 782-0 - surface
	Éxito mine	Chimneys 215-5 – surface [(1)]
		Chimneys 801-6 – surface [(1)]
Waste handling facilities		
Waste Rock Dumps	Central mine	Waste deposit Mascota [(1)]
		Waste deposit Carmencita
		Waste deposit Juliana [(1)]
		Waste deposit Mariela
		Waste deposit Pawac
		Waste deposit Poderosa [(1)]
		Waste deposit Triada [(1)]
	Cachi Cachi mine	Waste deposit level 410
	Éxito mine	Waste deposit Éxito
	El Paso mine	Waste deposit Level 250[(1)]
Water handling facilities		
Water Treatment System	Éxito mine	Effluent treatment plant [(2)]
	Chumpe	Domestic wastewater treatment plant PTAR 17m3/día
	Yauricocha	Domestic wastewater treatment plant PTAR 40m3/día
Other project facilities		
Facilities	Central mine	Industrial fill [(2)]

(1) Components declared in the Yauricocha Mine Unit Closure Plan Update´s report N°1683-2013-MEM-AAM/MPC/ RPP/ADB/LRM

(2) Components declared in the report N° 112-2017-MEM-DGAAM/DNAM/DGAM/ PC

Source: Yauricocha Mine Unit Closure Plan Update´s report N°1683-2013-MEM-AAM/MPC/ RPP/ADB/LRM and report N° 112-2017-MEM-DGAAM/DNAM/DGAM/ PC

20.8.4 Final Closure

For Final Closure, a final Updated Closure Plan must be presented detailing the closure specifications and process of public consultation. Table 20-8 shows which components must be closed according to the last approved closure plan and its amendment.

Table 20-8: Components for Future Closure

Component	Zone	Description
Mine		
Shaft	Central mine	Pique Central
		Pique Mascota
Mine Entrance	Central mine	Level 300 – Mine entrance 0280-NW
	Cachi Cachi mine	Level 410 – Mine entrance - 1724-S
	Ipillo mine	Level 280 – Mine entrance 2015-SW
		Level 430 – Mine entrance 9249- S
		Central mine
	Central mine	Level 35 – Victoria
Tunnel	Chumpe	Level 720 – Klepetko tunnel
		Yauricocha tunnel – 2815-SW
Chimneys	Central mine	Chimney 473-6 – Surface
		Chimney 427-14 – Surface
		Chimney 568-8 – Surface
		Chimney 789-5 – Surface
		Chimney Yauricocha (raise bore)
		Chimney Amoeba - Surface
		Chimney 906-7
	Cachi Cachi mine	Chimney 316-6 - Surface
		Chimney 350-9 - Surface
		Chimney 211-1 - Surface
		Chimney 928-2 - Surface
		Chimney 825-0 - Surface
		Chimney Fortuna
	Ipillo mine	Chimney 578-3 - Surface
Processing Facilities		
Plant	Chumpe	Processing Plant
		Inclusion of new equipment in the Plant Profit
Waste Rock Dumps	Central mine	Yauricocha tailings deposit
		Regrowth of the Yauricocha deposit
	Ipillo mine	Waste rock dumps - Level 280
		Waste rock dumps – Level 430
		Waste rock dumps – Level 480
	Chumpe	Waste rock dumps – Chumpe

Component	Zone	Description
Processing Facilities		
Sistema de Tratamiento de Aguas	Chumpe	Effluent treatment plant
	Chumpe	Effluent treatment plant
	Chumpe	Domestic wastewater treatment plant – Chumpe (100m3)
	Chumpe	Water pumping system for Esperanza
	Chumpe	Domestic wastewater treatment plant – Chumpe (50m3)
	Chumpe	Pumping system – Aldrich / Chumpe – Yauricocha (Pool N°2)
Borrow Material		
Quarries	Yauricocha	Yauricocha High
		Yauricocha C. L.
	Chumpe	Chumpe
		Chumpe
Other Infrastructure for The Project		
Other Facilities	Yauricocha	Mine facilities: (warehouse, compressors, shaft, winch, maintenance workshop, carpentry, offices, chemical laboratory)
	Chumpe	Adjoining facilities processing plant (central warehouse, warehouse of fuel, junkyard)
	Central mine	Landfill
		Expansion of the sanitary landfill
		Composting area
	Central mine	Hazardous waste warehouse
	Ipillo mine	Concrete slab Nº 1
		Concrete slab Nº 2
		Trench
Housing and Services for Workers		
Camp	Central Mine	Yauricocha camps (Miraflores, Florida, Vista Alegre, Esperanza, Hotel Americano, casa de obreros y otros)
	Chumpe	Chumpe camps (Chumpe y Huacuypacha – workers houses, employees houses, stadium, school, market)
Dining rooms	Central mine	Dining rooms - Esperanza
	Chumpe	Dining rooms - Chumpe

Source: Yauricocha Mine Unit Closure Plan Update´s report N°1683-2013-MEM-AAM/MPC/ RPP/ADB/LRM and report N° 112-2017-MEM-DGAAM/DNAM/DGAM/ PC

20.9 Closure Monitoring

Operational monitoring continues until final closure is achieved.

20.10 Post-Closure Monitoring

According to the Yauricocha Mine Unit Closure Plan Update under Report N° 339-2020/MINEM-DGAAM-DEAM-DGAM all post closure monitoring activities shall be performed as follows:

- Physical stability monitoring - Monitoring of possible displacements and settlements, cracks, slip surfaces control in mine entrances, open pits, tailings deposit, waste rock dumps, camps and auxiliary related installations by topographic landmarks control (fixed concrete bases and stainless plates). The established monitoring frequency for the first two years is bi-annual, and for the following three years annually.
- Geochemical monitoring - Monitoring of tailings deposit, waste rock dumps, and open pits inspecting the cover´s surface for cracks and slip surfaces. The established monitoring frequency is bi-annual for the first two years and annually for the following three years.
- Hydrological monitoring - Inspection of the hydraulic components of the tailings deposit, waste rock dumps, and open pits for (structural) fissures, settlements, collapsing and flow obstructions. The established monitoring frequency for the first two years is bi-annual, and for the following three years annually.
- Water quality monitoring - In three monitoring stations (MA-1, MA-2, MA-3, see footnote [1]) for: pH, electrical conductivity, total suspended solids, total dissolved solids, nitrates, alkalinity, acidity, hardness, total cyanide, cyanide wad, ammonium, sulfates, total metals (Al, As, Cd, Ca, Cu, Fe, Pb, Hg, Mo, Ni, Se and Zn), DBO5, DQO, dissolved oxygen. The established monitoring frequency for the first two years is quaternary, and for the following three years bi-annual. No groundwater quality monitoring has been contemplated.
- Sediments monitoring - Data from three monitoring stations (MA-1, MA-2, MA-3, see footnote [1]) is analyzed for: total metals (Al, As, Cd, Ca, Cu, Fe, Pb, Hg, Mo, Ni, Se and Zn), total cyanide. The data collected shall be compared with reference values for the National Oceanic and Atmospheric Administration of the USA. The established monitoring frequency for the first two years is bi-annual, and annual for the following three years.
- Hydrobiological monitoring - In three monitoring stations (MA-1, MA-2, MA-3, see footnote [1]) for: phytoplankton, zooplankton, bentos, macrophytas. The established monitoring frequency for the first two years is bi-annual, and annual for the following three years.
- Biological monitoring - Vegetation control to verify the effectiveness of the plant cover systems evaluating the extent of engraftment of the species, the success of the revegetation systems and the need for complementary planting, seeding, fertilization and vegetation control. The established monitoring frequency for the first two years is bi-annual, and annual for the following three years.

[1] MA-1: Tingo river (UTM: N 424,650; E 8,642,250), MA-2: Milpoca Lake (UTM: N 423,975; E 8,634,588), MA-3: Rodiana creek wetland (UTM: N 427,310; E 8,631,000).

- Social monitoring - Monitoring to ensure the quality and accuracy of the information collected in the field, ensure the compliance with the goals and achievements of the objectives of the social activities and programs, and achieve its sustainability. The closure social program monitoring is summarized in this section.

Social monitoring - Consists of the development of a set of actions that will allow Sierra to verify the efficiency of social programs related to closure stages, in accordance with each specific objective established for each activity described in the plan, and with the aim to correct if deemed necessary. This program is implemented in the surrounding communities in the social influence area. The main objectives of this program are to provide organization, measurement, and information capabilities to the communities which will enable them to participate with the impact monitoring activities. The KPIs mostly used are related to:

Environmental perception surveys in the education centers:

- Dissemination of the operation's public information in the most representatives' buildings as well as internet;
- Closure schedule and progress per month;
- Roles and responsibilities;
- Resources requirements: Local transport;
- Quality control procedures; and
- Reports presentation.

Sierra will hire a specialist group of professionals with experience in social and communities' relations. This team will be onsite twice a year to the area and will submit a report, scheduling all the potential activities to develop.

20.11 Reclamation and Closure Cost Estimate

Table 20-9 shows the estimated mine closure costs.

Table 20-9: Closure Plan – Summary of Investment per Periods (US$)

Description	US$ without tax	US$ with taxes	Periods (years)
Progressive closure	11,127,444	13,130,384	Until 2027
Final Closing	11,643,732	13,739,604	2028 – 2029
Post-Closing	900,487	1,062,574	2030 – 2034
Total Closing	23,671,663	27,932,562	
Total amount of the guarantee		14,802,178	
Cost reference date 2019			

Note: The amount includes tax (VAT, 18%)
Source: Report Nº 033-2020-MINEM-DGM/DTM/PCM

21 Capital and Operating Costs

Capital and operating cost forecasts for underground mining were prepared by Sierra's technical team to support the proposed mine plans based on four different production rates. The costs were reviewed by SRK and appear to be reasonable. The production rates evaluated are:

1. 3,780 tpd (base case);
2. 5,500 tpd (in 2024);
3. 6,500 tpd (in 2024); and
4. 7,500 tpd (in 2024).

All costs presented in this section are Q2 2020 US dollars, unless stated otherwise.

Capital and operating cost forecasts are based upon forward-looking information. This forward-looking information includes forecasts with material uncertainty which could cause actual results to differ materially from those presented herein.

21.1 Capital Cost Forecast

The Project's technical team prepared a forecast of the capital required to sustain the mining and processing operations until the complete exploitation of the resources. This capital forecast is broken down into the following main areas:

- Mine development;
- Ventilation;
- Equipment;
- Infill drilling and exploration;
- Plant;
- TSF; and
- Mine closure.

Mine development is related to any underground mine development that is capitalized. The cost estimate is based on site specific data from Yauricocha. Equipment sustaining cost includes the capital to maintain and replace mine equipment, while plant and TSF sustaining capital accounts for the expansion of the plant and TSF. These costs were reviewed by SRK and appear to be reasonable.

Additional capital costs have been included to account for Plant improvements. Exploration capital will be used in the exploration of future mining opportunities within the company's mining and exploration concessions. Growth capital includes the capital to achieve the production rates proposed for each plan. There is a potential to optimize the use of growth capex, which can be analyzed at the prefeasibility stage.

21.2 Operating Cost Forecast

Operating cost forecasts are based on historical costs as provided by the Yauricocha Mine. The costs were broken down into three main areas, as follows:

- Mine;
- Plant; and
- G&A.

Table 21-1 through Table 21-12 show the capital (capex) and operating (opex) cost estimates for the four production plan scenarios proposed in this report.

Table 21-1: Opex Forecast 3,780 Tonnes/Day

Opex Total	Total (US$ 000s)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Mine	**639,839**	47,467	47,144	47,108	46,970	47,794	47,252	47,314	47,262	47,242	46,572	47,039	46,542	47,115	27,016
Plant	**198,865**	14,712	14,607	14,596	14,551	14,818	14,642	14,662	14,646	14,639	14,556	14,709	14,546	14,734	8,446
G&A	**93,800**	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700
Total	**932,504**	**68,879**	**68,451**	**68,403**	**68,221**	**69,312**	**68,595**	**68,677**	**68,608**	**68,581**	**67,829**	**68,448**	**67,789**	**68,549**	**42,163**

Source: Sierra Metals, Redco, 2020

Table 21-2: Sustaining Capex Forecast 3,780 Tonnes/Day

Sustaining Capex	Total (US$ 000s)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Exploration & Development															
Development	79,869	5,922	6,141	6,134	6,106	6,270	6,162	6,175	6,164	6,160	6,110	6,203	6,104	6,218	-
Equipment	10,320	1,080	1,080	2,040	1,500	720	720	720	720	720	720	300	-	-	
Projects															
Central Shaft Rehab	1,800	1,000	800	-	-	-	-	-	-	-	-	-	-	-	-
Personnel transportation	4,550	350	-	770	-	770	-	770	-	770	-	770	-	350	-
Concentrator Plant	5,450	1,270	380	800	300	300	300	300	300	300	300	300	300	300	-
Tunnel (Cx 5000 + Shotcrete Plant)	2,300	2,300	-	-	-	-	-	-	-	-	-	-	-	-	-
Drainage System + Study	2,200	1,000	600	600	-	-	-	-	-	-	-	-	-	-	-
Ventilation	10,002	879	869	868	864	888	872	874	873	872	865	878	400		
Ramp Lv 1592 and Mascota	3,240	3,240	-	-	-	-	-	-	-	-	-	-	-	-	-
Environmental	1,165	82	82	83	83	83	83	83	83	83	83	83	83	83	83
Seismograph Study and Instrumentation	250	150	50	50	-	-	-	-	-	-	-	-	-	-	-
Geomechanical Model Study	500	-	250	-	-	250	-	-	-	-	-	-	-	-	-
Fuel Distribution System	300	300	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**121,945**	**17,573**	**10,252**	**11,345**	**8,854**	**9,281**	**8,138**	**8,922**	**8,140**	**8,906**	**8,078**	**8,535**	**6,887**	**6,951**	**83**

Source: Sierra Metals, Redco, 2020

Table 21-3: Growth Capex Forecast 3,780 Tonnes/Day

Growth Capex	Total (US$ 000s)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Projects															
Yauricocha Shaft	19,400	7,000	7,500	4,900	-	-	-	-	-	-	-	-	-	-	-
Access to Yauricocha Shaft	5,500	3,000	2,500	-	-	-	-	-	-	-	-	-	-	-	-
Tailing Dam	32,340	3,234	3,234	3,234	3,234	3,234	3,234	3,234	3,234	3,234	3,234				-
Ramp Lv 720 to Ramp Tatiana	600	600	-	-	-	-	-	-	-	-	-	-	-	-	-
Mine Camp	4,650	150	3,000	1,500	-	-	-	-	-	-	-	-	-	-	-
Studies (Techno-economic studies to increase production to 5,500 tpd)	500	250	250	-	-	-	-	-	-	-	-	-	-	-	-
Studies (geometallurgical)	300	150	-	150	-	-	-	-	-	-	-	-	-	-	-
Closure	9,450	1,000	650	650	650	650	650	650	650	650	650	650	650	650	650
Total	**72,740**	**15,384**	**17,134**	**10,434**	**3,884**	**3,884**	**3,884**	**3,884**	**3,884**	**3,884**	**3,884**	**650**	**650**	**650**	**650**

Source: Sierra Metals, Redco, 2020

Table 21-4: Opex Forecast 5,500 Tonnes/Day (2024)

Opex Total	Total (US$ 000s)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Mine	**635,510**	47,467	47,144	47,225	60,979	60,763	60,618	60,894	60,813	59,845	60,510	60,281	8,970
Plant	**198,975**	14,712	14,607	14,634	19,085	19,015	18,968	19,058	19,031	18,891	19,108	19,033	2,832
G&A	**80,400**	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700
Total	**914,844**	**68,879**	**68,451**	**68,559**	**86,765**	**86,478**	**86,287**	**86,652**	**86,544**	**85,436**	**86,317**	**86,014**	**18,502**

Source: Sierra Metals, Redco, 2020

Table 21-5: Sustaining Capex Forecast 5,500 Tonnes/Day (2024)

Sustaining Capex	Total (US$ 000s)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Exploration & Development													
Development	87,378	5,922	6,495	6,511	8,594	8,551	8,522	8,577	8,561	8,475	8,608	8,562	-
Equipment	14,867	2,577	2,577	3,537	2,997	720	720	720	720	300	-	-	
Projects													
Central Shaft Rehab	1,800	1,000	800	-	-	-	-	-	-	-	-	-	-
Personnel transportation	3,780	350	-	770	-	770	-	770	-	770	-	350	-
Concentrator Plant	4,850	1,270	380	800	300	300	300	300	300	300	300	300	-
Tunnel (Cx 5000 + Shotcrete Plant)	2,300	2,300	-	-	-	-	-	-	-	-	-	-	-
Drainage System + Study	2,200	1,000	600	600	-	-	-	-	-	-	-	-	-
Ventilation	11,911	879	1,076	1,076	1,251	1,287	1,262	1,282	1,264	1,272	1,263		
Ramp Lv 1592 and Mascota	3,240	3,240	-	-	-	-	-	-	-	-	-	-	-
Environmental	998	82	82	83	83	83	83	83	83	83	83	83	83
Seismograph Study and Instrumentation	250	150	50	50	-	-	-	-	-	-	-	-	-
Geomechanical Model Study	500	-	250	-	-	250	-	-	-	-	-	-	-
Fuel Distribution System	300	300	-	-	-	-	-	-	-	-	-	-	-
Total	**134,374**	**19,070**	**12,310**	**13,428**	**13,225**	**11,962**	**10,887**	**11,732**	**10,928**	**11,200**	**10,254**	**9,295**	**83**

Source: Sierra Metals, Redco, 2020

Table 21-6: Growth Capex Forecast 5,500 Tonnes/Day (2024)

Growth Capex	Total (US$ 000s)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Projects													
Yauricocha Shaft	19,400	7,000	7,500	4,900	-	-	-	-	-	-	-	-	-
Access to Yauricocha Shaft	5,500	3,000	2,500	-	-	-	-	-	-	-	-	-	-
Tailing Dam	35,381	3,931	3,931	3,931	3,931	3,931	3,931	3,931	3,931	3,931	.		-
Ramp Lv 720 to Ramp Tatiana	600	600	-	-	-	-	-	-	-	-	-	-	-
Mine Camp	4,650	150	3,000	1,500	-	-	-	-	-	-	-	-	-
Concentrator Plant to increase prod.	23,400	-	11,700	11,700	-		-	-	-	-	-	-	-
Studies (Techno-economic studies to increase production to 5,500 tpd)	500	250	250	-	-	-	-	-	-	-	-	-	-
Studies (geometallurgical)	300	150	-	150	-	-	-	-	-	-	-	-	-
Closure	10,831	1,000	894	894	894	894	894	894	894	894	894	894	894
Total	**100,562**	**16,081**	**29,775**	**23,075**	**4,825**	**4,825**	**4,825**	**4,825**	**4,825**	**4,825**	**894**	**894**	**894**

Source: Sierra Metals, Redco, 2020

Table 21-7: Opex Forecast 6,500 Tonnes/Day (2024)

Opex Total	Total (US$ 000s)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Mine	**639,135**	47,467	47,144	47,373	67,962	69,376	68,588	68,547	68,006	68,287	67,816	18,569
Plant	**200,815**	14,712	14,607	14,681	21,345	21,803	21,548	21,535	21,556	21,648	21,494	5,886
G&A	**73,700**	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700
Total	**913,650**	**68,879**	**68,451**	**68,755**	**96,007**	**97,879**	**96,836**	**96,782**	**96,262**	**96,635**	**96,010**	**31,155**

Source: Sierra Metals, Redco, 2020

Table 21-8: Sustaining Capex Forecast 6,500 Tonnes/Day (2024)

Sustaining Capex	Total (US$ 000s)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Exploration & Development												
Development	91,187	5,922	7,238	7,283	9,974	10,254	10,098	10,090	10,103	10,159	10,065	-
Equipment	17,628	3,447	3,447	4,407	3,867	720	720	720	300	-	-	-
Projects												
Central Shaft Rehab	1,800	1,000	800	-	-	-	-	-	-	-	-	-
Personnel transportation	3,010	350	-	770	-	770	-	770	-	350	-	-
Concentrator Plant	4,550	1,270	380	800	300	300	300	300	300	300	300	-
Tunnel (Cx 5000 + Shotcrete Plant)	2,300	2,300	-	-	-	-	-	-	-	-	-	-
Drainage System + Study	2,200	1,000	600	600	-	-	-	-	-	-	-	-
Ventilation	12,434	870	1,284	1,284	1,499	1,489	1,515	1,501	1,474	1,517	-	-
Ramp Lv 1592 and Mascota	3,240	3,240	-	-	-	-	-	-	-	-	-	-
Environmental	915	82	82	83	83	83	83	83	83	83	83	83
Seismograph Study and Instrumentation	250	150	50	50	-	-	-	-	-	-	-	-
Geomechanical Model Study	500	-	250	-	-	250	-	-	-	-	-	-
Fuel Distribution System	300	300	-	-	-	-	-	-	-	-	-	-
Total	**140,313**	**19,932**	**14,131**	**15,277**	**15,724**	**13,866**	**12,717**	**13,464**	**12,261**	**12,410**	**10,449**	**83**

Source: Sierra Metals, Redco, 2020

Table 21-9: Growth Capex Forecast 6,500 Tonnes/Day (2024)

Growth Capex	Total (US$ 000s)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Projects												
Yauricocha Shaft	19,400	7,000	7,500	4,900	-	-	-	-	-	-	-	-
Access to Yauricocha Shaft	5,500	3,000	2,500	-	-	-	-	-	-	-	-	-
Tailing Dam	36,923	4,615	4,615	4,615	4,615	4,615	4,615	4,615	4,615			
Ramp Lv 720 to Ramp Tatiana	600	600	-	-	-	-	-	-	-	-	-	-
Mine Camp	4,650	150	3,000	1,500	-	-	-	-	-	-	-	-
Concentrator Plant to increase prod.	41,400	-	20,700	20,700	-		-	-	-	-	-	-
Studies (Techno-economic studies to increase production to 6,500 tpd)	500	250	250	-	-	-	-	-	-	-	-	-
Studies (geometallurgical)	300	150	-	150	-	-	-	-	-	-	-	-
Closure	11,916	1,000	1,229	1,229	1,229	1,229	1,000	1,000	1,000	1,000	1,000	1,000
Total	**121,189**	**16,765**	**39,794**	**33,094**	**5,844**	**5,844**	**5,615**	**5,615**	**5,615**	**1,000**	**1,000**	**1,000**

Source: Sierra Metals, Redco, 2020

Table 21-10: Opex Forecast 7,500 Tonnes/Day (2024)

Opex Total	Total (US$ 000s)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Mine	**633,633**	47,467	47,144	47,373	76,544	76,311	76,521	76,712	75,931	75,772	33,858
Plant	**199,466**	14,712	14,607	14,681	24,123	24,047	24,115	24,177	24,144	24,092	10,766
G&A	**67,000**	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700	6,700
Total	**900,009**	**68,879**	**68,451**	**68,755**	**107,367**	**107,058**	**107,336**	**107,590**	**106,775**	**106,565**	**51,324**

Source: Sierra Metals, Redco, 2020

Table 21-11: Sustaining Capex Forecast 7,500 Tonnes/Day (2024)

Sustaining Capex	Total (US$ 000s)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Exploration & Development											
Development	92,896	5,922	8,462	8,508	11,671	11,625	11,667	11,705	11,684	11,653	-
Equipment	20,388	4,317	4,317	5,277	4,737	720	720	300	-	-	-
Projects											
Central Shaft Rehab	1,800	1,000	800	-	-	-	-	-	-	-	-
Mine Camp	-	-	-	-	-	-	-	-	-	-	-
Mascota Shaft	-	-	-	-	-	-	-	-	-	-	-
Personnel transportation	3,010	350	-	770	-	770	-	770	-	350	-
Concentrator Plant	4,250	1,270	380	800	300	300	300	300	300	300	-
Tunnel (Cx 5000 + Shotcrete Plant)	2,300	2,300	-	-	-	-	-	-	-	-	-
Drainage System + Study	2,200	1,000	600	600	-	-	-	-	-	-	-
Ventilation	12,846	1,397	1,397	1,397	1,730	1,737	1,724	1,718	1,745		
Ramp Lv 1592 and Mascota	3,240	3,240	-	-	-	-	-	-	-	-	-
Environmental	831	82	82	83	83	83	83	83	83	83	83
Seismograph Study and Instrumentation	250	150	50	50	-	-	-	-	-	-	-
Geomechanical Model Study	500	-	250	-	-	250	-	-	-	-	-
Fuel Distribution System	300	300	-	-	-	-	-	-	-	-	-
Total	**144,813**	**21,328**	**16,339**	**17,485**	**18,522**	**15,486**	**14,494**	**14,876**	**13,813**	**12,386**	**83**

Source: Sierra Metals, Redco, 2020

Table 21-12: Growth Capex Forecast 7,500 Tonnes/Day (2024)

Growth Capex	Total (US$ 000s)	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Projects											
Yauricocha Shaft	19,400	7,000	7,500	4,900	-	-	-	-	-	-	-
Access to Yauricocha Shaft	5,500	3,000	2,500	-	-	-	-	-	-	-	-
Tailing Dam	37,615	4,702	4,702	4,702	4,702	4,702	4,702	4,702	4,702		
Ramp Lv 720 to Ramp Tatiana	600	600	-	-	-	-	-	-	-	-	-
Mine Camp	4,650	150	3,000	1,500	-	-	-	-	-	-	-
Concentrator Plant to increase prod.	59,400	-	29,700	29,700	-	-	-	-	-	-	-
Studies (Techno-economic studies to increase production to 7,500 tpd)	500	250	250	-	-	-	-	-	-	-	-
Studies (geometallurgical)	300	150	-	150	-	-	-	-	-	-	-
Closure	12,700	1,000	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
Total	**140,665**	**16,852**	**48,952**	**42,252**	**6,002**	**6,002**	**6,002**	**6,002**	**6,002**	**1,300**	**1,300**

Source: Sierra Metals, Redco, 2020

22 Economic Analysis

The economic analysis for this PEA was prepared by Sierra Metals and reviewed by SRK. The analysis is based on Mineral Resources which includes Inferred Mineral Resources. Mineral resources that are not Mineral Reserves do not have demonstrated economic viability and are not supported at least by a pre-feasibility study. This PEA is preliminary in nature and there is no certainty that the results of the PEA will be realized.

The results of the economic analysis in this PEA are based upon forward-looking information. This forward-looking information includes forecasts with material uncertainty which could cause actual results to differ materially from those presented herein.

Table 22-1 shows the metals prices used in this PEA study.

Table 22-1: Commodity Prices (CIBC, Consensus Commodity Forecast, August 2020)

Metal	Unit	2020	2021	2022	2023	Long Term (LT)
Au	$/oz	1,755	1,907	1,782	1,737	1,541
Ag	$/oz	19.83	24.12	22.22	22.47	20
Cu	$/lb	2.65	2.86	2.89	2.93	3.05
Pb	$/lb	0.82	0.87	0.89	0.9	0.91
Zn	$/lb	0.94	0.99	1.04	1.04	1.07

Source: CIBC Global Mining Group, 2020

The main economic factors and assumptions used in the economic analysis include the following:

- Average grades of Zn 1.71%, Pb 0.48%, Ag 34.2 g/t (1.1 oz/t), Cu 1.28% and Au 0.42 g/t (0.01 oz/t);
- Ordinary Mining Entitled Royalty rate depending on the operating margin;
- Extraordinary Mining Entitled Royalty rate depending on the operating margin;
- Corporate Tax rate of 29.5%;
- Numbers are presented on a 100% ownership basis and do not include financing costs; and
- The metallurgical recoveries used in the evaluation are:
  - 80.4% Cu, 88.6 % Pb, 89.2 % Zn; and
  - 76.4 % Ag, 17.2 % Au.

The source of this information is the previous NI 43-101 Technical Report (SRK Consulting (Canada) Inc., January 17, 2020) which SRK considers still to be valid. The four production rates evaluated in this PEA are:

1. 3,780 tpd (base case);
2. 5,500 tpd (in 2024);

3. 6,500 tpd (in 2024); and
4. 7,500 tpd (in 2024).

The economic analysis is based on the economic factors and assumptions listed above, the mine schedules prepared for each production rate scenario, the capex and opex estimates described in Section 21, and the price assumptions shown in Table 22-1.

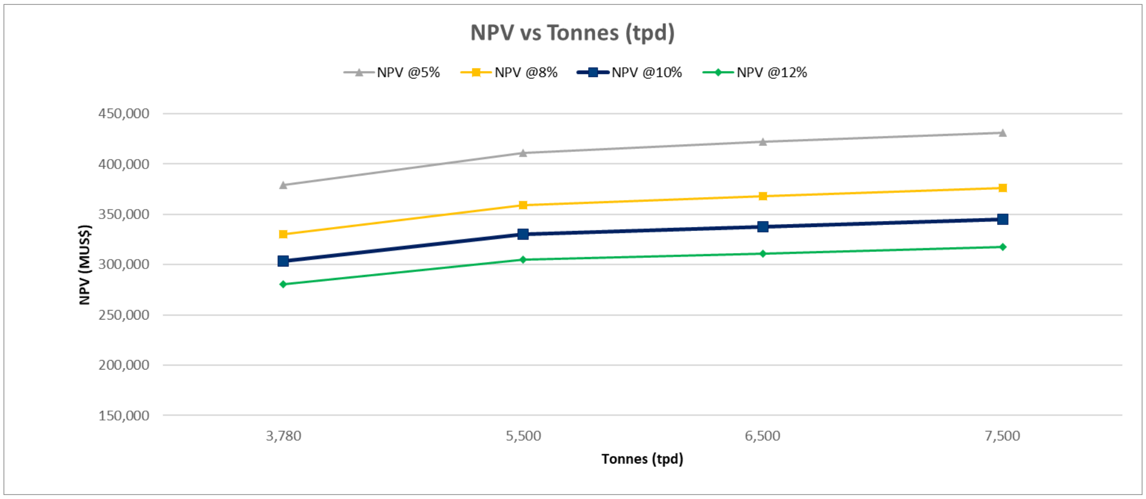
Table 22-2 shows the results of the economic evaluations made to the proposed mine plans in this PEA, with the options 3,780 tpd, 5,500 tpd, 6,500 tpd and 7,500 tpd, with maximum production in 2024 (except for the base case of 3,780 tpd which is at maximum production already). Of all the production rate options evaluated, the 7,500 tpd production rate has the highest after tax NPV.

Table 22-2: Summary Economic Forecast

Description	**Unit**	**3,780 TPD**	**5,500 TPD (2024)**	**6,500 TPD (2024)**	**7,500 TPD (2024)**
Life of Mine	Years	14	12	11	10
Market Prices (Long Term)					
Zinc	$/lb	1.07	1.07	1.07	1.07
Lead	$/lb	0.91	0.91	0.91	0.91
Silver	$/oz	20	20	20	20
Copper	$/lb	3.05	3.05	3.05	3.05
Gold	$/oz	1541	1541	1541	1541
Net Sales					
Sales Zinc	k$	558,072	578,936	587,889	590,280
Sales Lead	k$	149,424	151,951	152,915	153,376
Sales Silver	k$	266,341	274,736	279,640	281,911
Sales Copper	k$	1,220,911	1,278,506	1,316,770	1,331,787
Sales Gold	k$	63,240	66,406	68,668	69,402
Gross Revenue	**k$**	***2,257,988***	***2,350,535***	***2,405,883***	***2,426,757***
Charges for treatment, refining, impurities	k$	296,927	310,249	316,280	318,900
Gross Revenue After Selling and Treatment Costs	**k$**	***1,961,061***	***2,040,286***	***2,089,603***	***2,107,857***
Royalty and Mining Permits	k$	58,483	63,756	66,082	65,745
Gross Revenue After all Costs	***k$***	***1,902,578***	***1,976,529***	***2,023,521***	***2,042,112***
Operation Costs					
Mine	k$	639,839	635,510	639,135	633,633
Plant	k$	198,865	198,975	200,815	199,466
G&A	k$	93,800	80,400	73,700	67,000
Total Operation	**k$**	***932,504***	***914,884***	***913,650***	***900,099***
EBITDA	**k$**	***1,028,557***	***1,125,402***	***1,175,953***	***1,207,757***
LOM Capital + Sustaining Capital	k$	194,685	234,936	261,502	285,478
Working Capital	k$	8,719	0	382	754
Income Taxes	k$	210,675	231,514	236,622	235,147
Cash flow before Taxes	k$	704,570	758,467	778,238	786,467
Cash flow after Taxes	k$	493,894	526,953	541,616	551,321
After Tax NPV @5%	**k$**	***378,916***	***410,728***	***421,905***	***431,088***
After Tax NPV @8%	**k$**	***330,092***	***359,087***	***368,002***	***376,239***
After Tax NPV @10%	**k$**	***303,394***	***330,193***	***337,640***	***345,130***
After Tax NPV @12%	**k$**	***280,395***	***304,910***	***310,954***	***317,654***

Source: Sierra Metals, Redco, 2020

Figure 22-1 shows the relationship of NPV vs Production Rate scenarios at different discount rates.



Source: Sierra Metals, Redco, 2020

Figure 22-1: Sensitivity Analysis – NPV vs. Production Rate

The incremental internal rate of return (IRR) indicates that the highest return on investment occurs when the production increase is made from 3,780 tpd to 5,500 (35.74% in Table 22-3). Table 22-4 shows the Profitability Index (PI), showing that the 5,500 tpd alternative has a higher profitability index (0.85).

Table 22-3: Incremental NPV and IRR Forecast

INCREMENTAL NET PRESENT VALUE	NPV US$	IRR %
3,780 tpd – 5,500 tpd	**28,427,956**	**35.74%**
3,780 tpd – 6,500 tpd	37,350,922	25.78%
3,780 tpd – 7,500 tpd	45,569,379	24.80%
5,500 tpd – 6,500 tpd	8,922,966	13.59%
5,500 tpd – 7,500 tpd	17,141,424	16.86%
6,500 tpd – 7,500 tpd	8,218,458	21.70%

Source: Sierra Metals, Redco, 2020

Table 22-4: Incremental NPV and Profitability Index (PI) Forecast

INCREMENTAL NET PRESENT VALUE	NPV US$	PI
3,780 tpd – 5,500 tpd	**28,427,956**	**0.85**
3,780 tpd – 6,500 tpd	37,350,922	0.62
3,780 tpd – 7,500 tpd	45,569,379	0.54

Source: Sierra Metals, Redco, 2020

Sierra observes that there are some mineralized material and waste haulage issues due to mineralized zone geometry and distribution. As such, Sierra has decided that the 5,500 tpd production rate option is the recommended case for a future pre-feasibility study. Increased production rates beyond 5,500 tpd may be possible once Yauricocha has resolved the mineralized material and waste haulage issues.

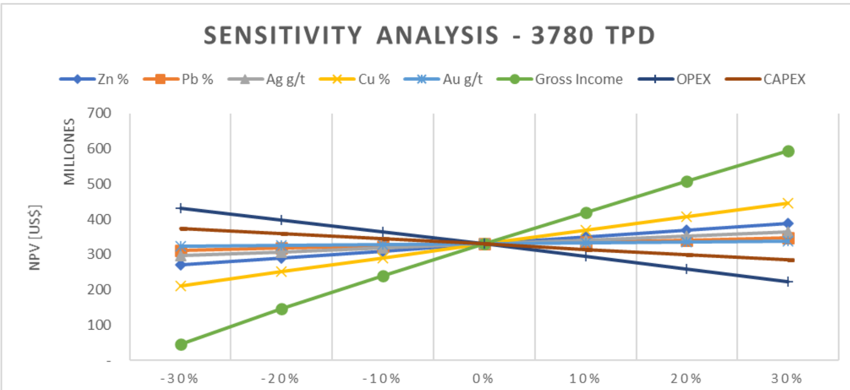
The 5,500 tpd (2024) proposed mine plan has a capital requirement (initial and sustaining) of US$ 235 M over the 12-year LOM; efficiencies associated with higher throughputs are expected drive a reduction in operating costs on a per tonne basis. This PEA indicates an after-tax NPV (8%) at 5,500 tpd (in 2024) of US$ 359 M. Total operating cost for the LOM is US$ 915 M, equating to a total operating cost of US$ 45.25 per tonne milled and US$ 1.19 per pound copper equivalent. Economic estimates are based upon forward-looking information. This forward-looking information includes forecasts with material uncertainty which could cause actual results to differ materially from those presented herein.

A sensitivity analysis was performed for each mining plan to analyze the impact of the change on the main drivers: metal grades, operating and capital costs, and gross income. These are shown in Table 22-5 to Table 22-8, and in Figure 22-2 to Figure 22-9.

Table 22-5: Sensitivity Analysis NPV, 3,780 TPD (US$)

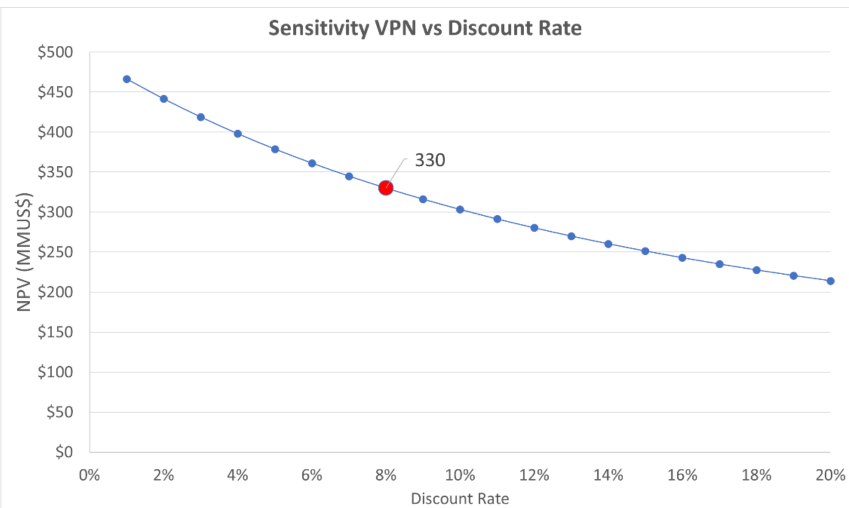
Sensitivity	-30%	-20%	-10%	0%	10%	20%	30%
Zn %	270,714,748	290,541,908	310,335,318	330,091,950	349,795,125	369,363,464	388,906,084
Pb %	312,664,485	318,479,458	324,291,346	330,091,950	335,884,858	341,676,520	347,468,006
Ag g/t	296,530,086	307,728,465	318,917,368	330,091,950	341,243,929	352,353,463	363,420,094
Cu %	211,721,408	251,469,461	290,880,472	330,091,950	368,614,231	406,870,396	444,992,548
Au g/t	322,853,495	325,267,444	327,680,632	330,091,950	332,503,123	334,913,051	337,321,676
Gross Income	45,827,517	147,841,486	239,569,747	330,091,950	419,018,674	507,225,581	595,014,298
OPEX	431,994,329	398,480,703	364,551,227	330,091,950	294,752,784	259,035,397	222,865,373
CAPEX	375,013,887	360,039,908	345,065,929	330,091,950	315,117,971	300,143,992	285,170,013

Source: Sierra Metals, Redco, 2020



Source: Sierra Metals, Redco, 2020

Figure 22-2: Sensitivity Analysis – 3,780 TPD



Source: Sierra Metals, Redco, 2020

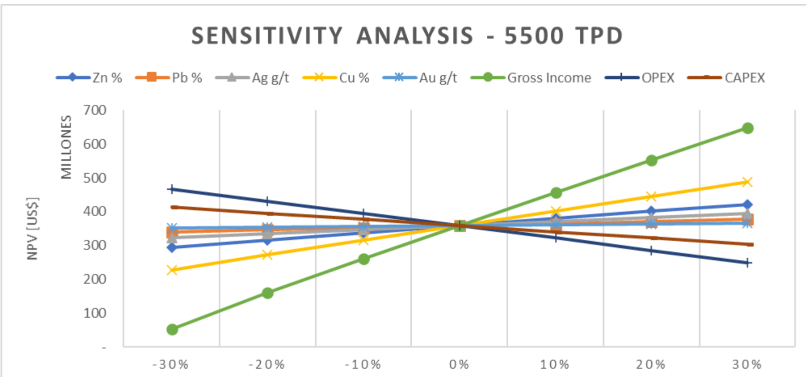
Figure 22-3: Sensitivity NPV vs. Discount Rate – 3,780 TPD

The analysis shows that the NPV is most sensitive to changes in gross income and operating costs, moderately sensitive to changes in capex and the grade of copper, and least sensitive to changes in the grades of silver, gold, lead and zinc.

Table 22-6: Sensitivity Analysis NPV, 5,500 TPD (US$)

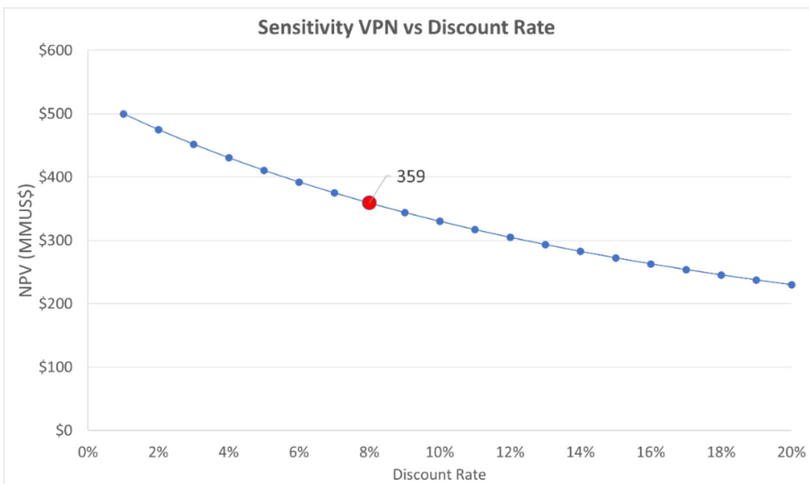
Sensitivity	-30%	-20%	-10%	0%	10%	20%	30%
Zn %	295,434,160	316,689,640	337,905,568	359,087,090	380,241,533	401,360,516	422,441,354
Pb %	340,874,910	346,948,143	353,018,564	359,087,090	365,155,543	371,223,995	377,290,055
Ag g/t	323,503,333	335,375,049	347,238,069	359,087,090	370,928,662	382,758,872	394,576,726
Cu %	228,631,042	272,408,502	315,875,035	359,087,090	402,104,535	444,939,142	487,606,417
Au g/t	351,120,340	353,776,921	356,433,425	359,087,090	361,739,842	364,392,593	367,045,345
Gross Income	54,227,481	161,565,913	260,905,553	359,087,090	456,422,261	553,171,841	649,463,883
OPEX	465,787,555	430,629,638	395,063,069	359,087,090	322,722,805	285,948,736	248,793,884
CAPEX	413,901,191	395,629,824	377,358,457	359,087,090	340,815,724	322,544,357	304,272,990

Source: Sierra Metals, Redco, 2020



Source: Sierra Metals, Redco, 2020

Figure 22-4: Sensitivity Analysis – 5,500 TPD



Source: Sierra Metals, Redco, 2020

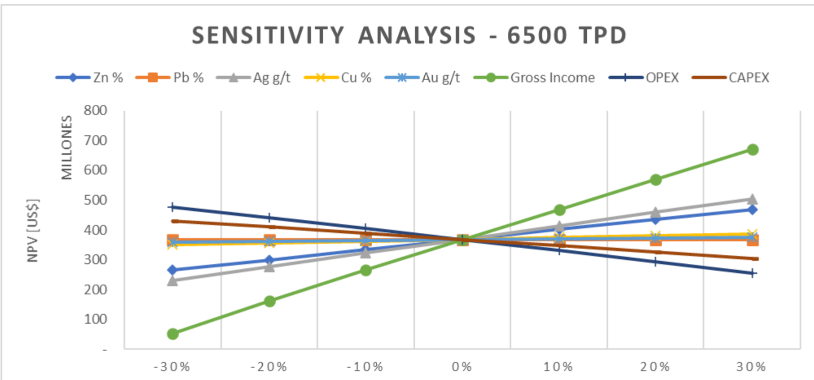
Figure 22-5: Sensitivity NPV vs. Discount Rate – 5,500 TPD

The analysis shows that the NPV is most sensitive to changes in gross income and operating costs, moderately sensitive to changes in capex and the grade of copper, and least sensitive to changes in the grades of silver, gold, lead and zinc.

Table 22-7: Sensitivity Analysis NPV, 6,500 TPD (US$) (2024)

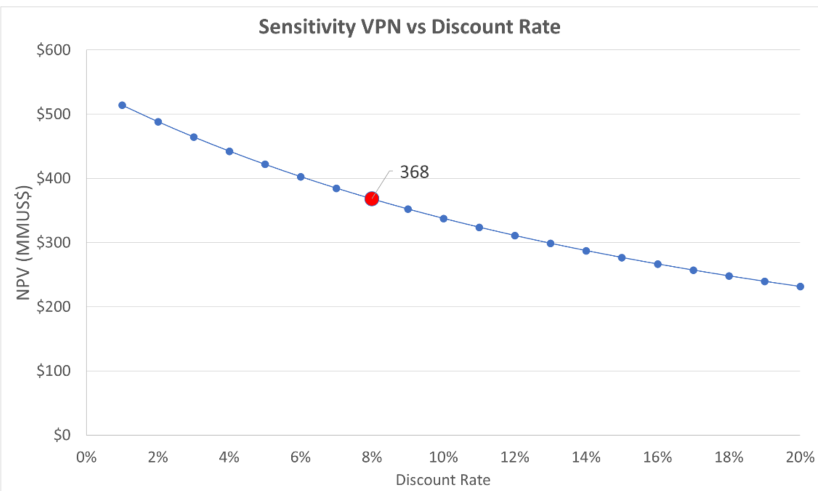
Sensitivity	-30%	-20%	-10%	0%	10%	20%	30%
Zn %	265,768,364	299,961,146	334,028,208	368,001,674	401,880,085	435,682,111	469,440,309
Pb %	368,001,674	368,001,674	368,001,674	368,001,674	368,001,674	368,001,674	368,001,674
Ag g/t	229,985,530	276,298,033	322,281,610	368,001,674	413,501,382	458,807,777	503,993,781
Cu %	349,557,670	355,708,869	361,857,080	368,001,674	374,142,407	380,277,792	386,410,726
Au g/t	359,558,775	362,374,188	365,188,353	368,001,674	370,814,293	373,623,595	376,432,600
Gross Income	52,734,344	162,062,310	265,623,751	368,001,674	469,526,742	570,447,894	670,915,267
OPEX	477,295,936	441,270,072	404,838,105	368,001,674	330,757,644	293,107,085	255,056,186
CAPEX	430,773,100	409,849,291	388,925,483	368,001,674	347,077,866	326,154,057	305,230,249

Source: Sierra Metals, Redco, 2020



Source: Sierra Metals, Redco, 2020

Figure 22-6: Sensitivity Analysis – 6,500 TPD



Source: Sierra Metals, Redco, 2020

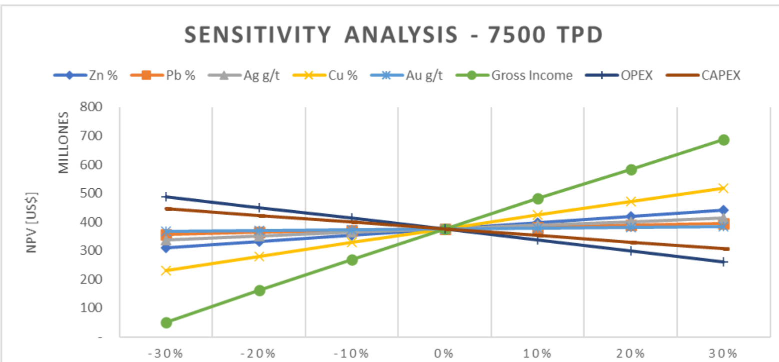
Figure 22-7: Sensitivity NPV vs. Discount Rate – 6,500 TPD

The analysis shows that the NPV is most sensitive to changes in gross income and operating costs, moderately sensitive to changes in capex and the grade of copper, and least sensitive to changes in the grades of silver, gold, lead and zinc.

Table 22-8: Sensitivity Analysis NPV, 7,500 TPD (US$) (2024)

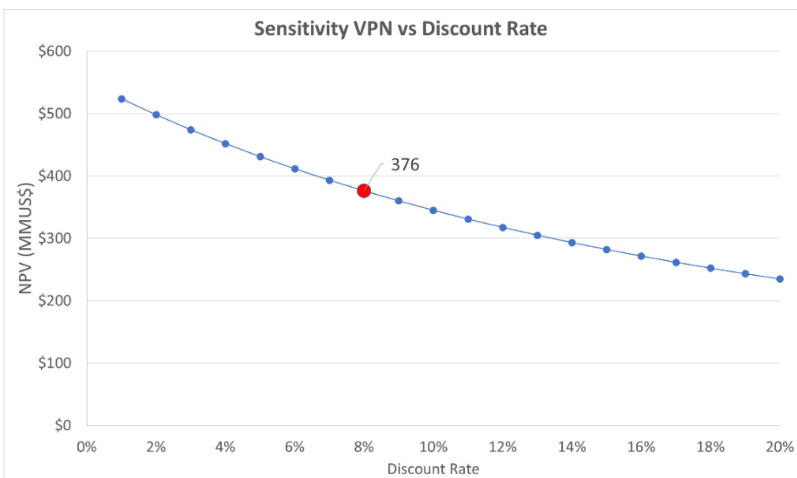
Sensitivity	-30%	-20%	-10%	0%	10%	20%	30%
Zn %	309,647,428	331,888,596	354,093,382	376,239,165	398,358,937	420,443,584	442,477,279
Pb %	357,528,363	363,765,567	370,002,366	376,239,165	382,473,807	388,700,622	394,922,695
Ag g/t	338,429,656	351,042,022	363,643,314	376,239,165	388,821,875	401,390,792	413,956,353
Cu %	231,539,685	280,064,864	328,299,523	376,239,165	423,979,128	470,984,600	517,202,459
Au g/t	367,430,570	370,367,689	373,304,404	376,239,165	379,172,574	382,104,846	385,035,084
Gross Income	51,875,757	162,836,345	270,132,005	376,239,165	481,425,423	584,178,414	686,443,329
OPEX	486,768,495	450,937,379	413,814,021	376,239,165	338,269,479	299,915,772	261,169,028
CAPEX	446,194,872	422,876,303	399,557,734	376,239,165	352,920,596	329,602,027	306,283,458

Source: Sierra Metals, Redco, 2020



Source: Sierra Metals, Redco, 2020

Figure 22-8: Sensitivity Analysis – 7,500 TPD



Source: Sierra Metals, Redco, 2020

Figure 22-9: Sensitivity NPV vs. Discount Rate – 7,500 TPD

The analysis shows that the NPV is most sensitive to changes in gross income and operating costs, moderately sensitive to changes in capex and the grade of copper, and least sensitive to changes in the grades of silver, gold, lead and zinc.

22.1 Risk Assessment

The Yauricocha Mine experiences risks that are similar to those faced by any other base and precious metals mining operation. The mine features several positive characteristics which significantly reduce the risks involved with the mine's continued operation. These include, but are not limited to, many years of proven mine extraction, processing history, knowledge and experience, a favourable regulatory climate with existing agreements and permits for operations, access, power, water and land use, and the ability to further reduce unit costs by increasing the production rate. Sierra prepared a risk assessment for the Yauricocha Mine and this was reviewed by SRK.

Table 22-9 provides a list of the potential risks associated with the continued operation of the Yauricocha Mine. The risk ratings for each category at Yauricocha range from "Low in Green", "Medium in Yellow" and "High in Red". The risk ratings for the majority of categories are low or medium with only Hydrogeological rated as high risk, as detailed below.

Table 22-9: Yauricocha Mine - Risk Assessment

Risk	Risk Rating		
	Low	Medium	High
Operations			
LOM Schedule			
Production Expansion			
Infrastructure			
Economics			
Opex			
Capex			
Metal prices			
Off-site treatment costs			
Marketing agreements			
Technical			
Resources/Exploration			
Geotechnical/Hydrogeological			
Mining			
Pillar recovery			
Processing			
Tailings Storage			
Other			
Permits			
Social License			
Environment			

Source: Sierra Metals, Redco, 2020

Operations

Sierra has many years of successful operational experience at the Yauricocha mine and therefore considers the risk rating for the various LOM schedules it has prepared for this PEA study as being low. A production rate increase from 3,780 tpd to 5,500 tpd represents a 46% increase in the production rate and therefore further study will be required to determine the maximum capacity of the existing mine infrastructure, and what aspects of the mine's infrastructure may have to be expanded to achieve 5,500 tpd and beyond. Thus, the categories of production expansion and mine infrastructure have a medium risk rating; uncertainties concerning production expansion and mine infrastructure can be mitigated through future studies such as prefeasibility and feasibility studies.

Economics

Operating costs are based on actual production data and are therefore more accurate than estimated operating costs normally found in PEA reports. These costs form the basis of the base case (3,780 tpd) and have been conservatively factored to estimate the operating costs for higher production rates. The NPV is moderately sensitive to changes in capital cost and therefore capital cost control will be important as the mine undertakes new capital expenditures to support production expansion.

Technical

This PEA report includes Inferred Resources in the LOM schedules. Inferred Resources are too speculative to be used in an economic analysis, except as allowed for by NI 43-101 in PEA studies.

Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability. There is no certainty that Inferred Resources can be converted to Indicated or Measured Resources or Mineral Reserves, and as such, there is no certainty that the results of this PEA will be realized. As such, the Mineral Resource risk for the Yauricocha Mine is considered to be medium. More exploration work will be required to establish increases in Measured and Indicated Resources.

The geotechnical knowledge of the Yauricocha Mine is good, and the stope and ground support designs derived from this knowledge have served the mine well. The mineralized zones yet to be developed are not considered materially different than the zones being currently mined. Hydrogeological risks, however, are considered high, since there is a presence of water in several sectors, and the safe continuation of the mining work must be ensured, particularly as the mining takes place at greater depth in the future.

In the case of the mine, plant and tailings processes, these are well understood processes and their risk is assigned a medium rating when considered in the context of making a significant production rate expansion.

Other

The mine is legally permitted for full mining operations, access, water, power and land use. The mine conforms with all regulatory requirements, is recognized as a safe and efficient mining operation, and is noted to be a good employer in the region. Sierra considers there to be potential risks related to include Permits, Social License and the Environment. The relationship with local communities and other interested parties is always a consideration and can positively or negatively influence issues; therefore, the risks for Permits, Social License and the Environment are assigned a medium rating.

23 Adjacent Properties

SRK is not aware of any adjacent properties to the Yauricocha Mine as defined under NI 43-101.

24 Other Relevant Data and Information

There is no other relevant information or explanation necessary to make the Technical Report understandable and not misleading.

25 Interpretation and Conclusions

25.1 Geology and Exploration

SRK is of the opinion that the exploration at Yauricocha is being conducted in a reasonable manner and is supported by an extensive history of discovery and development. Recent exploration success at Esperanza and Cuye will continue to develop in the near term and SRK notes that other areas near the current mining operation remain prospective for additional exploration, and that these will be prioritized based on the needs and objectives of the Yauricocha Mine. Regional exploration continues at Doña Leona, a geophysical interpreted anomaly located 2.5 km southeast of the Yauricocha Mine and at Kilcaska, a geochemical anomaly situated 7.5 km southeast of the Yauricocha Mine.

The understanding of the geology and mineralization at Yauricocha is based on a combination of geologic mapping, drilling, and development sampling that guides the ongoing mine design. SRK has reviewed the methods and procedures for these data collection methods and notes that they are generally reasonable and consistent with industry best practice. The validation and verification of data and information supporting the Mineral Resource estimation has historically been deficient, but strong efforts are being made to modernize and validate the historic information using current, aggressive QA/QC methods and more modern practices for drilling and sampling. SRK notes that the majority of the remaining resources in areas such as Mina Central and Cachi-Cachi are supported by more modern data validation and QA/QC, and that new areas like Esperanza feature extensive QA/QC and third-party analysis.

The current QA/QC program is aggressive and should be providing very high confidence in the quality of the analytical data. Unfortunately, the results from both the ALS and Chumpe laboratories continue to show significant failures which could be related to several factors that may be out of the control of the laboratory.

SRK is of the opinion that the current procedures and methods for the data collection and validation are reasonable and consistent with industry best practices, but that there are opportunities to improve this going forward. For example, the current management of the “database” is effectively maintained through a series of individual Excel files, which is not consistent with industry best practice. Modern best practices generally feature a unified database software system with all of the information compiled and stored in one place, with methods and procedures in place to verify the data, prevent tampering and track any changes.

25.2 Mineral Resource Estimate

The procedures and methods supporting the Mineral Resource estimation have been developed in conjunction with Minera Corona geological personnel, and the resource estimations presented herein have been conducted by independent consultants using supporting data generated by site personnel. In general, the geological models are defined by the site geologists using manual and implicit 3D modeling techniques from drilling and development information. These models are used to constrain block models, which are flagged with bulk density, mine area, depletion, etc. Grade is estimated into these block models using both drill and channel samples and applying industry-standard estimation methodology. Mineral Resources estimated by the independent consultants are categorized in a manner consistent with industry best practice and are reported above reasonable unit value cut-offs.

SRK notes that the procedures used for estimating the Mineral Resources at the mine (i.e. Minera Corona) are in development and are far more advanced than in previous years.

SRK noted some unusual approaches with the sample selection criteria and search distances that yielded reasonable results but could be refined. For example, the sample selection criteria were locally very restrictive, and the search distances were very limited; these could be improved through more detailed geostatistical analysis. Nonetheless, SRK's review and validation of the Minera Corona models found them to be reasonable approximations of the input data and supported by the mine's understanding of the geology.

SRK is of the opinion that the resource estimations are suitable for public reporting and are a fair representation of the in-situ contained metal for the Yauricocha deposit.

25.3 Mineral Processing and Metallurgical Testing

SRK is the opinion that Yauricocha's processing facility is reasonably well operated and shows flexibility to treat multiple sources of mineralized material. The metallurgical performance, i.e., metal recovery and concentrate grade, has been consistent throughout the period evaluated allowing the mine to produce commercial quality copper concentrate, lead concentrate, and zinc concentrate.

The spare capacity in their oxide circuit is an opportunity to source material from third-party mines located in the vicinity. The presence of arsenic is being well managed by blending mineralized material in order to control arsenic concentration in the final concentrates. Gold deportment seems an opportunity that Yauricocha may want to investigate, particularly by evaluating gravity concentration in the grinding stage, or alternatively in the final tails, or both.

25.4 Mineral Reserve Estimate

A Mineral Reserve has not been estimated for the Project as part of this PEA.

25.5 Mining Methods

25.5.1 Mining

The Yauricocha Mine is a producing operation with a long production history. The majority of mining is executed through mechanized sub-level caving with a relatively small portion of the mining using overhand cut and fill. The mine uses well-established, proven mining methods and is anticipated to continue to maintain a 3,800 tpd (1.4 Mt/y) production rate for the remainder of 2020.

25.5.2 Geotechnical

A current industry standard is to have geotechnical databases within three-dimensional modelling software such as Leapfrog Geo. The Leapfrog Geo models provided to SRK for this PEA did not contain geotechnical data and were largely only focused on the zones of mineralization. From this observation, SRK is unclear whether the Yauricocha mine staff are updating and maintaining the geotechnical model that was prepared in conjunction with SRK. If they are not, SRK recommends that the mine resume updating and maintaining the geotechnical model.

The ground control management level plans reviewed present a rock mass quality regime that is consistent with the conceptual geotechnical rock mass model, as well as the description of the domains and sub-domains from the 2015 Technical Report. The level plans, and accompanying development profile and installation procedures are well developed and appropriate for operational application. The ground support designs were not reviewed in detail as part of this study, but an observation was made that the ground support type for good ground did not include any surface support. Unless there is a thorough and regimented check-scaling procedure ensured, industry standard is to have surface support of mesh and/or shotcrete even in good ground.

SRK is of the opinion that the current understanding of subsidence and its effects is reasonable. The current understanding of in-situ and induced stress for the current mining areas is satisfactory, but for the deeper planned mining areas, site specific stress measurements and stress modelling are needed. The current understanding of the conditions leading to a mud rush and the mitigation measures put in place are reasonable; however, the potential occurrence of a mud rush event is an ever-present risk, particularly when entering new mining areas. Dewatering practices need to be maintained, existing drawpoints monitored, and new areas investigated prior to being developed.

25.5.3 Hydrology

As the mine expands, water inflows should be expected to increase. Mitigation efforts should continue to be assessed and tested, but operational management plans should continue to assume that inflows and mud rush potential will increase until such a time that the effectiveness of mitigation efforts can be proven, or decisions are made to address water-related risks through other management plans.

Past efforts have been made to control or reduce inflows. A large amount of data is available that could be used to understand the source of water, but it is currently not compiled in a manner to allow this to be easily done.

In the past, drainage tunnels and exploratory test drill holes have been completed in efforts to control or reduce inflow to mining areas. Drain holes were completed in the 920 and 870 levels in Antacaca Sur, 920 level in Antacaca, 920 and 970 levels in Catas and 870 and 920 levels in Rosaura. All of these water management features were oriented into the granodiorite to intercept flow before reaching the subsidence zone. Some of drillholes were later cemented to reduce inflows into mining zones.

During drilling, inflows were observed to decrease on the 820 and 870 levels, and post drilling decreasing inflows were observed on the 920 level. Inflows in Antacaca Sur and Rosaura have been reduced over time, but inflows appear to be increasing in Catas and Esperanza.

In conclusion, the mine has in the past, or currently, been able to manage water sufficiently to allow mining to proceed. As the mine expands, water inflows should be expected to increase. Mitigation efforts should continue to be assessed and tested, but operational management plans should continue to assume that inflows and mud rush potential will increase until such a time that the effectiveness of mitigation efforts can be proven, or decisions are made to address water-related risks through other management plans.

25.6 Recovery Methods

Yauricocha operates a conventional processing plant that has been subject to continuous improvements in recent years, including a crushing stage for the oxide circuit and installation of multiple flotation cells in the polymetallic circuit to improve recovery and deportment of metals.

25.7 Infrastructure

The infrastructure is well developed and functioning as would be expected for a mature operation. The TSF continues to develop and will require ongoing monitoring to assure the construction of the next lift is timely to support the operation. Ongoing monitoring of the stability of the embankment and operations practices is recommended to conform to industry best practices.

25.8 Environmental Studies and Permitting

Sierra has all relevant permits required for the current mining and metallurgical operations. Sierra also has a Community Relations Plan including annual assessment, records, minutes, contracts and agreements.

Sierra applied to SENACE to start the evaluation process of the “Environmental Impact Study of the Metallurgical Mining Components Update Project” (Geoservice Ambiental S.A.C., 2017) within the framework of the Supreme Decree N° 016-1993-EM, as this study was initiated before the enforcement of the D.S N° 040-2014-EM and in application of an exceptional procedure established by it. The EIA was obtained on February 11, 2019.

25.9 Economic Analysis

Sierra Metals make the following interpretations and conclusions based on the economic analysis:

The PEA considered four different production rates for the Yauricocha Mine:

1. 3,780 tpd (base case);
2. 5,500 tpd (in 2024);
3. 6,500 tpd (in 2024); and
4. 7,500 tpd (in 2024).

Of all the production rate options evaluated, the 7,500 tpd production rate has the highest after tax NPV. A review of the incremental IRR indicates that the highest return on investment occurs when the production increase is made from 3,780 tpd to 5,500 tpd. The 5,500 tpd alternative also has the highest profitability index (0.85).

Sierra observes that there are some mineralized material and waste haulage issues due to mineralized zone geometry and distribution. As such, Sierra has decided that the 5,500 tpd production rate option is the recommended case for a future pre-feasibility study. Increased production rates beyond 5,500 tpd may be possible once Yauricocha has resolved the mineralized material and waste haulage issues.

The 5,500 tpd (2024) proposed mine plan has a capital requirement (initial and sustaining) of US$ 235 M over the 12-year LOM; efficiencies associated with higher throughputs are expected drive a reduction in operating costs on a per tonne basis. This PEA indicates an after-tax NPV (8%) at 5,500 tpd (in 2024) of US$ 359 M. Total operating cost for the LOM is US$ 915 M, equating to a total operating cost of US$ 45.25 per tonne milled and US$ 1.19 per pound copper equivalent. Economic estimates are based upon forward-looking information. This forward-looking information includes forecasts with material uncertainty which could cause actual results to differ materially from those presented herein.

A sensitivity analysis was performed for each mining plan to analyze the impact of the change on the main drivers: metal grades, operating and capital costs, and gross income. The analysis shows that the NPV is most sensitive to changes in gross income and operating costs, moderately sensitive to changes in capex and the grade of copper, and least sensitive to changes in the grades of silver, gold, lead and zinc.

The proposed mine plan is conceptual in nature and would benefit from further, more definitive, investigation.

25.10 Foreseeable Impacts of Risks

Environment, Social and Permitting

Future expansions or modifications could be delayed due to permitting regulations and the requirement for evaluating environmental and social impact assessments with respect to environmental protection and management regulation for operating, profit, general labor and mining storage activities (Supreme Decree N° 040-2014-EM, 11/12/2014).

Other

SRK is unaware of any other significant factors and risks that may affect access, title, or the right or ability to perform the work recommended for the Project.

26 Recommendations

26.1 Recommended Work Programs

SRK notes that the Yauricocha Mine is currently in operation and has an extensive past production record. Thus, the recommendations that follow are aimed at improving operational performance and grade per tonne reconciliation.

26.1.1 Geology and Mineral Resource Estimation

SRK has the following recommendations for the geology and Mineral Resources at Yauricocha:

- Construct and compile a single reliable secure drilling and sampling database for the entire mine area, which can be easily verified, audited, and shared internally. This can be accomplished through commercially available SQL database management tools.
- Exploration should continue in the Esperanza area, which is locally open along strike and at depth.
- Long-term exploration should be focused on areas such as the possible intersection of the Yauricocha fault and the Cachi-Cachi structural trend, where recent geophysical data are currently being generated to assist in targeting.
- Given the use of channel samples in the Mineral Resource estimations, SRK recommends ensuring that the channel samples are collected on a representative basis, and that they are collected across the entire exposed thickness of a mineralized zone. In addition, they should be weighed for each sample to ensure that appropriate quantities of material are sampled from both the harder, more difficult material and the higher-grade, softer material.
- SRK strongly recommends reviewing the performance of the QA/QC program as soon as batches of results are returned. If any failures occur, investigation and re-analysis of these samples and +/- five adjacent samples on either side of the respective failure should be completed as soon as possible to prevent any sample preparation or laboratory issues.
- No umpire laboratory checks of the Chumpe laboratory were completed in the period November 2019 to June 2020. SRK recommends that umpire duplicates be implemented on a regular basis for both coarse and pulp reject material.
- SRK recommends that density measurements of drillhole core be implemented as a regular practice to improve density relationships in mineralized and non-mineralized rock.
- Minera Corona should produce detailed internal documentation summarizing the procedures and methods similar to those described in this report.
  - Of note, SRK strongly recommends developing internal standards and procedures for estimation and reporting of Mineral Resources. Although this is somewhat new for the mine personnel, SRK is of the opinion that sufficient talent and technology support exists to continue to develop this expertise.

- Exploration should be supported by a reasonably detailed litho-stratigraphic and structural model for the area to aid in exploration targeting. At present, this model does not exist and should be generated by mine and exploration personnel to produce fit for purpose models.
- SRK recommends that a standardized workflow is applied to the geological modelling to prevent significant changes in mineralized shape forms with minor additions of drillhole information. The integration of structure, stratigraphy and mineralized zone into a global model is essential in developing a comprehensive exploration and mining model. This will prevent inconsistencies and overlap between mineralized zones modelled.
- Classification of certain areas should be reviewed to determine if opportunities exist to refine the scripted classification scheme, or that based on estimation pass (in the case of Minera Corona models) to a hybrid approach taking into account the confidence in the estimation and the reasonableness of the classification distribution.
- Modelling variogram anisotropy for each of the mineralized domains can be improved by considering relevant transformation e.g. gaussian or log transforms of the composites before producing the experimental variograms. Ideally, modelled variograms should be back-transformed before the estimation. Certain commercially available software can complete this process seamlessly.
- Local and global grade anisotropy occur within the larger mineralized bodies. The sensitivity of utilizing a local anisotropy in highly informed data areas, whereas utilizing a global trend in poorly informed areas should be investigated.
- The models estimated internally by the mine should endeavor to regularize certain estimation parameters (such as sample selection criteria) so that these do not vary significantly between metals.
- SRK recommends that Minera Corona implement short term grade control models to track and reconcile with production.

26.1.2 Mining

SRK has the following recommendations for the mining at Yauricocha:

- The Yauricocha shaft project should be monitored closely in order to ensure timely access to mineralized zones below 1070 level.
- A consolidated 3D LOM design should be completed to improve communication of the LOM plan, infill drilling requirements, and general mine planning and execution.
- Further technical-economic evaluations of the production rate expansion options should be undertaken via prefeasibility and feasibility studies.

26.1.3 Geotechnical and Hydrogeological

SRK's geotechnical and hydrogeological recommendations are as follows:

- continue collecting geotechnical characterization data from mined drifts and exploration drillholes;
- maintain a central geotechnical database;
- develop and maintain geotechnical models, including structures and rock mass wireframes;
- conduct a program of stress measurement in the deeper planned mining areas;
- conduct numerical stress analyses of mining-induced stress effects on planned mining;
- continue a short-term to long-term dewatering programs with drainage systems;
- examine the current mine sequence and simulate the optimal mine sequence to reduce safety risks and the risk of sterilizing mineralized material due to unexpected ground problems; and
- revisit the current ground control management plans to check that they are appropriate for the deeper mining areas.
- continue to actively dewater ahead of production mining and monitor for conditions that could lead to mud rushes.

26.1.4 Infrastructure

Ongoing monitoring of the stability of the TSF embankment and operations practices is recommended to conform to industry best practices.

26.1.5 Recovery Methods

SRK recommends that Yauricocha improve its control of plant operations by installing more instrumentation and an automation control system. Doing so would lead to more consistent plant operation, reduced electrical energy and reagent consumption, and ultimately initiate a continuous improvement of the plant's unit operations and overall performance.

26.1.6 Environmental Studies and Permitting

Social and environmental activities are currently of high importance in Peru; therefore, SRK recommends that the company's commitments and agreements be fulfilled in detail and in a timely manner. Reputation and legal risks can arise due to this issue.

26.2 Recommended Work Program Costs

Table 26-1 lists the estimated costs for the recommended work described in Section 26, and that is not considered to be covered by ongoing operating expenditures.

Table 26-1: Summary of Costs for Recommended Work

Category	Work	Units	Cost US$
Geology and Resources	Infill Drilling (1)	25,000 m	2,500,000
	Exploration Drilling - Yauricocha Expansion (1)	25,000 m	2,500,000
	Structural and litho-stratigraphic model	1	100,000
	Training	1	10,000
	QA/QC and Re-analysis	500	12,500
Geotechnical	Annual data and analysis review and data collection	N/A	100,000
	Stress measurements	1	30,000
Production Rate Increases	Pre-feasibility study	1	500,000
Total			**5,752,500**

Source: SRK, 2020
(2) Drilling costs assume US$100/m drilling costs.

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28 Glossary

The Mineral Resources have been classified according to CIM (CIM, 2014). Accordingly, the Resources have been classified as Measured, Indicated or Inferred, as defined below.

A Mineral Reserve was not estimated for this PEA report.

28.1 Mineral Resources

A **Mineral Resource** is a concentration or occurrence of solid material of economic interest in or on the Earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling.

An **Inferred Mineral Resource** is that part of a Mineral Resource for which quantity and grade or quality are estimated on the basis of limited geological evidence and sampling. Geological evidence is sufficient to imply but not verify geological and grade or quality continuity. An Inferred Mineral Resource has a lower level of confidence than that applying to an Indicated Mineral Resource and must not be converted to a Mineral Reserve. It is reasonably expected that the majority of Inferred Mineral Resources could be upgraded to Indicated Mineral Resources with continued exploration.

An **Indicated Mineral Resource** is that part of a Mineral Resource for which quantity, grade or quality, densities, shape and physical characteristics are estimated with sufficient confidence to allow the application of Modifying Factors in sufficient detail to support mine planning and evaluation of the economic viability of the deposit. Geological evidence is derived from adequately detailed and reliable exploration, sampling and testing and is sufficient to assume geological and grade or quality continuity between points of observation. An Indicated Mineral Resource has a lower level of confidence than that applying to a Measured Mineral Resource and may only be converted to a Probable Mineral Reserve.

A **Measured Mineral Resource** is that part of a Mineral Resource for which quantity, grade or quality, densities, shape, and physical characteristics are estimated with confidence sufficient to allow the application of Modifying Factors to support detailed mine planning and final evaluation of the economic viability of the deposit. Geological evidence is derived from detailed and reliable exploration, sampling and testing and is sufficient to confirm geological and grade or quality continuity between points of observation. A Measured Mineral Resource has a higher level of confidence than that applying to either an Indicated Mineral Resource or an Inferred Mineral Resource. It may be converted to a Proven Mineral Reserve or to a Probable Mineral Reserve.

28.2 Mineral Reserves

A **Mineral Reserve** is the economically mineable part of a Measured and/or Indicated Mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined or extracted and is defined by studies at Pre-Feasibility or Feasibility level as appropriate that include application of Modifying Factors. Such studies demonstrate that, at the time of reporting, extraction could reasonably be justified.

A **Mineral Reserve** was not estimated for this PEA report.

28.3 Definition of Terms

Table 28-1 shows the definitions for many of the mining terms used in this report.

Table 28-1: Definition of Terms

Term	Definition
Assay	The chemical analysis of mineral samples to determine the metal content.
Capital Expenditure	All other expenditures not classified as operating costs.
Composite	Combining more than one sample result to give an average result over a larger distance.
Concentrate	A metal-rich product resulting from a mineral enrichment process such as gravity concentration or flotation, in which most of the desired mineral has been separated from the waste material in the ore.
Crushing	Initial process of reducing ore particle size to render it more amenable for further processing.
Cut-off Grade (CoG)	The grade of mineralized rock, which determines as to whether or not it is economic to recover its gold content by further concentration.
Dilution	Waste, which is unavoidably mined with ore.
Dip	Angle of inclination of a geological feature/rock from the horizontal.
Fault	The surface of a fracture along which movement has occurred.
Footwall	The underlying side of an orebody or stope.
Gangue	Non-valuable components of the ore.
Grade	The measure of concentration of gold within mineralized rock.
Hangingwall	The overlying side of an orebody or slope.
Haulage	A horizontal underground excavation which is used to transport mined ore.
Hydrocyclone	A process whereby material is graded according to size by exploiting centrifugal forces of particulate materials.
Igneous	Primary crystalline rock formed by the solidification of magma.
Kriging	An interpolation method of assigning values from samples to blocks that minimizes the estimation error.
Level	Horizontal tunnel the primary purpose is the transportation of personnel and materials.
Lithological	Geological description pertaining to different rock types.
LOM Plans	Life-of-Mine plans.
LRP	Long Range Plan.
Material Properties	Mine properties.
Milling	A general term used to describe the process in which the ore is crushed and ground and subjected to physical or chemical treatment to extract the valuable metals to a concentrate or finished product.

Term	Definition
Mineral/Mining Lease	A lease area for which mineral rights are held.
Mineral Reserve	A Mineral Reserve is the economically mineable part of a measured and/or Indicated Mineral Resource. It includes diluting materials and allowances for losses, which may occur when the material is mined or extracted and is defined by studies at pre-feasibility or feasibility level as appropriate that include application of Modifying Factors. Such studies demonstrate that, at the time of reporting, extraction could reasonably be justified.
Mineral Resource	A Mineral Resource is a concentration or occurrence of solid material of economic interest in or on the earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction.
Mineralized Material	A concentration or occurrence of solid material of economic interest in or on the earth's crust in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction. If the material includes Inferred resources, it is too speculative to be considered as ore.
Mining Assets	The Material Properties and Significant Exploration Properties.
Ongoing Capital	Capital estimates of a routine nature, which is necessary for sustaining operations.
Ore	Ore is mineralized material that is part of a Mineral Reserve and includes material that is in either the Proven and/or Probable classification of a Mineral Reserve. Ore cannot include Inferred resources.
Ore Reserve	See Mineral Reserve.
Pillar	Rock left behind to help support the excavations in an underground mine.
ROM	Run-of-Mine.
Sedimentary	Pertaining to rocks formed by the accumulation of sediments, formed by the erosion of other rocks.
Shaft	An opening cut downwards from the surface for transporting personnel, equipment, supplies, ore and waste.
Sill	A thin, tabular, horizontal to sub-horizontal body of igneous rock formed by the injection of magma into planar zones of weakness.
Smelting	A high temperature pyrometallurgical operation conducted in a furnace, in which the valuable metal is collected to a molten matte or doré phase and separated from the gangue components that accumulate in a less dense molten slag phase.
Stope	Underground void created by mining.
Stratigraphy	The study of stratified rocks in terms of time and space.
Strike	Direction of line formed by the intersection of strata surfaces with the horizontal plane, always perpendicular to the dip direction.
Sulfide	A sulfur bearing mineral.
Tailings	Finely ground waste rock from which valuable minerals or metals have been extracted.
Thickening	The process of concentrating solid particles in suspension.
Total Expenditure	All expenditures including those of an operating and capital nature.
Variogram	A statistical representation of the characteristics (usually grade).

28.4 Abbreviations

The following abbreviations may be used in this report.

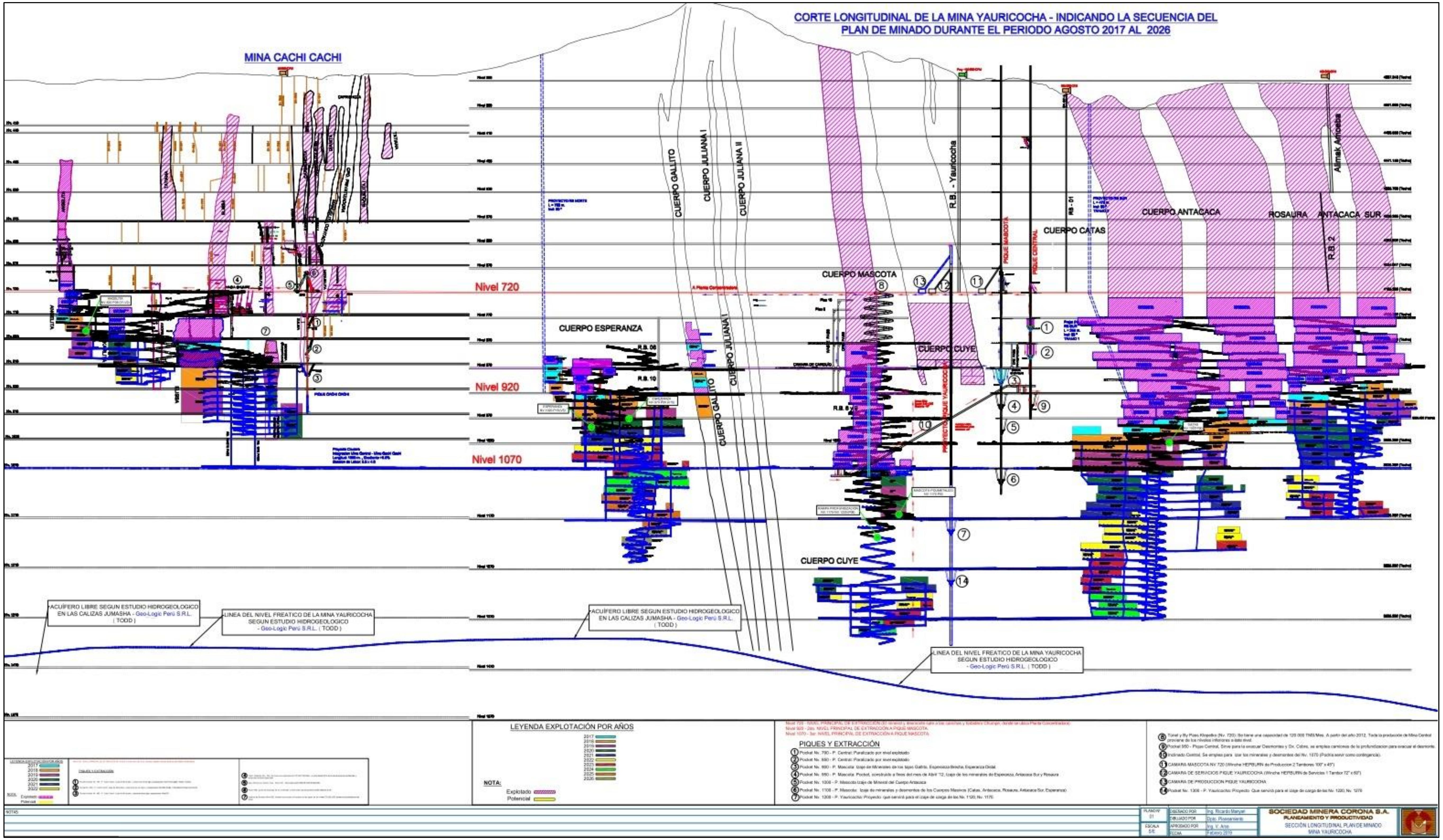
Table 28-2: Abbreviations

Abbreviation	Unit or Term
AA	atomic absorption
Ag	silver
Au	gold
AuEq	gold equivalent grade
bhp	brake horsepower
°C	degrees Centigrade
CoG	cut-off grade
cm	centimeter
cm^2	square centimeter
cm^3	cubic centimeter
cfm	cubic feet per minute
°	degree (degrees)
dia	diameter
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
g	gram
gal	gallon
g/L	gram per liter
g-mol	gram-mole
gpm	gallons per minute
g/t	grams per tonne
ha	hectares
HDPE	Height Density Polyethylene
hp	horsepower
ICP	Inductively coupled plasma
ID2	inverse-distance squared
ID3	inverse-distance cubed
kg	kilograms
km	kilometer
km^2	square kilometer
koz	thousand troy ounce
kt	thousand tonnes
kt/d	thousand tonnes per day
kt/y	thousand tonnes per year
kV	kilovolt
kW	kilowatt
kWh	kilowatt-hour
kWh/t	kilowatt-hour per metric tonne
L	liter

Abbreviation	Unit or Term
L/sec	liters per second
L/sec/m	liters per second per meter
lb	pound
m	meter
m^2	square meter
m^3	cubic meter
masl	meters above sea level
mg/L	milligrams/liter
mm	millimeter
mm^2	square millimeter
mm^3	cubic millimeter
Moz	million troy ounces
Mt	million tonnes
MW	million watts
m.y.	million years
NI 43-101	Canadian National Instrument 43-101
OSC	Ontario Securities Commission
oz	troy ounce
%	percent
ppb	parts per billion
ppm	parts per million
QA/QC	Quality Assurance/Quality Control
RC	rotary circulation drilling
RoM	Run of mine
RQD	Rock Quality Designation
S/	Sol (Peruvian currency)
SEC	U.S. Securities & Exchange Commission
sec	second
t	tonne (metric ton) (2,204.6 pounds)
t/h	tonnes per hour
tpd	tonnes per day
t/y	tonnes per year
TSF	tailings storage facility
µm	micron or microns
V	volts
W	watt
XRD	x-ray diffraction
y	year

Appendix A – Certificates of Qualified Persons

Appendix B – Longitudinal Section Showing Yauricocha Life of Mine Plan



Source: Sierra Metals, 2020