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2022 Mineral Resources and Mineral Reserves of the Caraíba Operations, Curaçá Valley, Bahia, Brazil

Report Prepared For:

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The effective date of this report is September 30, 2022. The issue date of this report is December 22, 2022. See Appendix A to this Report for certificates of Qualified Persons, as such term is defined under National Instrument 43-101, Standards of Disclosure for Mineral Projects.

UPDATED MINERAL RESOURCES AND MINERAL RESERVES STATEMENTS
FORM 43-101F1 TECHNICAL REPORT

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1 EXECUTIVE SUMMARY

Ero Copper Corp. ("Ero Copper", "Ero" or the "Company") is a Vancouver-based publicly listed copper mining company that trades on the Toronto and New York Stock Exchanges under the ticker "ERO" and exists under the British Columbia *Business Corporations Act*. Ero Copper's principal asset is a 99.6% interest in Mineração Caraíba S.A. ("MCSA", or herein referred to as "Ero Brasil"), a Brazilian mining company operating in the Curaçá Valley, northeastern Bahia State, Brazil. The regional Ero Brasil operations in Bahia include fully integrated processing operations and, currently, three active producing mining locations within the Curaçá Valley. The active operations include the Caraíba Complex (comprised of the underground Pilar Mine ("Pilar UG Mine"), the underground Vermelhos Mine ("Vermelhos UG Mine"), the Surubim Mine and the integrated Caraíba Mill (which includes an inactive solvent extraction electrowinning plant ("SX/EW Plant")). The past producing operations include the open pit mines of R22 ("R22 Mine") as well as the historic mines of Angicos ("Angicos Mine") and Suçuarana ("Suçuarana Mine"). Collectively the active and past-producing mines comprise the "Caraíba Operations". Additionally, future operations are forecast to occur later in the production plan within the northern part of the Curaçá Valley including: the adjacent Vermelhos West (N8) and Vermelhos East (N9) open pits (collectively the "N8/N9 OP Mine"), the Siriema open pit mine ("Siriema OP Mine"), collectively with the active Vermelhos UG Mine comprise the mineral reserves within the "Vermelhos District". In the central part of the Curaçá Valley, future operations include: the expansion of the adjacent Surubim and C-12 underground mine (the "C-12 UG Mine") and the C-12 open pit ("C-12 OP Mine"), collectively the Surubim Mine, which re-started operations during 2022, comprise the stated mineral reserves of the "Surubim District". In the southern part of the Curaçá Valley, the past producing Suçuarana open pit ("Suçuarana OP Mine") and the R22W open pit ("R22W OP Mine"), collectively with the active Pilar UG Mine comprise the stated mineral reserves of the "Pilar District". The Pilar District is located approximately 385 kilometers ("km") north-northwest of Salvador and 90 km southeast of Petrolina, in the State of Bahia, Brazil. The center of the Surubim District is located approximately 33km north of the Pilar UG Mine and Caraíba Mill (jointly referred to as the "Caraíba Mine") at the Surubim Mine, while the center of the Vermelhos District and the Vermelhos UG Mine is located another 31km north-northwest of the Surubim Mine. In aggregate, mining and development activities occur over approximately 100km in strike length across the Curaçá Valley.

The Caraíba Operations have an extensive operating history in the region. Open pit and processing operations started in 1979, while underground mining operations commenced in 1986. Ero Brasil owns a 100% interest in the Caraíba Operations including the abovementioned mines, integrated processing facilities and all supporting infrastructure. The Pilar UG Mine currently produces a nominal 4,000 to 6,000 tonnes per day ("t/d"), or approximately 1.0 to 1.5 Mtpa from underground operations that, combined with the nominal 3,000 to 5,000 t/d, or approximately 1.5 Mtpa currently mined from satellite mining operations within the Caraíba Operations, including the Vermelhos UG Mine and the Surubim Mine, serves as feed for the Caraíba Mill. The Caraíba Mill is currently producing high quality, low impurity copper concentrate grading approximately 33%-35% copper. The concentrate typically contains minor amounts of precious metals. Historical average grades of precious metals in concentrate are approximately 2 grams per tonne ("g/t" or "gpt") gold and 43 g/t silver in concentrate.

The Company's 2022 life of mine ("LOM") planning process considers recently completed and ongoing investments in mining and milling infrastructure under the Company's "Pilar 3.0" initiative, which includes the integration of newly defined mineral resources and reserves in the upper levels of the Pilar UG Mine (efforts were focused on an area known as "Project Honeypot") the ongoing construction of a new external shaft to access mineralization below level -965 in the Pilar UG Mine (known as the "Deepening Project" or from a geological perspective, the "Deepening Extension Zone"), and the ongoing expansion of the Caraíba Mill to increase processing capacity to approximately 4.2 million tonnes per annum ("Mpta"). As a result of the integration of Project Honeypot and the nature of the mineralization remaining in the upper levels of the Pilar Mine, and more broadly within the Company's underground operations, effective extraction of the mineral reserves necessitated the consideration of inferred mineral resources in the Company's long-term strategic planning efforts, particularly in the design of stopes that include measured, indicated and some inferred mineral resources - a process that has been utilized at the Pilar UG Mine since underground operations commenced in 1986. Inferred mineral resources are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. Mineral resources which are not mineral reserves do not have demonstrated economic viability. The Company has commenced a program to continue infill drilling of the Inferred resource to further upgrade this material; however, until this work is completed, and the Inferred resources have been upgraded to reserves, there is no certainty this material will be converted into mineral reserves.

The purpose of this report ("Report" or "Technical Report") is to set out and to provide background and supporting information on the mineral resources and mineral reserves for the Caraíba Operations. The Report was prepared by GE21 Consultoria Mineral Ltda. ("GE21"), BNA Mining Solutions ("BNA") and NCL Ingeniería y Construcción SpA ("NCL") on behalf of Ero Copper. This Report and estimates herein have been prepared following the guidelines of the Canadian Securities Administrators' National Instrument 43-101 – *Standards of Disclosure for Mineral Projects* ("NI 43-101") and Form 43-101F1 – Technical Report ("Form 43-101F1").

The effective date of this Report is September 30, 2022 (the "Effective Date"). The issue date of this Report is December 22, 2022.

1.1 PROPERTY DESCRIPTION AND OWNERSHIP

The Caraíba Operations are located in northeastern Bahia State, Brazil, about 385 km north-northwest of the capital city of Salvador. The center of the Caraíba Operations is located at 9º 52' South, 39º 52' West. As of the Effective Date, Ero Brasil holds, has applications in process, or has negotiated agreements with third-parties for a north-trending set of 138 mineral exploration rights, six mining concessions and seven additional mining concessions are under application. The property, including mining and permits under application covers a total area of 185,865.0 hectares ("ha"). The exploration rights held or with applications in process cover an area of 171,045.2 ha and consist of areas up for renewal as well as negotiated with third-parties under normal course of business. Ero Brasil holds 100% legal and beneficial ownership of exploration rights for a period varying up to three years with three-year extensions provided annual reporting requirements are performed on the property. Within the exploration rights, Ero Brasil's interests include the right to access the property, to engage in exploration, development, processing, and construction activities in support of mineral exploration and development. Where applicable, compensation is provided to the holder of surface rights for occupation or loss caused by the work.

Mining and development activities are contained within seven mining concessions covering 3,299.6 ha. In addition, Ero Brasil has seven applications for mining covering 10,521.4 ha. Within the mining concessions, Ero Brasil holds 100% legal and beneficial ownership. There are no time constraints provisioned with the mining concessions; however, operating permits and licenses are extended and renewed in normal course of business according to the nature of each permit and requirements therein.

Infrastructure maps of the Caraíba Operation and the broader Curaçá Valley are shown in Appendix D to the Report.

1.2 GEOLOGY AND MINERALIZATION

The Curaçá Valley's mafic-ultramafic complex is located within the Curaçá high-grade metamorphic gneissic terrain - part of the Salvador-Curaçá orogen, a northern extension of the Atlantic Coast Granulite Belt in the São Francisco Craton. The mining and development projects located within the Caraíba Operations lie within a Trans-Amazonian age belt bordered on the west by volcano-sedimentary rocks of the Jacobina Group and on the east by the Itiúba intrusive syenite rocks.

Known copper deposits are hosted within the Rio Curaçá and Tanque Novo sequences, differentiated by metamorphic facies. The two sequences are located across the base of the Caraíba Operations and include the mafic-ultramafic rocks as well as granite, granodiorite and syenite. Pyroxenite has been described within the mafic-ultramafic lenses at the Caraíba Mine, R22W Mine, Angicos Mine, Suçuarana Mine, Surubim Mine and the Vermelhos UG Mine.

The Cu-rich deposits are hosted by irregular-shaped intrusive bodies of pyroxenite (hypersthenite) and minor gabbro-norite that have been intruded into granulite facies gneiss and migmatite at the northern margin of the São Francisco Craton. The intrusions have been interpreted as either deformed sill-like bodies or irregular shaped intrusions into an anastomosing ductile shear zone. Mineralized textures include interstitial, net-textured, stringer and sulphide-rich matrix breccias. There is additional evidence throughout the Curaçá Valley of sulphide zonation, characterized as pyrrhotite +/- pentlandite zoning to pyrrhotite +/- pentlandite plus chalcopyrite and finally to chalcopyrite plus bornite. High-grade mineralization is often closely associated with phlogopite enrichment. Additional work is underway to evaluate recent observed occurrences of nickel, including the recently discovered Ni-rich Umburana System, as well as platinum group elements which have been documented throughout the Curaçá Valley.

In late 2022, subsequent to the Effective Date, Ero Copper announced the first documented nickel sulphide discovery in the Curaçá Valley as part of its ongoing regional exploration program. The nickel system, known as the "Umburana System", is located approximately 20 kilometers from the Caraíba Mill. The system was discovered using detailed field mapping and soil geochemistry collected during the Company's 2021 and 2022 exploration programs in conjunction with the Company's airborne electromagnetic ("AEM") survey. The ongoing program identified large intervals of disseminated and interstitial nickel sulphides as well as zones of high-grade semi-massive (containing approximately 30% to 60% sulphides) and massive sulphides (containing approximately 60% to 80% sulphides), with massive sulphide intercepts up to 1.5 meters in thickness grading up to 6.59% nickel. Nickel mineralization has been identified as outcropping at surface, as evident in trenches and remains open down-plunge. As at the date of this Report, maximum depth of drilling within the Umburana System was approximately 300 meters below surface.

1.3 EXPLORATION STATUS

Following the commencement of open pit mining operations in 1979, limited exploration work was performed regionally outside of the main Caraíba Mine area prior to Ero Copper's acquisition of MCSA in 2016. Where it did occur, such exploration work focused primarily on exploration permit renewal requirements. The Caraíba Operations were privatized in 1994 and further exploration work was limited until the formation of the Codelco Joint Venture in 2004 (the "Codelco JV") which existed until 2008. Under the Codelco JV, work was conducted on several prospects outside of the Caraíba Mine area including an airborne Versatile Time Domain Electromagnetic ("VTEM") survey over the Vermelhos District. Ground Moving-loop Electromagnetic and Bore-hole Electromagnetic test surveys were also conducted.

Near-surface copper mineralization in the Curaçá Valley has historically been well-defined by geochemical sampling methods. Mineralized mafic-ultramafic intrusions show anomalous copper, nickel, cobalt, gold and silver. Several soil geochemical surveys have been conducted regionally throughout the Curaçá Valley. Geochemistry leveling efforts undertaken by Ero Copper in 2018 to normalize multiple surveys into a central database have been successful and the dataset, supplemented with ongoing soil geochemistry campaigns, continues to be used to define areas of exploration potential.

Historic regional exploration activities also included geophysical surveys performed locally on specific targets. These include ground magnetic, gravity and induced polarization ("IP") surveys. Regional airborne geophysical surveys consist of a historic magnetic and radiometric survey flown by the Brazil National Department of Mineral Production ("DNPM" which was replaced in 2018 by the new federal mining agency of Brazil, the Agência Nacional de Mineração ("ANM")). Based on known deposits, mineralized mafic-ultramafic intrusions respond well to gravity, IP and electromagnetic ("EM") surveys including the use of bore-hole EM ("BHEM").

Since the acquisition of Mineração Caraíba in late 2016, Ero Copper has worked extensively with the broader exploration team of Ero Brasil to compile, organize, validate, analyze and interpret the various historical data sets. A list of prioritized exploration targets using district-wide dataset compilation and validation for Ero Brasil's exploration permits throughout the Curaçá Valley continues to be worked systematically. Priority targets occur in three main areas or "Districts": the southern Pilar District, the northern Vermelhos District and the central Surubim District.

In 2018, Ero Copper advanced its exploration efforts and completed approximately 158,000 meters ("m") of drilling with the objective of upgrading and increasing mineral resources and reserves as well as commenced testing new regional targets in the Curaçá Valley. Simultaneously, Ero Copper continued development and production from the Pilar UG Mine, Surubim Mine (which re-started operations in 2022) and commenced production from the Vermelhos UG Mine. In support of its regional exploration efforts, Ero Copper commissioned and completed a ~24,000 line-km airborne electromagnetic and gravity geophysical survey focused on high-grade discoveries throughout the Curaçá Valley. From 2019 through 2022 Ero Copper has continued to increase drilling activities, completing over 200,000m of drilling each year. Drilling remains focused on upgrading and increasing mineral resources and reserves as well as testing of new regional copper and nickel sulphide targets throughout the Curaçá Valley. In support of the current mineral resource and mineral reserve estimate, a total of 1,413,124 m of diamond core drilling was incorporated into the geological model.

1.4 DEVELOPMENT AND OPERATIONS

Mining operations within the Curaçá Valley are currently comprised of two core operations: the Pilar UG Mine and the Vermelhos UG Mine. Production from these two mines currently serves as primary feed for the Caraíba Mill with supplemental feed from the Surubim Mine. Ongoing development and exploration activities include: the continued advancement of the primary ramp and associated infrastructure of the Pilar and Vermelhos underground mines, the construction of the new external shaft to support the Deepening Project, as well as the completion of the Caraíba Mill expansion to 4.2Mtpa, expected to be completed by the end of 2023, in support of the LOM production plan.

1.5 DATA VERIFICATION AND QA/QC

GE21 has visited the Caraíba Operations on a regular basis since 2017 to assess Ero Brasil's exploration data, including overall procedures for drilling, logging, sample handling, control, storage, quality-assurance quality-control ("QA/QC"), database preparation and density measures.

Sample Preparation, Analyses and Security

The Caraíba Operation's sampling procedures are well-defined, in line with the industry best practices. Physical preparation and chemical analysis of core samples are performed by the Caraíba Operation's on-site laboratory, following well-defined procedures. GE21 evaluated the sample collection, analysis and security methods, as well as the procedures used by the Caraíba Operation's internal laboratory.

Quality Assurance and Quality Control

Standard QA/QC procedures implemented by the Caraíba Operations were found to be complete and aligned with industry best practices. A selection of historic information (collected before the current QA/QC procedures were implemented in 2007) as well as historic drilling associated with Project Honeypot was verified by the authors of this Report via a post-mortem validation process. Data from historic drill holes that could not be validated were omitted from the mineral resource estimate.

The QA/QC process implemented includes the analysis of blanks, standards, pulverized duplicates, coarse tailings duplicates, field duplicates and a second third-party laboratory check-assay. Check-assay analysis of copper grades by a second third-party laboratory was implemented as part of the Caraíba Operations' QA/QC program in 2020. As part of the validation process, GE21 verified 377 holes totaling 96,417m of drilling. Density information has been obtained for over 40 years, and measurement processes are aligned with standard industry practice. Based upon the validation process, GE21 concluded that Caraíba's exploration data is adequate for the current mineral resource and mineral reserve estimate.

1.6 MINERAL RESOURCE AND MINERAL RESERVE ESTIMATES

Mineral resource and mineral reserve estimates for the Caraíba Operations were classified and prepared in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum ("CIM") Definition Standards for Mineral Resources and Mineral Reserves, adopted by the CIM Council on May 10, 2014, as amended (the "CIM Standards"), and the CIM Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines, adopted by CIM Council on November 29, 2019, as amended (the "CIM Guidelines") by Sr. Porfirio Cabaleiro Rodriguez, FAIG, with contributions from others at GE21. All are independent Qualified Persons as such term is defined under NI 43-101.

The authors of this Report validated the current mineral resource estimate that was prepared by Ero Brasil under the supervision of GE21, by preparing a separate 3D model using Leapfrog Geo software, to define and interpolate geological domains. The variograms prepared by Ero Brasil under the supervision of GE21 were reproduced and applied through an independent grade estimate, using Leapfrog Edge software. Resource classification was determined based upon the number of "passes" and results were used to compare the tonnage, grade and contained copper content within each geological domain. Differences of less than 5% of the contained copper content was considered acceptable within each domain. The validation performed did not indicate any material differences between the two estimates.

Mineral reserves were classified according to the CIM Standards and the CIM Guidelines by Dr. Beck Nader, FAIG, of BNA, and Alejandro Sepúlveda from NCL SpA. Both of whom are independent Qualified Persons as such term is defined under NI 43-101.

1.6.1 Mineral Resources

Cut-off grades of 0.51% copper as well as a marginal cut-off grade of 0.34% copper, were used for underground mineral resources and 0.16% copper for open pit mineral resources. Mineral resources were estimated using ordinary kriging within 5m by 5m by 5m block sizes. Mineral resources are shown inclusive of mineral reserves.

Following the application of reasonable prospect for eventual economic extraction ("RPEEE") criteria, Table 1-1 presents the 2022 updated mineral resources by expected mining method for the Caraíba Operations and, due to its importance to the Company's strategy, Table 1-2 further details the mineral resources for the Project Honeypot areas and Pilar UG Mine as at the Effective Date.

Table 1-1: Caraíba Operations Mineral Resource by Mine Type

Mining Method	Classification	Tonnage (000 tonnes)	Grade (Cu %)	Cu Contained (000 tonnes)
Underground Operations	Measured	34,224	1.44	493.2
	Indicated	35,389	1.48	524.8
	Measured & Indicated	**69,613**	**1.46**	**1,018.0**
	Inferred	35,888	1.15	411.4
Open Pit Operations	Measured	20,803	0.62	128.7
	Indicated	27,486	0.56	154.1
	Measured & Indicated	**48,289**	**0.59**	**282.8**
	Inferred	11,513	0.62	71.4
Total Underground and Open Pit	Measured	55,027	1.13	621.9
	Indicated	62,875	1.08	678.9
	Measured & Indicated	**117,901**	**1.10**	**1,300.8**
	Inferred	47,400	1.02	482.8

Mineral Resource Notes:

1. Mineral resource effective date of September 30, 2022.
2. Presented mineral resources inclusive of mineral reserves. All figures have been rounded to the relative accuracy of the estimates. Summed amounts may not add due to rounding.
3. Underground mineral resources have been constrained within newly developed 3D lithology models applying a 0.45% and 0.20% copper grade envelope for high and marginal grade, respectively. Within these envelopes, mineral resources for underground deposits were constrained using varying stope dimensions of up to 20m by 10m by 35m applying a 0.51% copper cut-off grade, as well as a 0.34% copper marginal cut-off grade. Mineral resources have been estimated using ordinary kriging inside 5m by 5m by 5m block sizes.
4. The Qualified Person for the Mineral Resource estimate is Sr. Porfírio Cabaleiro Rodriguez.
5. Open pit mineral resource estimates have been constrained within newly developed 3D lithology models using a 0.16% copper cut-off grade for open pit deposits. Mineral resources have been estimated using ordinary kriging inside 5m by 5m by 5m block sizes.
6. Mineral resource estimates were prepared in accordance with the CIM Standards, and the CIM Guidelines, using geostatistical and/or classical methods, plus economic and mining parameters appropriate to the deposit.

Mineral resources which are not mineral reserves do not have demonstrated economic viability.

Table 1-2: Pilar UG Mineral Resources

Pilar UG Mine	Classification	Tonnage (000 tonnes)	Grade (Cu %)	Cu Contained (000 tonnes)
Project Honeypot Areas	Measured	3,229	1.86	60.0
	Indicated	6,459	1.88	121.3
	Measured & Indicated	**9,687**	**1.87**	**181.3**
	Inferred	896	1.07	9.6
Total Pilar Mine, including Project Honeypot	Measured	29,806	1.38	412.4
	Indicated	23,947	1.73	413.3
	Measured & Indicated	**53,753**	**1.54**	**825.8**
	Inferred	16,993	1.42	241.3

Pilar UG Mine Mineral Resource Notes:

1. Mineral resource effective date of September 30, 2022.
2. Presented mineral resources inclusive of mineral reserves. All figures have been rounded to the relative accuracy of the estimates. Summed amounts may not add due to rounding.
3. Underground mineral resources have been constrained within newly developed 3D lithology models applying a 0.45% and 0.20% copper grade envelope for high and marginal grade, respectively. Within these envelopes, mineral resources for underground deposits were

constrained using varying stope dimensions of up to 20m by 10m by 35m applying a 0.51% copper cut-off grade, as well as a 0.34% copper marginal cut-off grade. Mineral resources have been estimated using ordinary kriging inside 5m by 5m by 5m block sizes.

4. The Qualified Person for the Mineral Resource estimate is Sr. Porfírio Cabaleiro Rodriguez.
5. Mineral resource estimates were prepared in accordance with the CIM Standards, and the CIM Guidelines, using geostatistical and/or classical methods, plus economic and mining parameters appropriate to the deposit.

Mineral resources which are not mineral reserves do not have demonstrated economic viability.

1.6.2 Mineral Reserves

The Mineral Reserves for the Caraíba Operations are derived from the Measured and Indicated mineral resources as defined within the resource block models following the application of economic and other modifying factors further described below. Inferred mineral resources, where unavoidably included within a defined mining shape have been included in the mineral reserve estimate at zero grade.

Table 1-3: Caraíba Operations Mineral Reserve Estimate

	Classification	Tonnage (000 tonnes)	Grade (Cu %)	Cu Contained (000 tonnes)
Reserves, Underground				
Pilar UG, Deepening Extension Zone (Pilar Mine below Level -965)	Proven	774	1.16	9.0
	Probable	10,201	1.76	179.1
Pilar UG, Ex-Deepening & Ex-Honeypot (Pilar Mine above Level -965)	Proven	11,722	1.18	138.3
	Probable	4,118	1.06	43.6
Pilar UG, Honeypot	Proven	2,595	1.66	43.1
	Probable	5,551	1.56	86.6
Vermelhos UG	Proven	2,245	1.57	35.3
	Probable	2,255	1.05	23.7
Total Proven		**17,336**	**1.30**	**225.6**
Total Probable		**22,125**	**1.51**	**333.1**
Total Proven & Probable, Underground		**39,461**	**1.42**	**558.7**
Reserves, Open Pit				
Vermelhos (N8, N9 & N5/Siriema)	Proven	9,794	0.50	49.0
	Probable	22,048	0.53	116.6
Surubim (Surubim & C12)	Proven	4,343	0.80	34.9
	Probable	1,432	0.63	9.0
Suçuarana	Proven	5,011	0.43	21.6
	Probable	678	0.42	2.9
Total Proven		**19,148**	**0.55**	**105.5**
Total Probable		**24,158**	**0.53**	**128.4**
Total Proven & Probable, Open Pit		**43,306**	**0.54**	**233.9**
Total Proven		**36,484**	**0.91**	**331.1**
Total Probable		**46,283**	**1.00**	**461.5**
Total Proven & Probable, Open Pit & Underground		**82,767**	**0.96**	**792.6**

Mineral Reserve Notes:

1. Mineral reserve effective date of September 30, 2022. All figures have been rounded to the relative accuracy of the estimates. Summed amounts may not add due to rounding.
2. Mineral reserve estimates were prepared in accordance with the CIM Standards, and the CIM Guidelines, using geostatistical and/or classical methods, plus economic and mining parameters appropriate for the deposit. Mineral reserves are based on a long-term copper price of US$3.30 per lb, and a USD:BRL foreign exchange rate of 5.29, except the underground portion of the Surubim Mine, which applied a copper price of US$2.75 per lb and a USD:BRL foreign exchange rate of 5.23. Mineral reserves are the economic portion of the Measured and Indicated mineral resources. Mining dilution and recovery factors vary for specific mineral reserve sources and are influenced by factors such as deposit type, deposit shape, stope orientation and selected mining method. Inferred resource blocks, where unavoidably mined, were assigned zero

grade. Dilution occurring from Measured & Indicated resource blocks was assigned grade based upon the mineral resource grade of the blocks included in the dilution envelope.
3. The Qualified Persons for the Mineral Reserve estimate are Dr. Beck Nader and Mr A. Sepúlveda.
4. Tonnages are rounded to the nearest 1,000 tonnes; copper grades are rounded to two decimal places. Tonnage and grade values are in metric units; contained copper is reported as thousands of tonnes. Rounding as required by reporting guidelines may result in summation differences.
5. The Surubim Mine mineral reserves are presented inclusive of open pit and underground estimates, as the underground portion comprises a single stope beneath the open pit.

A summary of the mineral reserve estimate parameters is provided below:

Table 1-4: Mineral Reserve Estimate Parameters

Mining Costs (US$/tonne ore mined)	
Pilar UG Mine	$29.68
Vermelhos UG Mine	$27.89
Surubim & C12 OP Mine	$2.09
Suçuarana OP Mine	$2.09
N8/N9 & Siriema (N5) OP Mines	$2.09
Transportation Costs (US$/tonne to mill)	
Pilar UG Mine	(none)
Vermelhos UG Mine	$10.05
Surubim & C12 OP Mine	$3.19
Suçuarana OP Mine	$1.95
N8/N9 & Siriema (N5) OP Mines	$6.47
Processing Costs (US$/tonne milled)	
Pilar & Vermelhos Mines	$9.31
Surubim & C12 OP Mine	$5.70
Suçuarana, N8/N9 & Siriema (N5) OP Mines	$5.70
Metallurgical Recovery (average)	
Pilar UG Mine	90.4%
Vermelhos UG Mine	90.9%
Surubim OP / C12 OP	85.9%
N8/N9 & Siriema (N5) OP Mines	87.5%
Suçuarana OP Mine	84.8%
LME Copper Price (US$/lb)	**$3.30**
Net Smelter Return	**97.66%**
Transport & Sales Costs (US$/tonne copper)	**$99.40**
CFEM Royalty (after tax)	**1.55%**
Foreign Exchange Rate (USD:BRL)	5.29

Reserve Parameters Note

1. All road-maintenance costs associated with the Curaçá Valley haul road have been allocated to the Vermelhos UG Mine. Calculated differences between open pit mining and processing costs are a result of additional incurred costs related to contract mining vs. employee operated and the allocation of mining and processing administrative / fixed costs between mines.
2. Metallurgical recoveries vary by deposit. G&A costs of US$5.45 per tonne were applied to the current operating underground mining operations of the Pilar and Vermelhos Mines.
3. USD:BRL foreign exchange rate of 5.29 applied to all mines, except the underground portion of the Surubim Mine, as the mine design did not change from 2021, and was based on a USD:BRL foreign exchange rate of 5.23. London metal exchange long-term copper price ("LME Copper Price") was based on US$3.30 per lb. for all mines, except the underground portion of the Surubim Mine, as the mine design did not change from 2021, and was based on US$2.75 per lb.
4. Compensação Financeira pela Exploração de Recursos Minerais ("CFEM") royalty rate was based on a blended net after-tax rate of 1.55% across all mines, except the Surubim Mine, as the mine design did not change from 2021, and is based on a rate of 2.00%.
5. Transport and sales costs of US$99.40 per tonne copper has been embedded within the Net Smelter Return value.

Other modifying factors considered in the determination of the mineral reserve estimate include:

- A Selective Mining Unit ("SMU") methodology for estimating dilution has been applied to N8 (7% dilution), N9 (13%), N5 OP (17%), Surubim Mine (17%), C12 OP (12%) and Suçuarana OP Mine (4%). The conventional definition of the SMU is the smallest volume of material on which ore/waste classification is determined and relates to the smallest unit that can be mined selectively. The Vermelhos UG Mine considers 10% dilution, based on mining method and stope geometry. Within the Pilar UG Mine, a 1.0m operational dilution method was applied to the hanging wall and footwall, except for the Deepening Project, which applied 0.5m of operational dilution, resulting in a planned plus operational dilution of 27%, on average. Project Honeypot and the Upper Levels of the Pilar UG Mine consider 32% dilution, on average.

- Maximum bench height of 15m for open pit mines. Maximum underground stope dimensions based on geotechnical assessments from previous studies and past operating experience within each mining area, combined with evaluation of induced stresses and the calculated rock mass rating ("RMR").

- Vertical retreat mining ("VRM") method with cemented paste fill was selected for the Pilar UG Mine, where the method is currently in use. For the Vermelhos UG Mine, Sublevel stoping with cemented rock fill ("CRF") is currently in use. These mining methods are based on consideration of dip, plunge and thickness of the orebodies, as well as the rock quality designation ("RQD") and overall competence of the host rock.

- Mining recovery of 98% (average) has been applied for open pit mines. The Pilar UG Mine and Vermelhos UG Mine assume 96% and 95% mine recovery, respectively.

- Within designed stopes, all contained material was assumed to be mined with no selectivity. Inferred mineral resources, where unavoidably included within a defined mining shape have been included in the mineral reserve estimate at zero grade. Mining dilution resulting from Measured and Indicated blocks was assigned the grade of those blocks captured in the dilution envelope using the estimated grade within the blocks of the dilution and development model.

Additionally, GE21 and BNA Mining Solutions presents the following accompanying comments to the mineral resource and mineral reserve estimate:

- Ero Brasil holds the surface rights required to support the mine operations considered in the Mineral Reserve estimate. Future development beyond the stated mineral reserves of these areas may require additional acquisition of surface rights.

- As of the date of this Report, Ero Brasil possesses the requisite permits to allow for current mining and processing operations from its core assets of the Pilar UG Mine, the Vermelhos UG Mine and the Surubim Mine is in the process of obtaining mining permits for future production areas commensurate with the envisioned production timelines of those areas as outlined in the LOM plan. Based upon the long operating history of Ero Brasil, the well-established timelines and procedures to obtain such permits, it is the opinion of the QPs that permitting of future production areas within the envisioned timelines does not pose a material risk for the development of the stated mineral reserves.

- Overall, GE21 considers that the components of the mineral reserve estimate (including but not limited to geology, mining, processing, infrastructure, logistics, market, environmental and social considerations) have been conducted at a feasibility level of study and in accordance with NI 43-101.

It is the opinion of the QPs that there are no known mining, metallurgical, infrastructure, permitting, legal, political, environmental, title, taxation, socio-economic, marketing or other relevant factors that could materially affect the potential development of the stated mineral reserves.

1.7 RECOVERY METHODS

The Caraíba Mill has been producing copper concentrate since commissioning in 1979 and has benefited from improvement projects over the years, including most recently those undertaken by Ero Copper. The mill has been designed to process ore from both the Pilar UG Mine, via a production shaft supported by two primary underground jaw crushers as well as ore from throughout the Curaçá Valley (including within the Vermelhos and Surubim Districts) via a primary gyratory crusher located on surface. The concentrator is operated 24 hours per day, 7 days per week with monthly scheduled downtime for routine maintenance. In its current configuration, the plant is capable of processing a nominal 3.2 million tonnes of copper ore per annum assuming 91% availability. Pursuant to the current LOM plan, the milling capacity of the Caraíba Mill will be increased to 4.2 million tonnes per annum ("Mtpa") through integration of the Company's high intensity grinding mill ("HIG Mill") that was successfully installed during the third quarter of 2020, upgrades to the secondary crusher system due to obsolescence, the installation of a third ball mill, the installation of a Jameson cell and an increase to concentrate filtration capacity. The Caraiba Mill expansion is currently under construction and is expected to be completed by the end of 2023. In support of the LOM production plan, the Company will integrate ore sorting technology into the future open pit operations of the Vermelhos District beginning in 2033.

Through the end of 2021, the Caraíba Mill has produced over 3.0 million tonnes of concentrate containing over 1.0 million tonnes of copper. The Caraíba Mill operating results from 2011 to 2021, and from January to September 30th of 2022 are provided below in Table 1-5 and Table 1-6, respectively.

Table 1-5: Caraíba Mill Processing Results, 2011 to 2021

	Caraíba Mill Feed		Copper Production	
Year	Tonnes	Grade (% Cu)	Tonnes	Recovery (%)
2011	2,749,812	1.09	25,096	83.7
2012	2,717,980	1.07	24,827	85.4
2013	2,940,566	0.91	22,494	84.3
2014	3,014,269	1.01	25,717	84.7
2015	2,836,528	1.11	27,046	86.0
2016	826,759	0.71	4,895	83.5
2017	1,771,209	1.31	20,133	86.8
2018	2,257,917	1.56	30,426	86.3
2019	2,424,592	1.93	42,318	90.5
2020	2,271,625	2.08	42,814	90.5
2021	2,370,571	2.08	45,511	92.4

Table 1-6: Caraíba Mill Processing Results, January to September 2022

	Caraíba Mill Feed		Copper Production	
Year	Tonnes	Grade (%Cu)	Tonnes	Recovery (%)
2022 (Jan-Sep)	2,118,380	1.73	33,707	91.8

The table below shows the production plan for the Caraíba Mill as outlined for the current mineral reserve estimate and LOM production plan. Production has been adjusted from mined totals, where appropriate, for forecast stockpiles and in-process inventories, as well as the integration of ore-sorting. Metallurgical recoveries, including the impacts of ore sorting on the open pit mines of the Vermelhos District are discussed in greater detail in Chapter 13 – Mineral Processing and Metallurgical Testing and Chapter 17 – Recovery Methods.

Table 1-7: 2022 Reserve LOM Plan, Mining Operations, Mineral Reserves

	Unit	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Underground Operations											
Tonnes Mined	kt	2,445	2,774	2,941	3,249	3,422	3,304	2,996	2,458	2,131	2,010
Grade Mined	% Cu	1.54	1.30	1.36	1.34	1.27	1.38	1.46	1.41	1.40	1.43
Open Pit Operations											
Tonnes Mined	kt	541	488	514	558	1,024	—	68	287	950	1,061
Grade Mined	% Cu	0.68	0.55	0.52	0.73	1.07	—	0.80	0.74	0.57	0.68
Total Mining Operations											
Tonnes Mined	kt	2,986	3,262	3,455	3,807	4,446	3,304	3,065	2,745	3,082	3,072
Grade Mined	% Cu	1.39	1.19	1.24	1.25	1.23	1.38	1.44	1.34	1.14	1.17
Contained Copper	kt	41.5	38.9	42.7	47.5	54.5	45.7	44.3	36.9	35.2	35.9

	Unit	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Underground Operations											
Tonnes Mined	kt	2,143	2,532	2,275	1,534	1,671	966	168	—	—	—
Grade Mined	% Cu	1.24	1.26	1.35	1.56	1.70	1.83	2.97	—	—	—
Open Pit Operations											
Tonnes Mined	kt	1,302	963	2,527	2,030	3,703	5,007	5,419	5,945	5,950	4,797
Grade Mined	% Cu	0.68	0.91	0.72	0.50	0.46	0.45	0.42	0.44	0.50	0.60
Total Mining Operations											
Tonnes Mined	kt	3,445	3,495	4,802	3,565	5,374	5,974	5,586	5,945	5,950	4,797
Grade Mined	% Cu	1.03	1.16	1.02	0.95	0.85	0.68	0.50	0.44	0.50	0.60
Contained Copper	kt	35.5	40.7	49.0	34.0	45.5	40.4	27.9	25.9	29.8	28.6

All figures have been rounded to reflect the accuracy of the estimates. Summed amounts may not add due to rounding. LOM plan totals are based on mineral reserves. Mineral resources that are not mineral reserves do not have a demonstrated economic viability.

Table 1-8: 2022 Strategic LOM Plan, Mining Operations, Inferred

	Unit	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Underground Operations											
Tonnes Mined	kt	507	560	634	516	523	665	877	1,430	1,518	1,347
Grade Mined	% Cu	1.70	1.79	1.34	1.39	1.46	1.03	1.15	1.16	1.44	1.32
Open Pit Operations											
Tonnes Mined	kt	68	135	20	41	12	—	9	11	96	117
Grade Mined	% Cu	0.49	0.68	0.48	0.35	1.81	—	0.61	0.55	0.61	0.63
Total Mining Operations											
Tonnes Mined	kt	575	696	653	557	536	665	886	1,441	1,614	1,465
Grade Mined	% Cu	1.55	1.57	1.32	1.31	1.47	1.03	1.14	1.15	1.39	1.26
Contained Copper	kt	8.9	11.0	8.6	7.3	7.9	6.8	10.1	16.6	22.4	18.5

	Unit	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Underground Operations											
Tonnes Mined	kt	1,557	1,099	1,016	970	429	427	57	—	—	—
Grade Mined	% Cu	1.50	1.42	1.53	2.10	2.13	2.23	0.50	—	—	—
Open Pit Operations											
Tonnes Mined	kt	140	67	49	140	204	82	115	201	126	33
Grade Mined	% Cu	0.59	1.01	0.58	0.47	0.37	0.46	0.40	0.47	0.51	0.65
Total Mining Operations											
Tonnes Mined	kt	1,697	1,166	1,065	1,110	633	510	172	201	126	33
Grade Mined	% Cu	1.42	1.40	1.48	1.89	1.57	1.94	0.44	0.47	0.51	0.65
Contained Copper	kt	24.1	16.3	15.8	21.0	9.9	9.9	0.8	0.9	0.6	0.2

The 2022 Strategic LOM Plan applies the same mining and recovery methods as the 2022 Reserve LOM Plan. Accordingly, the same mining, recovery and dilution modifying factors have been applied to inferred resources included in the 2022 Strategic LOM Plan. Please refer to Chapter 16 for additional information. Modified inferred mineral resources are not mineral reserves. Mineral resources that are not mineral reserves do not have a demonstrated economic viability.

Table 1-9: 2022 Strategic LOM Plan, Processing Operations

	Unit	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Milling Operations (incl. stockpile + ore sorting adjustments)											
Tonnes Processed	kt	3,467	3,900	4,197	4,080	4,200	4,213	4,200	4,200	4,200	4,200
Grade Processed	% Cu	1.43	1.29	1.24	1.28	1.25	1.29	1.34	1.31	1.36	1.33
Recovery	%	91.6	92.3	92.1	92.3	92.1	92.3	92.5	92.4	92.6	92.4
Copper in Concentrate	kt	45.3	46.3	47.8	48.3	48.5	50.3	52.0	50.9	53.1	51.5

	Unit	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Milling Operations (incl. stockpile + ore sorting adjustments)											
Tonnes Processed	kt	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,080	3,375	2,997
Grade Processed	% Cu	1.32	1.32	1.40	1.52	1.22	1.05	0.77	0.65	0.78	0.96
Recovery	%	92.4	92.4	92.7	93.1	92.0	91.2	89.7	88.7	89.7	90.8
Copper in Concentrate	kt	51.2	51.2	54.6	59.4	47.1	40.0	28.8	23.4	23.6	26.2

The Company's 2022 Strategic LOM Plan is preliminary in nature and includes inferred mineral resources which are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. As such, there is no certainty that the 2022 Strategic LOM Plan will be realized. The Company has an active drill program in place to continuously infill and upgrade inferred mineral resources once underground drill stations have been developed. However, until this work is completed, and the inferred resources have been upgraded to mineral reserves, there is no certainty this material will be converted into mineral reserves. Modified inferred mineral resources are not mineral reserves. Mineral resources that are not mineral reserves do not have a demonstrated economic viability. Please refer to Chapter 16 for additional information.

1.8 INFRASTRUCTURE

The Caraíba Operations infrastructure includes fully integrated mining and processing operations located within the Curaçá Valley. All supporting infrastructure required for mining operations are currently in place. The current mining operations include the Pilar UG Mine, the Vermelhos UG Mine and the Surubim Mine. Primary components of installed infrastructure comprising the Caraíba Operations outside of the individual mining operations, include:

- Caraíba Mill processing plant with installed capacity of approximately 3.2Mtpa currently undergoing an expansion to increase installed capacity to 4.2Mtpa by the end of 2023;
- access to water via an Ero Brasil owned, operated and maintained 86km permanent steel pipeline, 80 centimeters (“cm”) in diameter, from the São Francisco River;
- water treatment plant;
- metallurgical laboratory;
- main substation and transformers, each configured with 60 MVA / 230 kV / 13.8 kV;
- power lines supplied by Companhia Hidroelétrica do São Francisco (“CHESF”), a Brazilian State-owned power company;
- ancillary surface buildings including maintenance, security and administration; and
- an inactive Solvent Extraction and Electrowinning (“SX/EW”) operations

1.9 ENVIRONMENT

The current permitting status for the active operations of the Caraíba Operations can be summarized in the following table:

Table 1-10: Summary of Primary Operational Permits

Mine/Project	License Scope	Project Phase	Permit Period		Status
			Start	Expiry	
Pilar UG Mine	Mining Operations	Operational	August 23, 2022	August 23, 2025	Valid
Pilar UG Mine	Alteration	Operational	September 9, 2022	August 23, 2025	Valid
Pilar UG Mine	Chemical Products	Operational	April 4, 2022	October 22, 2023	Valid
Pilar UG Mine	Fuel Station	Operational	May 6, 2020	May 6, 2023	Valid
Surubim Mine	Mining Operations	Operational	April 1, 2022	April 1, 2025	Valid
Surubim Mine	Alteration	Operational	May 27, 2022	May 27, 2024	Valid
Surubim Mine	Fuel Station	Operational	May 18, 2021	May 18, 2024	Valid
Surubim Mine	Deforestation and Fauna Management	Operational	May 27, 2022	May 27, 2024	Valid
Surubim Mine	Creek Deviation	Operational	May 27, 2022	May 27, 2027	Valid
Vermelhos UG Mine	Mining Operations	Operational	October 26, 2022	October 26, 2025	Valid
Vermelhos UG Mine	Fuel Station	Operational	November 11, 2021	October 28, 2024	Valid
Vermelhos UG Mine	Fauna Management	Operational	November 6, 2021	November 6, 2023	Valid
Vermelhos UG Mine	Creek Deviation	Operational	March 15, 2022	March 15, 2027	Valid

Ero Brasil maintains an excellent relationship with the communities throughout the Curaçá Valley, having held regular meetings and consultation sessions with local stakeholders routinely for over 40 years. In support of this relationship, Ero Brasil undertakes several key initiatives annually focused on sustainable community development – it is a core pilar of the Company's operating philosophy.

1.10 CAPITAL & OPERATING COSTS

The total Mineral Reserve LOM Production Plan capital costs estimate is approximately US$1,083M and have been based on supporting the requirements for the mining and processing operations of the current mineral reserves over the 20-year estimated operating life of the Caraíba Operations. Total capital investments include capitalized mine development as well as ongoing capital requirements primarily in the form of equipment replacement at the end of each unit's useful life. Capital cost projections are based upon vendor quotes and management estimates incorporating historical operating data and previously supplied quotes from the current operations. Capital expenditure estimates reflect the total cost for developing and extracting the current mineral reserves included in the Mineral Reserve LOM Production Plan. Total estimates by category are presented in USD in Table 1-11.

Table 1-11: Total LOM Capital Expenditure Estimate

Category	LOM Total (USD 000s)*
UG Mine Development	346,019
OP Mine Pre-Stripping	151,551
Infrastructure	209,083
UG Equipment	79,273
OP Equipment	43,079
Mineral Processing	99,051
Tailings	44,075
Safety & Environment	73,306
IT & Services	3,799
Other Capital Costs	33,890
Total Capital Cost	**1,083,126**

(*) BRL amounts converted to USD at a USD:BRL foreign exchange rate of 5.29.

An operating cost model was generated using historic operating performance at the Caraíba Operations, incorporating specific consumption coefficients based on operational data, after application of adjustments for differences between ore sources in the Mineral Reserves LOM Production Plan. Cost estimates were built using first principles incorporating both fixed and variable components to account for production rate variations. Costs were adjusted annually based on the changes to ore sources including rock support, transport, and infrastructure requirements. Underground mining costs consist of the operational costs related to ore extraction at the Pilar UG Mine, Vermelhos UG Mine, and Surubim UG Mine. Direct mining costs include drilling, blasting, and mucking. Indirect costs include ore and waste transport, mine services, and mine supplies. A summary of the average LOM operating costs is presented in BRL per tonne in Table 1-12.

Table 1-12: Average LOM Operating Costs

Cost Parameter, Average LOM	Underground Operations			Open Pit Operations		
	Pilar UG Mine	Vermelhos UG Mine	Surubim Mine, underground	Surubim Mine, open pit	N8/N9 & N5 (Siriema) OP Mines	Suçuarana OP Mine
Mining Cost *(BRL per tonne mined)*	157.07	147.54	153.36	11.06	11.06	11.06
Transport to Caraíba Mill *(BRL per tonne moved)*	n/a	53.16	16.88	16.88	34.23	10.32
Processing Costs* *(BRL per tonne processed)*	49.25	49.25	30.15	30.15	30.15	30.15
Concentrate Transport *(BRL per wet metric tonne of concentrate)*	404.69	404.69	404.69	404.69	404.69	404.69

(*) Fixed processing costs are allocated to the Pilar UG and Vermelhos UG Mines which comprise the majority of Caraíba Mill feed.

1.11 CONCLUSIONS

1.11.1 Mineral Exploration and Geology

The geological descriptions, sampling procedures and density tests that were evaluated were found to be of acceptable quality and in accordance with industry best practices. Data was stored in a standardized database, which was found to be secure and auditable. The complexity of the mineralization controls and the quantity and phases of data in the Curaçá Valley merits the use of visualization and data integration tools that are more advanced than those which had at its disposal at the time of this Technical Report.

While GE21 believes that the current QA/QC program can guarantee the quality of the exploration data used in the resource estimates, GE21 suggests that a chain of custody program be implemented for good measure. GE21 supervised the process through which density was determined and concluded that it aligns with industry best practices.

1.11.2 QA/QC

GE21 performed the evaluation of the data generated after the last validation and concluded that the QA/QC procedures are being followed using the same standards. GE21 considered the standard QA/QC procedures to be in accordance with mining industry best practice and appropriate for use in the current mineral resource estimation.

It was observed tthroughout the 2021 review period by GE21, that the Caraíba Operations laboratory continues to display a tendency to underestimate the copper assay values when using certified reference material ("CRM") ITAK 825; however, the results of the laboratory when using CRM ITAK 851, which features a similar copper grade range, demonstrate better reproducibility.

1.11.3 Geological Model

The procedure that was adopted to produce the 3D geological model (wireframes), consisting of generating triangulations between interpreted geological cross sections, was executed properly and in accordance with the opinions of GE21. Due to the plunge of the mineralized zone at the Pilar UG Mine towards the north and the east-west geological cross sections, a pattern of sub-vertical discontinuous lenses was created locally within the regions of lower drill hole density.

GE21 noted that, with respect to the integration and interpretation of geological data, limited lithostructural mapping (mine, surface and subsurface) had been undertaken. GE21 also notes that the field interpretation and 3D interpretation were historically focused on interpreting only copper grade, therefore, few vertical and horizontal lithostructural geological sections have been developed which may provide greater understanding and control of aspects relating to the geology and other potential metals of significance in the Curaçá Valley. In 2020, the Caraíba Operations started to adopt 3D implicit modelling techniques based upon grouped lithologies and copper grade shells using Leapfrog software. This methodology was used by GE21 to create 3D validation models and GE21 encourages the expansion of this program at the Caraíba Operations.

1.11.4 Grade Estimation

The variograms that were used in the estimation method are satisfactory and consistent with respect to the grade estimation that was calculated via ordinary kriging, making use of search anisotropy determined in the variographic analysis.

GE21 considers the resource classification model and the analysis of criteria for the classification of those mineral resources, to be satisfactory although some processes could be improved. Such recommended improvements did not impose limitations on the classification of Measured and Indicated mineral resources.

1.11.5 Mineral Resource Estimate

The authors of this Report are not aware of any environmental, permitting, legal, title, taxation, socio-economic, marketing, political or other relevant factors which could materially affect the current mineral resource estimate. It is the opinion of GE21 that the current drilling information is sufficiently reliable to interpret with confidence the boundaries of higher-grade mineralized domains and that the assay data is sufficiently reliable to support estimation of mineral resources. The authors of this Report that validated the mineral resource estimate did not identify overall or local grade biases, as demonstrated by Swath Plot analysis. The authors found that the quality of the data is appropriate for the classification of the mineral resource, in accordance with the CIM Standards and CIM Guidelines.

1.11.6 Mineral Reserve Estimate

GE21 and BNA carried out a detailed review of the current mineral reserves for Curaçá Valley, aimed at demonstrating its technical and profitable extraction for the production and sale of copper concentrate. The results for this review, demonstrated a good adherence using detailed verification procedures performed by the authors of this Report. In general, resulting in differences of less than 1% in the total copper metal contained, which BNA considered acceptable.

Several observations related with the current mineral reserve are worth noting:

- The metallurgical recovery benefits from the commissioned and operational HIG Mill were applied to the underground mining operations of Ero Brasil;
- Within the Vermelhos District ore sorting will be integrated within the open pit operations to reduce transport and processing costs. However, these potential savings have not been considered in current reserve estimation as the global Ero Brasil geology team continues to conduct additional project assessments as at the Effective Date of this Report;
- The core operating mines of the Company (Pilar UG Mine and Vermelhos UG Mine) currently employ a joint reconciliation process in which it is difficult to accurately differentiate mine-to-mill reconciliation from one mine to another; and,

- As at the date of this Report, the ventilation and cooling infrastructure for the Pilar UG Mine, is being upgraded according to the plans developed by Ero Brasil.

The mineral reserve estimation has been performed according to industry best practice and conform to the CIM Standards and CIM Guidelines.

BNA has not identified any mining, metallurgical, infrastructure, permitting, legal, political, environmental, technical, or other relevant factors that could materially affect the potential development of the current mineral reserves.

1.11.7 Recommendations

Regarding the mineral resource estimate, the authors recommend a work program to include the following, most of which can be completed at little or no cost. Estimated costs of the work program are shown in the table below.

i. Formalize the use of implicit modelling internally throughout the Company, emphasizing structural geology and variation in lithology for domain definition and exploration target integration.

ii. Implement additional empirical criteria for resource classification, based on the ‘15% Rule’, as commonly attributed to Dr. Harry Parker and since expanded upon in multiple sources of geostatistical literature.

iii. Expand ongoing geometallurgical studies to encompass all deposits and blends therein to study mill feed interaction. Suggest including standardized laboratory tests as normal operating procedure. Additionally, it is recommended that the Company advance geometallurgical studies for inclusion in mineral reserve definition, in order to classify metallurgical recovery according to the different characteristics associated with each lithological domain rather than by deposit.

iv. Validate of the certified grade for CRM ITAK 825 due to the observed inconsistencies in assay values, in contrast with the consistent results obtained when utilizing CRM ITAK 851, which has a similar Cu grade range.

v. Recommend standardizing QA/QC mass controls during assay sample crushing and grinding in order to evaluate the quality of the comminution procedures and ensure no sample loss during sample preparation.

vi. Install a sample tower to improve the mine to mill reconciliation process for the current operating mines. Such an installation will allow differentiation of ore source reconciliation within the processing plant.

vii. Improve systems for mineral reserve attribute database management to standardize fleet sizing, economic and consumable parameters, swell factors, dilution and mine call factors as well as store historic block model and design attributes including mathematical pit designs and supporting assumptions within a centralized validated database to improve the application of mineral reserve modifying factors in future studies.

Table 1-13: Proposed Budget for Recommended Work, Mineral Resources

Program	Budget (US$)
Advance geometallurgical studies	$200,000
Continued multi-element assays for the Vermelhos District (incl. check assays)	$50,000
Installation of sampling tower to enhance Mine-to-Mill reconciliation for multiple mining operations	$500,000
Improvement of reconciliation systems	$60,000
Advance geotechnical monitoring campaigns and geotechnical-lithology model development	$100,000
Deepening Inferred Project drill program	$7,000,000
Total	**$7,910,000**

With respect to mineral reserves, additional engineering work should continue alongside the exploration program to promote the confidence of the mine design and costing parameters of the Strategic LOM Plan, including stress modelling and monitoring system for Pilar UG Mine, continued pilot test stopes within the Project Honeypot areas to calibrate modifying factors, expansion of survey investigation on the historic mining and Baraúna crown pillar stability analysis. The Qualified Person, Dr. Beck Nader of BNA notes the following recommendations related to mineral reserve estimation:

- Continue with the ongoing geometallurgical studies to encompass all deposits and blends therein to study mill feed interaction. Suggest including standardized laboratory tests as normal operating procedure. Additionally, it is recommended that the Company advance geometallurgical studies for inclusion in mineral reserve definition, in order to classify metallurgical recovery according to the different characteristics associated with each lithological domain rather than by deposit.

- Continuing with the studies to improve the mine to mill reconciliation process for the current operating mines.

- Continue with the systems improvement for the mineral reserve attribute database management to standardize fleet sizing, economic and consumable parameters, swell factors, dilution, and mine call factors as well as store historic block model and design attributes including mathematical pit designs and supporting assumptions within a centralized validated database to improve the application of mineral reserve modifying factors in future studies.

- The authors recommend that a drill program for the inferred portion of the Deepening Project (as described in Chapter 24 of this Report) be executed to promote the resource classification from Inferred to Measured or Indicated. Additional engineering work should continue alongside the exploration program to promote the confidence of the mine design and costing parameters of the Deepening Inferred Project. The authors note at the time of this Report, such programs were underway.

- The SMU (Selective Mining Unit) methodology was applied to estimate the dilution for the Open Pit projects and for the Underground projects modeled stope dilution was estimated using the equivalent linear over-break slough ("ELOS") method including additional 1.0 m in the Hanging wall (HW) and 1.0 m in the Footwall (FW). Future studies will be done to improve the application of mineral reserve modifying factors.

Alejandro Sepúlveda, Qualified Person of NCL SpA recommends the following actions for Project Honeypot and additional mining areas within the upper levels of the Pilar Mine, including P1P2, R22, MSBW and Baraúna (collectively known as the "Upper Areas"):

- Develop a stress measurement campaign and a comprehensive lithological geotechnical and structural model.
- Utilize the seismic and stress monitoring data for design and scheduling.
- The integration with current operations must produce minimum interferences.
- Prepare a detailed analysis, including boreholes to ensure the backfill type and the strength of the cemented paste fill on those stopes already mined. This is highly recommended for Sector 1 and Sector 2 of the Pilar UG Mine.
- Develop engineering for a comprehensive stope test on the areas limited by historic excavations. The following information should be validated from these tests:
    - Mining recovery assumptions
    - Waste/backfill dilution assumptions
    - Productivity assumptions

Table 1-14: Proposed Budget for Recommended Work for Mineral Reserves

Program	Budget (US$)
Stress modelling & monitoring for Pilar UG	$200,000
Pilot test for Honeypot area to calibrate modifying factors	$1,200,000
Baraúna crown pilar stability analysis	$20,000
Advance survey on Honeypot historic mining	$700,000
Total	**$2,120,000**

2 INTRODUCTION AND TERMS OF REFERENCE

Ero Copper Corp. ("Ero Copper", "Ero" or the "Company") is a Vancouver-based publicly listed copper mining company that trades on the Toronto and New York Stock Exchanges under the ticker "ERO" and exists under the British Columbia *Business Corporations Act*. Ero Copper's principal asset is a 99.6% interest in Mineração Caraíba S.A. ("MCSA", or herein referred to as "Ero Brasil"), a Brazilian mining company operating in the Curaçá Valley, northeastern Bahia State, Brazil. The regional Ero Brasil operations in Bahia include fully integrated processing operations and, currently, three active producing mining locations within the Curaçá Valley. The active operations include the Caraíba Complex (comprised of the underground Pilar Mine ("Pilar UG Mine"), the underground Vermelhos Mine ("Vermelhos UG Mine"), the Surubim Mine and the integrated Caraíba Mill (which includes an inactive solvent extraction electrowinning plant ("SX/EW Plant")). The past producing operations include the open pit mines of R22 ("R22 Mine") as well as the historic mines of Angicos ("Angicos Mine") and Suçuarana ("Suçuarana Mine"). Collectively the active and past-producing mines comprise the "Caraíba Operations". Additionally, future operations are forecast to occur later in the production plan within the northern part of the Curaçá Valley including: the adjacent Vermelhos West (N8) and Vermelhos East (N9) open pits (collectively the "N8/N9 OP Mine"), the Siriema open pit mine ("Siriema OP Mine"), collectively with the active Vermelhos UG Mine comprise the mineral reserves within the "Vermelhos District". In the central part of the Curaçá Valley, future operations include: the expansion of the adjacent Surubim and C-12 underground mine (the "C-12 UG Mine") and the C-12 open pit ("C-12 OP Mine"), collectively the Surubim Mine, which re-started operations during 2022, comprise the stated mineral reserves of the "Surubim District". In the southern part of the Curaçá Valley, the past producing Suçuarana open pit ("Suçuarana OP Mine") and the R22W open pit ("R22W OP Mine"), collectively with the active Pilar UG Mine comprise the stated mineral reserves of the "Pilar District". The Pilar District is located approximately 385 kilometers ("km") north-northwest of Salvador and 90 km southeast of Petrolina, in the State of Bahia, Brazil. The center of the Surubim District is located approximately 33km north of the Pilar UG Mine and Caraíba Mill (jointly referred to as the "Caraíba Mine") at the Surubim Mine, while the center of the Vermelhos District and the Vermelhos UG Mine is located another 31km north-northwest of the Surubim Mine. In aggregate, mining and development activities occur over approximately 100km in strike length across the Curaçá Valley.

The Caraíba Operations have an extensive operating history in the region. Open pit and processing operations started in 1979, while underground mining operations commenced in 1986. Ero Brasil owns a 100% interest in the Caraíba Operations including the abovementioned mines, integrated processing facilities and all supporting infrastructure. The Pilar UG Mine currently produces a nominal 4,000 to 6,000 tonnes per day ("t/d"), or approximately 1.0 to 1.5 Mtpa from underground operations that, combined with the nominal 3,000 to 5,000 t/d, or approximately 1.5 Mtpa currently mined from satellite mining operations within the Caraíba Operations, including the Vermelhos UG Mine and the Surubim Mine, serves as feed for the Caraíba Mill. The Caraíba Mill is currently producing high quality, low impurity copper concentrate grading approximately 33%-35% copper. The concentrate typically contains minor amounts of precious metals. Historical average grades of precious metals in concentrate are approximately 2 grams per tonne ("g/t" or "gpt") gold and 43 g/t silver in concentrate.

The Company's 2022 life of mine ("LOM") planning process considers recently completed and ongoing investments in mining and milling infrastructure under the Company's "Pilar 3.0" initiative, which includes the integration of newly defined mineral resources and reserves in the upper levels of the Pilar UG Mine (efforts were focused on an area known as "Project Honeypot"), the ongoing construction of a new external shaft to access mineralization below level -965 in the Pilar UG Mine (known as the "Deepening Project" or, from a geological perspective the "Deepening Extension Zone"), and the ongoing expansion of the Caraíba Mill to increase processing capacity to approximately 4.2 million tonnes per annum ("Mpta"). As a result of the integration of Project Honeypot and the nature of the mineralization remaining in the upper levels of the Pilar Mine, and more broadly within the Company's underground operations, effective extraction of the mineral reserve necessitated the consideration of inferred mineral resources in the Company's long-term strategic planning efforts, particularly in the design of stopes that include measured, indicated and some inferred mineral resources - a process that has been utilized at the Pilar UG Mine since underground operations commenced in 1986. Inferred mineral resources are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. Mineral resources which are not mineral reserves do not have demonstrated economic viability. The Company has commenced a program to continue infill drilling of the Inferred resource to further upgrade this material; however, until this work is completed, and the Inferred resources have been upgraded to reserves, there is no certainty this material will be converted into mineral reserves.

The purpose of this report ("Report" or "Technical Report") is to set out and to provide background and supporting information on the mineral resources and mineral reserves for the Caraíba Operations. The Report was prepared by GE21 Consultoria Mineral Ltda. ("GE21"), BNA Mining Solutions ("BNA") and NCL Ingeniería y Construcción SpA ("NCL") on behalf of Ero Copper. This Report and estimates herein have been prepared following the guidelines of the Canadian Securities Administrators' National Instrument 43-101 – *Standards of Disclosure for Mineral Projects* ("NI 43-101") and Form 43-101F1 – Technical Report ("Form 43-101F1").

The effective date of this Report is September 30, 2022 (the "Effective Date"). The issue date of this Report is December 22, 2022.

The scope of work undertaken by GE21 included:

- Project management as lead QP of the Technical Report;
- review and validate the Company's QA/QC program and data collected during the 2018-2020 drill programs;
- perform validation of the geological models prepared by Ero Brasil;
- update mineral resource block models using an industry standard geostatistical approach;
- classify the Company's mineral resource into Measured, Indicated and Inferred categories, following CIM Standards and CIM Guidelines for the known copper sulphide mineralization of the Caraíba Operations; and,
- where relevant, GE21, reviewed work prepared by independent third-party consultants that constitute an integral component of current and planned operations as contemplated in this Report.

The scope of work undertaken by BNA and NCL included:

- Review of updated mineral resource block models prepared by Ero Brasil, verified and classified with the support of GE21;
- review of mine design and planning on Measured and Indicated mineral resource for the deposits in support of the mineral reserve estimate;
- Where relevant, due to the operating nature of the Caraíba Operations and the Deepening Project, review work prepared by independent third-party consultants that constitute an integral component of current and planned operations as contemplated in this Report;
- review and validate the economic analysis performed to verify economic feasibility in support of the mineral reserves; and,
- compilation of the Technical Report detailing the mineral resource and mineral reserve for the Caraíba Operations incorporating the work performed by GE21 and the work of the Ero Brasil technical team.

2.1 QUALIFICATION, EXPERIENCE AND INDEPENDENCE

GE21 is an independent mineral consulting firm based in Brazil developed by a team of professionals accredited by the Australian Institute of Geoscientists ("AIG"), The Society for Mining, Metallurgy and Exploration, Inc. or Australasian Institute of Mining and Metallurgy as Qualified Persons for estimate of mineral resources and mineral reserves in accordance with NI 43-101.

BNA is an independent Mining and Engineering consulting firm based in Brazil.

Each of the authors of this report has the appropriate qualifications, experience, competence and independence, to be considered as qualified person ("QP" or "Qualified Person"), as such term is defined in NI 43-101. Neither GE21 nor BNA nor the authors of this Report have or have had any material interest in Ero Copper, Ero Brasil or related entities. The relationship between these companies and Ero Copper and Ero Brasil is solely of professional association between client and independent consultant. This Report was prepared in exchange for fees based on rates set by a commercial agreement. Payment of these fees is in no way dependent on the results of this Report.

In accordance with NI 43-101 guidelines, at least one of the Qualified Persons, including the lead QP, has visited the Caraíba Operations on multiple prior occasions, and most recently during September of 2021, as shown in the table below and as outlined in the QP certificates found in Appendix A to the Report.

Table 2-1: Qualified Persons and Dates of Recent Site Visit

Company	Qualified Person	Recent Site Visit	Responsibility*
GE21	Porfírio Cabaleiro Rodriguez, FAIG (#3708)	4 days' duration, September 2021	Lead QP and supervised the preparation of the Technical Report. Overall responsibility on behalf GE21, responsible for Chapters 2, 3, 13, 14, 17, 19, 20, 22, 23, and 27 and jointly responsible for Chapters 21 and 24.
GE21	Bernardo Horta de Cerqueira Viana, FAIG (#3709)	4 days' duration, September 2021	Jointly responsible for Chapters 4, 5, 6, 7, 8, 9, 10, 11, 12 and 24.
GE21	Fábio Valério Câmara Xavier, MAIG, (#5179)	4 days' duration, September 2021 3 days' duration, September 2022	Jointly responsible for Chapters 4, 5, 6, 7, 8, 9, 10, 11 and 12.
GE21	Ednie Rafael, MAIG (#7974)	3 days' duration, September 2022	Jointly responsible for Chapter 12.
BNA	Dr. Beck Nader, FAIG (#4472)	3 days' duration, September 2021	Jointly responsible for Chapters 15, 16, 18, 24 and 25.
NCL	Alejandro Sepulveda, Registered member and QP CMC (#0293	9 days' duration in June 2022 5 days' duration in July 2022 5 days' duration in August 2022	QP responsible for Project Honeypot, and jointly responsible for chapters 15, 16, 18, 24 and 25.

(*) Each QP was also responsible for the corresponding sections within Chapters 1, 25 and 26 related to stated Chapters of responsibility.

2.2 MAIN SOURCES OF INFORMATION

In addition to the personal inspection of the Caraíba Operations performed by certain Qualified Person during the period noted in the table above, GE21, BNA and NCL were involved in multiple discussions with the Ero Brasil team regarding processes and procedures including surveying, sampling, QA/QC, and mineral resource and mineral reserve estimation methods – including the design and integration of the Deepening and Honeypot Projects. The results presented in this Report have been generated from information provided and compiled by Ero Brasil through data organized in spreadsheets, internal and third-party technical reports, as well as supplemental information obtained from the Ero Brasil technical team. GE21, BNA and NCL have made all necessary inquiries to determine the integrity and authenticity of the information provided and identified herein.

2.3 EFFECTIVE DATE

The Effective Date of this Technical Report is September 30, 2022

2.4 UNITS OF MEASUREMENT

Unless otherwise stated, the units of measurement in this Report are all metrics in the International System of Units (“SI”). All monetary units are expressed in BRL or United States Dollars (“US$” or “USD”), unless otherwise indicated. Although substantively all costs are incurred in BRL, where applicable, these amounts have been converted to USD for presentation purposes.

The UTM projection, Zone 24 South, SIRGAS2000 datum was adopted as a spatial reference for all mines and projects within the Curaçá Valley with the exception of the Pilar UG Mine, where Local Coordinates were adopted as the spatial reference.

3 RELIANCE ON OTHER EXPERTS

The authors of this report are Qualified Persons as defined under NI 43-101, with relevant experience in mineral exploration, data validation, mine planning and mineral resource and mineral reserve estimation.

The information presented regarding the tenure, status and work permitted by permit type within the Caraíba Operations in Chapter 4 – Property Description and Location, is based on information published by the ANM of Brazil as at the Effective Date.

The copper market conditions and key contracts as of the Effective Date included in Chapter 19 – Market Studies and Contracts and environmental licensing status information and work plans related to community and social outreach included in Chapter 20 – Environmental Studies, Permitting and Social or Community Impact, were prepared by Ero Brasil and Ero Copper and reviewed by GE21. GE21 determined that the economic factors used in the determination of specific technical parameters of this Report, including copper, gold, silver and the USD:BRL assumptions used were in-line with industry norms, broader market consensus and are acceptable for use in the current mineral resource estimate and mineral reserve estimate. The authors of this Report have not identified any significant risks in the underlying assumptions.

The forecast capital expenditures and operating costs as well as tax and royalty obligations included in Chapter 21 – Capital and Operating Costs were prepared by Ero Brasil and Ero Copper based on the extensive operating history of the operations and ongoing nature of the operations. The forecasts were reviewed against historic information and deemed to be reasonable and adequate for the purposes of NI 43-101 by the authors of this Report.

4 PROPERTY DESCRIPTION AND LOCATION

4.1 PROPERTY LOCATION

Ero Brasil currently has two primary mining operations located within the Curaçá Valley in northeastern Bahia State, Brazil: the Caraíba Mine and the Vermelhos UG Mine. Production from these operations is supplemented by the Surubim Mine, which re-started operations in 2022. The Caraíba Mine, containing the Pilar UG Mine and the fully integrated Caraíba Mill are located approximately 385 km north-northwest of the capital city of Salvador and 90 km southeast of the dual-cities of Petrolina and Juazeiro (combined population of approximately 570,000), States of Pernambuco and Bahia on the São Francisco River (Figure 4-1). The Vermelhos UG Mine is located 83 km north-northwest of the Pilar UG Mine. Ore is transported from the Vermelhos UG Mine and the Surubim Mine to the Caraíba Mill complex via the Curaça Valley Haul Road, which passes adjacent to the Surubim Mine in the central portion of the Curaçá Valley, over a total transport distance of approximately 80 kilometers. The Caraíba Mine is located at 9°52'04"S and 39°52'18"W and the Vermelhos UG Mine is located at 9°18'28"S and 39°56'14"W. The Pilar and Vermelhos Districts, which encompass these operations as well as neighboring mineral resources, mineral reserves and exploration targets are located at the southern and northern ends of the Curaçá Valley, respectively.

The Pilar District, containing the Pilar UG Mine and Caraíba Mill, includes two additional projects containing mineral resources and reserves which include R75, located at 9°51'10"S and 39°52'6"W and Suçuarana located at 9°59'34"S and 39°54'3"W. The Vermelhos District, containing the Vermelhos UG Mine, also includes the N8/N9 OP Mine, centred at 9°18'15"S and 39°56'18"W, the Vermelhos North project, located at 9°17'6"S and 39°56'3"W and the Siriema OP Mine, located at 9°19'20"S and 39°56'38"W.

Additionally, the Surubim District, containing the Surubim Mine (including planned production from underground), located at 9°34'12"S and 39°51'52"W, also includes the C-12 OP/UG Mine, located at 9°34'44"S and 39°52'27"W, the Lagoa da Mina project, located at 9°30'13"S and 39°47'48"W adjacent to the past producing Angicos Mine, the Cercado Velho project, located at located at 9°30'36"S and 39°47'52"W and the Terra do Sal project, located at 9°38'1"S and 39°49'6"W.

The primary access to the properties from the Petrolina Airport, featuring daily flights to Salvador and São Paulo, is via federal and state highways. From the Petrolina Airport it is approximately 125 km to the main access road of the Caraíba Mine. The nearest town of Pilar (population of approximately 15,000 people) is located approximately 15 km from the Caraíba Mine entrance and mine administration offices. The town features three hotels, community centers, a hospital, and housing for mine employees and their families. Daily bus service transports employees from Pilar to the mine entrance. The three principal mineral districts contained within the Curaçá Valley in relation to major cities in Bahia State are shown in the two figures below.

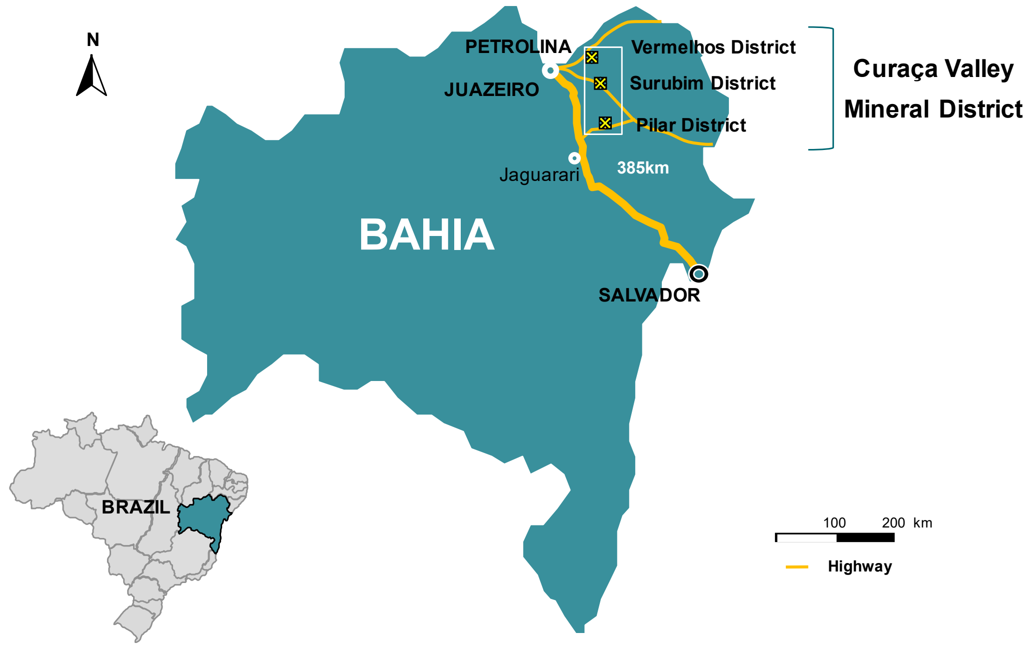


Figure 4-1: Location of the Primary Mineral Districts, Caraíba Operations, Bahia State, Brazil (Ero Copper, 2022)

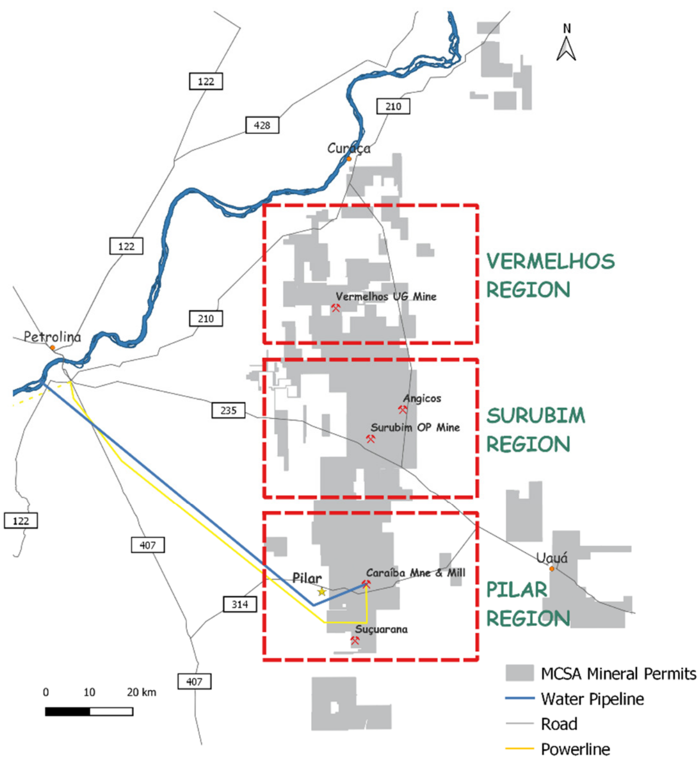


Figure 4-2: Detailed Map of Caraíba Operations, Curaçá Valley, Bahia State, Brazil (Ero Copper, 2022)

4.2 MINERAL TITLE IN BRAZIL

Mining legislation as it relates to mineral title in Brazil has been in place since 1967, and the last significant amendment took place in 1996. In 2017, there were changes to the institutional framework and to the statutory royalty Compensação Financeira pela Exploração de Recursos Minerais ("CFEM") legislation. Institutionally, a new National Mining Agency (Agência Nacional de Mineração, "ANM") was created to replace the National Department for Mineral Production (Departamento Nacional de Produção Mineral, "DNPM"). As it relates to the statutory royalty, new legislation enacted in December 2017 established new rates for mineral commodities and excluded certain deductions previously allowed, such as transportation and insurance costs. The royalty on copper producers remained the same at 2.00% of the gross revenue from sales.

In addition to the changes in legislation described above, in June 2018, the Federal Government enacted new regulations to the Mining Code. The purpose of the new regulations was to modernize parts of the previous legislation that do not require legislative action (i.e. no amendments to the Mining Code are required). In February 2022, the Federal Government further amended regulations in an effort to streamline the analysis of processes and reduce bureaucracy to attract new investment for the mining sector. These changes did not affect the methods for granting mineral rights, nor establish new investment commitments per license, but rather sought to ease the transition process from Exploration to Mining Licenses in as much as the Mining Code allows, particularly as it relates to supplementary work performed after the submission of a final exploration report. As of the date of this Report, the authors do not anticipate any significant change in Brazil's mining legislation that would adversely impact the operations of the Company.

4.3 MINING LEGISLATION, ADMINISTRATION, AND RIGHTS

The primary mining legislations in Brazil are the 1988 Federal Constitution and the 1967 Federal Mining Code (Decree-law No. 227), as amended over time. Minerals on the ground are a property of the Federal Government, and, therefore, mining legislation can only be enacted at the federal level. The ANM is the federal agency entitled to manage, regulate and supervise mining activities in Brazil, along with the Ministry of Mines and Energy ("MME"). By definition, exploration rights are granted by the ANM and, in most of the cases, mining concessions are granted by the MME.

Landowners and governments (municipal, state and federal) are entitled to a royalty. The CFEM rate varies from 1% to 3.5%, depending on the commodity. If any minerals are extracted from private lands that are not owned by the titleholder, the landowner is entitled to a royalty equal to 50% of the statutory CFEM royalty. Mining activities are subject to both federal and state level environmental licensing. Ero Brasil's operations for copper (in the Curaçá Valley) are subject to a 2% royalty on gross concentrate sales net of taxes levied on sales.

Exploration license holders are entitled to access their license area and work on it whether it is public or privately held, but such holders must compensate the owner of the surface rights for losses caused by the work and for the occupation of the land (typically in the form of rent). Compensation may be negotiated on a case-by-case basis, but the Mining Code provides that, should a court of law be required to set the amounts, the rent for occupation of the land cannot exceed the maximum net income that the owner would earn from its agricultural-pasture activity in the area of the property to be explored, and the losses caused by the work cannot exceed the assessed value of the area of the property intended for exploration.

In response to the Brumadinho disaster, new regulations and laws regarding the design, operation and monitoring of tailings dams in Brazil were passed. Specifically, on October 1, 2020. Law No 14,066/2020, which amended the National Dam Safety Policy, was enacted. As at the date of this Report, the Company continues to work with the ANM and state agencies to evaluate any potential operational changes and or additional monitoring or reporting requirements for its tailings facilities that may be required. The authors of this Report have reviewed the new legislation requirements and have not identified any material risk factors associated with compliance within the new legislation nor any potential adverse impact on the Company's ability to extract the current mineral reserves.

In response to the hardship experienced throughout Brazil during the COVID-19 pandemic, a series of Resolutions published between 2020 and 2022, resulted in the extension of procedural and administrative deadlines for exploration and mining concessions. Under the resolutions, administrative deadlines were extended for a maximum period of 560 days, from October 1, 2021.

4.4 EXPLORATION LICENSES

Exploration licenses are granted for up to three-year periods and may be renewed for another three years on the approval of an ANM inspection and satisfaction of certain environmental requirements. The size of an individual license area ranges from 50 ha to 10,000 ha depending on the state and the commodity.

4.5 ANNUAL FEES AND REPORTING REQUIREMENTS

Annual license fees for Exploration Licenses are based on size and are calculated at R$3.55/ha for the first license term and R$5.33/ha in subsequent terms. Each license holder must submit an exploration plan, budget and timeline, although there is no work or expenditure requirement. Licenses require an interim report two-months prior to license expiration (if an extension is to be applied for), describing exploration results, interpretation and expenditures. The renewal of a license may be granted at the discretion of the ANM considering the exploration works undertaken by the holder. A final report is due at the end the term or on relinquishment of the license.

4.6 MINERAL TITLES

Mining rights in Brazil are governed by the Mining Code Decree Number 227, dated February 27, 1967 and via subsequent rules and amendments enacted by the ANM. As of the Effective Date, Ero Brasil holds, has applications in process, or has negotiated with third-parties for 153 mineral rights in the State of Bahia, shown by type in the table below and graphically in Figure 4-3.

Table 4-1: Ero Brasil Mining Rights Within the Curaçá Valley

Permit Holder	Mineral Permit Type	Permits-Licenses Held	Hectares (ha)
Mineração Caraíba S.A.	Exploration*	138	171,045.2
	Right to Request Mining Grant	1	998.7
	Mining Application	7	10.521.4
	Mining	7	3,299.6
Total		**153**	**185,865.0**

*Includes Exploration permits under application and agreements with third-parties in place as of the Effective Date

There are no time constraints provisioned with the mining concessions; however, operating permits and licenses are extended and renewed in normal course of business according to the nature of each permit and requirements therein. Ero Brasil has all necessary licenses, permits, surface ownership and right of way where appropriate in place to conduct its current operations.

The table below shows the overall status, as of the Effective Date, of the Mining Permits and Mining Application Permit in which the Caraíba Mine, R22W Mine, Surubim Mine, Vermelhos UG Mine, Angicos Mine and the Suçuarana Mine are located.

Table 4-2: Status of Ero Brasil Mining Permits in the Curaçá Valley

ANM Issue ID	Permit Status	Holder	Ero Brasil Project
000737/1940	MiningPermit	Mineração Caraíba S.A.	Caraíba Mine
000619/1964	Mining Permit	Mineração Caraíba S.A	Surubim Mine
812998/1973	Mining Permit	Mineração Caraíba S.A	R22W Mine
870347/1984	Mining Permit	Mineração Caraíba S.A	Vermelhos UG Mine
873648/2006	Mining Permit	Mineração Caraíba S.A	Angicos Mine
871263/2011	Mining Permit	Mineração Caraíba S.A	Suçuarana Mine
973228/2020	Mining Permit	Mineração Caraíba S.A	Mining Group

See Appendix E to the Report for a complete list of Mineral Permits.

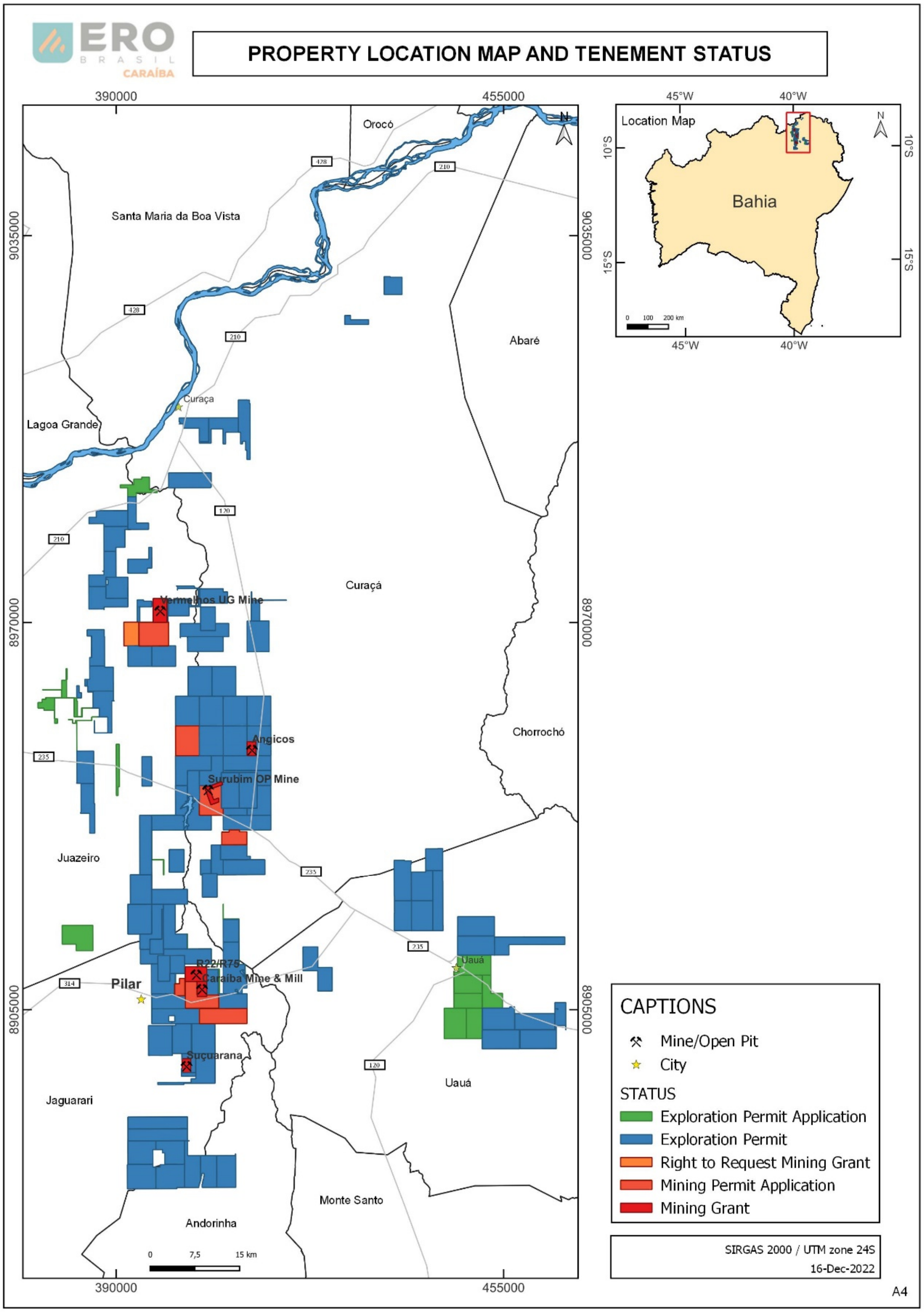


Figure 4-3: Location of the Ero Brasil Mining & Exploration Rights in the Curaçá Valley (Ero Brasil, 2022)

*Mineração Vale do Curaçá S.A. was a former subsidiary of Ero Brasil and merged into Ero Brasil in or about 2013.

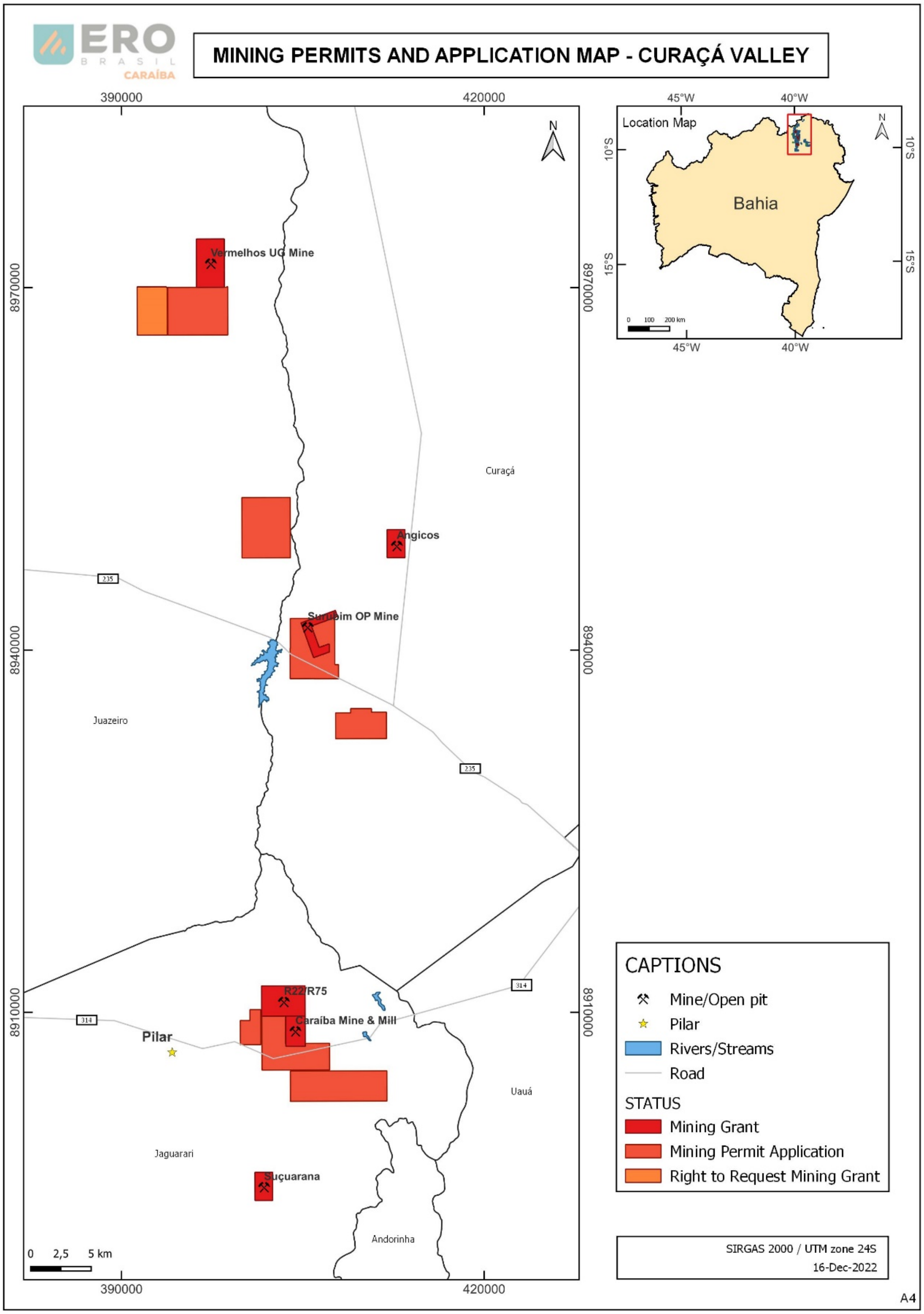


Figure 4-4: Status of the Mining Rights Related to the Vermelhos UG Mine, Surubim Mine, Angicos Mine, R22/R75 Mine, Caraíba Mine and the Suçuarana Mine (Ero Brasil, 2022)

5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY

5.1 ACCESSIBILITY

Ero Brasil's properties are located in the Curaçá Valley in the northern part of the State of Bahia, Brazil. The closest major cities are Petrolina, located in the State of Pernambuco on the northern side of the São Francisco River, and Juazeiro, in the State of Bahia located on the southern side of the river. The combined population of the two cities is approximately 570,000 people. The Caraíba Mine can be accessed from Petrolina or Juazeiro via BR407 south for 80km to the village of Barrinha. From Barrinha, east on BA314 for 45km and the mine access road intersects BA314. Both BR407 and BA314 are paved roads. Mine employees live in the town of Pilar (population of approximately 15,000) located approximately 15km from the mine entrance. Daily bus service transports Ero Brasil employees from Pilar to the Caraíba Mine main gate.

The Vermelhos UG Mine property lies approximately 83km north-northwest of the Caraíba Mine and can be accessed from Petrolina or Juazeiro by following BR407 15km to the intersection with BR235. BR235 intersects the Curaçá Valley Haul Road near the Surubim Mine in the center of the Curaçá Valley. The Vermelhos UG Mine can be accessed by following the haul-road north for approximately 40km.

Construction of a permanent haul-road from Vermelhos UG Mine to the Surubim Mine occurred in late 2018 joining the previously constructed haul-road between the Caraíba Mill and the Surubim Mine, constructed prior to Ero Copper. The Curaçá Valley Haul Road facilitates transport of ore from the Vermelhos UG Mine and Surubim Mine to the Caraíba Mill and is wide enough to accommodate two-direction traffic. While the majority of the Curaçá Valley Haul Road is dirt, portions of the road located near small communities are paved, primarily for dust control. The nearest town to the Vermelhos UG Mine property is the town of Curaçá (population of approximately 30,000). Daily bus service transports Ero Brasil employees working at the Vermelhos UG Mine from the town of Curaçá to the Vermelhos property.

5.2 PHYSIOGRAPHY

The Curaçá Valley can be characterized as generally as flat-lying topography featuring scattered elongated ridges, isolated rock outcrops and inselbergs. The elevation ranges from 400m to 600m above mean sea level. The presence of inselbergs is indicative of an advanced erosional cycle, developed under arid to semi-arid conditions. The inselbergs within the Curaçá Valley have peak elevations of up to 600m, approximately 100m to 200m above the valley floor.

Drainage is from south to north by the Curaçá River, a tributary of the São Francisco River. Two important tributaries of the Curaçá River are the Esfomeado and Vaca Creeks, which drain the west side of the valley. The drainage pattern is reticular and largely fault controlled.

5.3 CLIMATE

The region is classified as arid to semiarid, or BSh per the Köppen climate classification system. Within the mining and development properties, temperatures range from a low of 20°C in the winter months to a high of 40°C in the summer months. Summer average temperatures are 29°C while winter averages are 23°C. Annual rainfall is erratic and has a range of 100 to 900 millimetres ("mm"). On average, total annual rainfall is less than 700mm. Most precipitation occurs during the rainy season, December to March, in isolated high rainfall events associated with thunderstorm activity. The limited seasonal rainfall and temperate climate permit a year-around operating season for all activities of the Company including but not limited to mining, processing, transportation of ore on the Curaçá Valley Haul Road, shipments of final concentrate and all ongoing exploration programs.

5.4 VEGETATION

Northeastern Bahia is called the Sertão and can be characterized as having Caatinga-type vegetation, of low thorny plants and bushes adapted to the extreme arid climate. Predominant plants in the mining and development areas include cacti such as the mandacarú and xique-xique, as well as baraúna and umburana trees and bromeliads. The Curaçá Valley Caatinga vegetation ranges from shrubby, sparsely vegetated type to rocky, savanna type and typically ranges from 10% to 60% cover with lesser coverage typically associated in areas of goat farming activity.

5.5 INFRASTRUCTURE AND LOCAL RESOURCES

Except for a short period in 2016, the Caraíba Mine has been in continuous operation since 1979 and has all of the necessary infrastructure and skilled mine and processing personnel for continued operation.

During construction of the Caraíba Mine, the town of Pilar was constructed to house mine employees and to provide logistical support for mining activities. Initially, Pilar consisted of approximately 1,800 houses with fresh water supply, electrical power, and a sewage system. Today, Pilar has a population of approximately 15,000 people providing support for Ero Brasil and its personnel in the form of outsourced labor and small local businesses. This district also has banks, a hospital and a health center, schools, a post office, a town hall and recreational facilities including clubs and sports stadiums. All of the streets are paved and the district has a reliable phone system. Daily bus service takes Ero Brasil employees from the center of Pilar to the Caraíba Mine main entrance.

The main water supply for Pilar and the Caraíba Mill is brought from the São Francisco River via an 86 km pipeline that was constructed by and is owned and maintained by Ero Brasil. Electrical power is obtained from CHESF via a 13.8 kV substation connected to a 230 kV power transmission line.

In the Brazilian northeast, Ero Brasil is the largest primary copper mining company. Throughout its operating history, a robust social and logistics infrastructure framework has been developed, sufficient to supply all of the industrial and labor needs related to the production of copper from the Caraíba Operations.

6 HISTORY

The first documented occurrence of copper in the Curaçá Valley was located at Serra da Borracha, Curaçá County in 1782. Samples were taken to Salvador for tests and were reported to contain "pure" copper. The information about the discovery was delivered to the Portuguese Crown in Lisbon. The then governor of Bahia authorized a company to exploit copper, but the company never began commercial production of copper. It would be another 180 years before a formal exploration program occurred on the property.

In 1874, engineer A. M. de Oliveira Bulhões reported copper occurrences in the vicinity of the Caraíba Mine in a series of documented accounts. Mr. Bulhões made this observation while he was working for the São Francisco Railroad and wrote "copper exists in abundance and in many places the mineral can be seen on top of the soil". No formal copper exploration was completed on the property.

In 1915, the International Ore Corporation and the then landowner of the Caraíba Mine property signed a purchase option contract. No further work was done under the terms of the contract and very little exploration activity occurred beyond a preliminary test pit in 1915 and a surface sample program in 1938.

In 1962, the DNPM conducted a regional exploration program in the Curaçá Valley and made a preliminary resource estimate based on that work. Mineral permits were obtained by the Pignatari Group in 1966 and the first feasibility studies were completed on the project in 1969 by Mr. Francisco Pignatari. In 1974, the investment branch of the Brazilian National Economic and Social Development Bank ("BNDESPAR") took control of the property, and between 1974 and 1978, the property was developed by the Brazilian State-owned company Caraíba Metais S.A. Exploration work in support of the design and development of the mine was performed by Companhia Vale do Rio Doce ("CVRD"). The Caraíba Mine began commercial production in 1979. In addition to construction of mine and processing facilities, a smelter was constructed for refining copper concentrate into copper metal. Underground operations started in 1986 at the Pilar UG Mine and were conducted concurrently with open pit operations. The original open pit mine was depleted in 1998, but underground mining continued and is still in operation today.

In 1988, the smelting and mining operations were split into two separate business units to simplify privatization. The smelting unit was privatized under the name Caraíba Metais S.A. and was later sold to Eluma S.A. Industria e Comercio ("Eluma"), a part of the Paranapanema Group in 1992. The mining and processing units remained State owned and operated under the name Mineração Caraíba until 1994, when Mineração Caraíba was placed in the National Privatization Program and later sold to Eluma as well.

Between 1997 and 2004, under new ownership, Mineração Caraíba did not invest in new acquisitions or expansions. Beginning in 2004, Mineração Caraíba began a modest expansion and exploration effort within the Curaçá Valley. This resulted in the transfer of R22W Mine to Mineração Caraíba in 2005 from DOCEGEO, the exploration division of CVRD, and the formation of the Codelco JV joint venture in 2004 for further exploration of known copper occurrences within Curaçá Valley. In February 2008, Codelco withdrew from the joint venture and received payment of R$5.6 million from Mineração Caraíba. In 2012, Swiss-based Glencore International acquired a 28.5% equity interest in Mineração Caraíba.

In December 2016, Ero Copper acquired approximately 85.0% interest in Mineração Caraíba. In June 2017, Ero acquired an additional 14.5% by way of capital increase, for a total interest in Mineração Caraíba of approximately 99.5%. In December 2017, the Company acquired additional shares of Mineração Caraíba, increasing its ownership interest in Mineração Caraíba to 99.6%. In 2022, Mineração Caraíba undertook a rebranding initiative and is today known as Ero Brasil.

Ero Copper commenced trading on the Toronto Stock Exchange under the stock symbol "ERO" on October 19, 2017, following completion of the Company's initial public offering, and successfully listed on the New York Stock Exchange under the stock symbol "ERO" on June 15, 2021.

Historic mineral resource and reserve estimates are further detailed in subsequent sections for reference purposes only. Ero Copper is not treating any of the historic estimates as current mineral resources or mineral reserves.

6.1 HISTORIC MINERAL RESOURCE AND RESERVE ESTIMATES, PREVIOUSLY PUBLISHED TECHNICAL REPORTS

6.1.1 2017 Mineral Resource and Reserve Estimate

Throughout MCSA's operating history, many internal and third-party technical reports have been prepared for mine planning, development and estimation purposes. In 2017 Ero Copper released a mineral resources and mineral reserves estimate for the mineral deposits of the Curaçá Valley in a report titled "2017 Updated Mineral Resources and Mineral Reserves Statements of Mineração Caraíba's Vale do Curaçá Mineral Assets, Curaçá Valley", dated September 7, 2017 with an effective date of June 1, 2017, prepared by Rubens José de Mendonça, MAusIMM, of SRK Consultores do Brasil Ltda. ("SRK" or "SRK Brazil") as at the date of the report (now of Planminas – Projetos e Consultoria em Mineração Ltda. ("Planminas")), and Porfirio Cabaleiro Rodrigues, FAIG, Mário Conrado Reinhardt, MAIG, Fábio Valério Xavier, MAIG, and Bernardo H.C. Viana, FAIG, all of GE21 (the "2017 Technical Report"). Each of Rubens José de Mendonça, MAusIMM, Porfirio Cabaleiro Rodrigues, FAIG, Mário Conrado Reinhardt, MAIG, Fábio Valério Xavier, MAIG, and Bernardo H.C. Viana, FAIG, were a "qualified person" and "independent" of the Company within the meanings of NI 43-101.

SRK carried out the appropriate review to satisfy that the mineral reserve could be technically and profitably extracted through to the production of copper concentrate. Consideration was given to all technical areas of the operations, the associated capital and operating costs, and relevant factors including marketing, permitting, environmental, land use and social factors. SRK was satisfied that the technical and economic feasibility had been demonstrated.

The detailed economic, geotechnical and engineering parameters used for the mineral reserves estimates are described in detail in the 2017 Technical Report. The 2017 historical mineral resource and mineral reserve estimate has been provided for reference purposes only. Ero Copper is not treating this 2017 estimate as current mineral resources or mineral reserves.

Table 6-1: 2017 Mineral Resource Estimate

District / Mine	Resource Classification	Tonnes (kt)	Cu (%)	Contained Cu (kt)
Pilar UG Mine	Measured	10,778	1.52	163.4
	Indicated	6,452	2.67	172.5
	Measured & Indicated	**17,230**	**1.95**	**335.9**
	Inferred	1,514	2.45	37.2
R22W Mine	Measured	306	0.54	1.7
	Indicated	2	0.79	0.0
	Measured & Indicated	**308**	**0.54**	**1.7**
	Inferred	-	-	-
Vermelhos UG Mine	Measured	1,341	6.91	92.7
	Indicated	1,201	2.40	28.8
	Measured & Indicated	**2,541**	**4.78**	**121.5**
	Inferred	2,189	1.52	33.3
Surubim Mine (Oxides)	Measured	-	-	-
	Indicated	6	0.35	0.02
	Measured & Indicated	**6**	**0.35**	**0.02**
	Inferred	1	0.34	0.0
Surubim Mine (Sulphides)	Measured	18	0.53	0.1
	Indicated	394	0.89	3.5
	Measured & Indicated	**411**	**0.88**	**3.6**
	Inferred	79	1.02	0.8

1. Effective date of March 31, 2017.
2. Presented mineral resources inclusive of mineral reserves. All figures have been rounded to reflect accuracy of the estimates. Summed amounts may not add due to rounding.
3. Cut-off grade of 0.68% copper for underground resources and 0.18% copper for open pit resources based on 2015 operating costs (the last full year of operation prior to the 2017 Technical Report)
4. Resources estimated by ordinary kriging inside varying block sizes by deposit.

Mineral resources which are not mineral reserves do not have a demonstrated economic viability.

Table 6-2: 2017 Mineral Reserve Estimate

Mine	Category	Tonnes (kt)	Cu (%)	Contained Cu (kt)
	Proven	2,841	1.47	41.8
Pilar UG Mine	Probable	3,350	2.28	76.3
	Proven & Probable	**6,191**	**1.91**	**118.1**
	Proven	1,743	4.84	84.4
Vermelhos UG Mine	Probable	676	2.37	16.0
	Proven & Probable	**2,418**	**4.15**	**100.4**
	Proven	11	0.51	0.1
Surubim Mine	Probable	248	0.80	2.0
	Proven & Probable	**259**	**0.79**	**2.1**
	Proven	**4,595**	**2.75**	**126.3**
TOTAL	**Probable**	**4,274**	**2.21**	**94.3**
	Proven & Probable	**8,868**	**2.49**	**220.5**

1. Effective Date of June 1, 2017.
2. Mineral reserves included within stated mineral resources. All figures have been rounded to reflect the relative accuracy of the estimates. Summed amounts may not add due to rounding.
3. The mineral reserve estimates are prepared in accordance with the CIM Definition Standards, and the CIM Estimation of Mineral Resources and Mineral Reserves Best Practice Guidelines, using geostatistical and/or classical methods, plus economic and mining parameters appropriate for the deposit. Mineral reserves are based on a long-term copper price of US$2.75 per lb, and a USD:BRL foreign exchange rate of 3.20.
4. Mineral reserves are the economic portion of the Measured and Indicated mineral resources. Mineral reserve estimates include mining dilution at zero grade. Mining dilution and recovery factors vary for specific mineral reserve sources and are influenced by factors such as deposit type, deposit shape, stope orientation and selected mining method.

6.1.2 2018 Mineral Resource and Reserve Estimate

In 2018, Ero Copper released an updated mineral resources and mineral reserves estimate for the mineral deposits of the Curaçá Valley in a report titled “2018 Updated Mineral Resources and Mineral Reserves Statements of Mineração Caraíba’s Vale do Curaçá Mineral Assets, Curaçá Valley”, dated October 17, 2018 with an effective date of August 1, 2018, prepared by Rubens José De Mendonça, MAusIMM, of Planminas, and Porfirio Cabaleiro Rodrigues, FAIG, Fábio Valério Cãmara Xavier, MAIG, and Bernardo Horta de Cerqueira Viana, FAIG, all of GE21 (the “2018 Technical Report”). Each of Rubens José De Mendonça, MAusIMM, Porfirio Cabaleiro Rodrigues, FAIG, Fábio Valério Cãmara Xavier, MAIG, and Bernardo Horta de Cerqueira Viana, FAIG was a “qualified person” and “independent” of the Company within the meanings of NI 43-101.

The detailed economic, geotechnical and engineering parameters used for the mineral reserves estimates are described in detail in the 2018 Technical Report. The 2018 historical mineral resource and mineral reserve estimate has been provided for reference purposes only. Ero Copper is not treating this 2018 estimate as current mineral resources or mineral reserves.

Table 6-3: 2018 Mineral Resource Estimate

Mineral Resources	Category	Tonnage (000 tonnes)	Grade (Cu %)	Contained Cu (000 tonnes)
Pilar UG Mine	Measured	15,595	1.92	300.2
	Indicated	9,254	1.85	171.5
	Measured & Indicated	**24,849**	**1.90**	**471.6**
	Inferred	1,761	2.07	36.4
Vermelhos UG Mine	Measured	3,039	4.12	125.1
	Indicated	1,523	1.97	30.1
	Measured & Indicated	**4,562**	**3.40**	**155.2**
	Inferred	1,995	1.19	23.6
Vermelhos West OP	Measured	5,502	0.60	33.0
	Indicated	2,645	0.60	15.9
	Measured & Indicated	**8,147**	**0.60**	**48.9**
	Inferred	2,490	0.83	20.7
Surubim Mine	Measured	4,064	1.03	41.9
	Indicated	497	1.03	5.1
	Measured & Indicated	**4,561**	**1.03**	**47.0**
	Inferred	83	0.85	0.7
R22W OP	Measured	306	0.54	1.7
	Indicated	2	0.79	0.0
	Measured & Indicated	**308**	**0.54**	**1.7**
	Inferred	-	-	-
Total Resources	Measured	**28,506**	**1.76**	**501.8**
	Indicated	**13,921**	**1.60**	**222.6**
	Measured & Indicated	**42,428**	**1.71**	**724.4**
	Inferred	**6,328**	**1.29**	**81.4**

1. Mineral resource effective date of July 1, 2018, for the Pilar UG and Surubim Mines, and May 31, 2018 for the Vermelhos UG Mine, Vermelhos West OP and R22W OP.
2. Presented mineral resources inclusive of mineral reserves. All figures have been rounded to the relative accuracy of the estimates. Summed amounts may not add due to rounding.
3. Mineral resource copper cut-off grades of 0.68% copper for underground mineral resources and 0.18% for open pit mineral resources. Mineral resources have been estimated using ordinary kriging inside 5m by 5m by 5m block sizes. The mineral resource estimates were prepared in accordance with CIM Standards and CIM Guidelines, using geostatistical and/or classical methods, plus economic and mining parameters appropriate to the deposit.

Mineral resources which are not mineral reserves do not have a demonstrated economic viability.

Table 6-4: 2018 Mineral Reserve Estimate

Mineral Reserves	Category	Tonnage (000 tonnes)	Grade (Cu %)	Contained Cu (000 tonnes)
Pilar UG Mine	Proven	6,969	1.71	119.3
	Probable	3,998	1.74	69.4
Vermelhos UG Mine	Proven	3,394	3.30	112.1
	Probable	528	2.36	12.5
Vermelhos West OP	Proven	815	0.70	5.7
	Probable	269	0.69	1.9
Surubim Mine	Proven	2,130	0.95	20.2
	Probable	3	0.80	0.0
R22W OP	Proven	283	0.53	1.5
	Probable	47	0.46	0.2
Total	**Proven**	**13,591**	**1.90**	**258.8**
	Probable	**4,846**	**1.73**	**84.0**
	Proven & Probable	**18,437**	**1.86**	**342.8**

1. Mineral reserve effective date of August 1, 2018.
2. All figures have been rounded to the relative accuracy of the estimates. Summed amounts may not add due to rounding.
3. Mineral reserve estimates were prepared in accordance with the CIM Standards and the CIM Guidelines, using geostatistical and/or classical methods, plus economic and mining parameters appropriate for the deposit.
4. Mineral reserves are based on a long-term copper price of US$2.75 per lb, and a USD:BRL foreign exchange rate of 3.20. Mineral reserves are the economic portion of the Measured and Indicated mineral resources. Inferred mineral resources, where unavoidably included within a defined mining shape, have been included in the mineral reserves estimate at zero grade.
5. Mineral reserve estimates include mining dilution at zero grade.
6. Mining dilution and recovery factors vary for specific mineral reserve sources and are influenced by factors such as deposit type, deposit shape, stope orientation and selected mining method.

6.1.3 2019 Mineral Resource and Reserve Estimate

In 2019, Ero Copper released an updated mineral resources and mineral reserves estimate for the mineral deposits of the Curaçá Valley in a report titled “2019 Updated Mineral Resources and Mineral Reserves Statements of Mineração Caraíba’s Vale do Curaçá Mineral Assets, Curaçá Valley”, dated November 25, 2019 with an effective date of September 18, 2019, prepared by Rubens José De Mendonça, MAusIMM, of Planminas, Porfirio Cabaleiro Rodrigues, FAIG, Leonardo de Moraes Soares, MAIG, and Bernardo Horta de Cerqueira Viana, FAIG, all of GE21 (the “2019 Technical Report”). Each of Rubens José De Mendonça, MAusIMM, Porfirio Cabaleiro Rodrigues, FAIG, Leonardo de Moraes Soares, MAIG, and Bernardo Horta de Cerqueira Viana, FAIG was a “qualified person” and “independent” of the Company within the meanings of NI 43-101.

The detailed economic, geotechnical and engineering parameters used for the Mineral Reserves estimates are described in detail in the 2019 Technical Report. The 2019 historical mineral resource and mineral reserve estimate has been provided for reference purposes only. Ero Copper is not treating this 2019 estimate as current mineral resources or mineral reserves.

Table 6-5: 2019 Mineral Resource Estimate

Mineral Resources	Category	Tonnage (000 tonnes)	Grade (Cu %)	Contained Cu (000 tonnes)
Pilar District, Underground	Measured	19,155	1.83	351
	Indicated	14,260	1.36	194
	Measured & Indicated	**33,414**	**1.63**	**546**
	Inferred	7,456	1.17	87
Vermelhos District, Underground	Measured	3,513	3.25	114
	Indicated	2,875	1.22	35
	Measured & Indicated	**6,388**	**2.33**	**149**
	Inferred	9,122	0.90	83
Surubim District, Underground	Measured	2,809	1.03	29
	Indicated	2,104	0.92	19
	Measured & Indicated	**4,913**	**0.98**	**48**
	Inferred	5,501	0.89	49
Total Resources, Underground	Measured	25,476	1.94	494
	Indicated	19,239	1.29	249
	Measured & Indicated	**44,715**	**1.66**	**743**
	Inferred	22,079	0.99	219
Pilar District, Open Pit	Measured	2,841	0.49	14
	Indicated	462	0.44	2
	Measured & Indicated	**3,303**	**0.48**	**16**
	Inferred	1,276	0.45	6
Vermelhos District, Open Pit	Measured	4,464	0.63	29
	Indicated	14,521	0.62	72
	Measured & Indicated	**18,985**	**0.53**	**101**
	Inferred	1,397	0.72	10
Surubim District, Open Pit	Measured	2,217	0.80	18
	Indicated	2,2401	0.68	16
	Measured & Indicated	**4,618**	**0.74**	**34**
	Inferred	1,452	0.49	7
Total Resources, Open Pit	Measured	9,522	0.64	61
	Indicated	17,384	0.52	91
	Measured & Indicated	**26,907**	**0.56**	**151**
	Inferred	4,125	0.56	23

1. Mineral resource effective date varies by deposit, with an effective date of July 9, 2019, except for Vermelhos N8/N9 (July 31, 2019) and Baraúna and Siriema (September 15, 2019).
2. Presented mineral resources inclusive of mineral reserves. All figures have been rounded to the relative accuracy of the estimates. Summed amounts may not add due to rounding. Mineral resources which are not mineral reserves do not have demonstrated economic viability.
3. Mineral resources have been modeled within a 0.20% copper grade shell using a 0.68% copper cut-off grade for underground deposits and a 0.18% copper cut-off grade for open pit deposits. Mineral resources have been estimated using ordinary kriging inside 5m by 5m by 5m block sizes. The mineral resource estimates were prepared in accordance with the CIM Standards and the CIM Guidelines, using geostatistical and/or classical methods, plus economic and mining parameters appropriate to the deposit.

Table 6-6: 2019 Mineral Reserve Estimate

Mineral Reserves	Category	Tonnage (000 tonnes)	Grade (Cu %)	Contained Cu (000 tonnes)
Pilar District, Underground	Proven	6,339	1.54	98
	Probable	7,678	1.37	105
Vermelhos District, Underground	Proven	3,787	2.57	97
	Probable	1,269	1.24	16
Surubim District, Underground	Proven	1,875	0.91	17
	Probable	269	0.93	2
Total, Underground	**Proven**	**12,001**	**1.77**	**212**
	Probable	**9,126**	**1.35**	**123**
	Proven & Probable	**21,127**	**1.59**	**335**
Pilar District, Open Pit	Proven	1,623	0.42	7
	Probable	328	0.46	2
Vermelhos District, Open Pit	Proven	3,992	0.67	27
	Probable	9,558	0.56	53
Surubim District, Open Pit	Proven	798	1.03	8
	Probable	548	0.81	4
Total, Open Pit	**Proven**	**6,408**	**0.65**	**42**
	Probable	**10,434**	**0.57**	**59**
	Proven & Probable	**16,843**	**0.60**	**101**

1. Mineral Reserve effective date of September 18, 2019.
2. All figures have been rounded to the relative accuracy of the estimates. Summed amounts may not add due to rounding.
3. Mineral Reserve estimates were prepared in accordance with the CIM Standards and the CIM Guidelines, using geostatistical and/or classical methods, plus economic and mining parameters appropriate for the deposit.
4. Mineral Reserves are based on a long-term copper price of US$2.75 per lb, and a USD:BRL foreign exchange rate of 3.70. Mineral reserves are the economic portion of the Measured and Indicated mineral resources. Inferred mineral resources, where unavoidably included within a defined mining shape, have been included in the mineral reserves estimate at zero grade.
5. Mineral reserve estimates include mining dilution at zero grade.
6. Mining dilution and recovery factors vary for specific mineral reserve sources and are influenced by factors such as deposit type, deposit shape, stope orientation and selected mining method.

6.1.4 2020 Mineral Resource and Reserve Estimate

In 2020, Ero Copper released an updated mineral resources and mineral reserves estimate for the mineral deposits of the Curaçá Valley in a report titled “2020 Updated Mineral Resources and Mineral Reserves Statements of Mineração Caraíba’s Vale do Curaçá Mineral Assets, Curaçá Valley”, dated January 14, 2021 with an effective date of October 1, 2020, prepared by Porfírio Cabaleiro Rodriguez, FAIG, Bernardo Horta de Cerqueira Viana, FAIG, Paulo Roberto Bergmann, FAusIMM, Fábio Valério Câmara Xavier, MAIG, Dr. Beck Nader, FAIG and Dr. Augusto Ferreira Mendonça, RM SME (the “2020 Technical Report”), each a “qualified person” and “independent” of the Company within the meanings of NI 43-101.

The detailed economic, geotechnical and engineering parameters used for the Mineral Reserves estimates are described in detail in the 2020 Technical Report. The 2020 historical mineral resource and mineral reserve estimate has been provided for reference purposes only. Ero Copper is not treating this 2020 estimate as current mineral resources or mineral reserves.

Table 6-7: 2020 Underground Mineral Resources

Underground Mine / Deposit	Classification	Tonnage (000 tonnes)	Grade (Cu %)	Cu Contained (000 tonnes)
Deepening Extension Zone, Pilar Mine *(Pilar Mine below Level -965)*	Measured	-	-	-
	Indicated	7,527	1.86	140.0
	Measured & Indicated	**7,527**	**1.86**	**140.0**
	Inferred	4,476	2.12	94.8
Pilar Mine Ex-Deepening Extension Zone *(Pilar Mine above Level -965)*	Measured	26,829	1.50	401.3
	Indicated	13,991	1.11	154.8
	Measured & Indicated	**40,820**	**1.36**	**556.0**
	Inferred	12,790	0.87	111.6
Pilar District, Other Underground *(R75, Sucuarana)*	Measured	816	0.72	5.9
	Indicated	1,045	0.89	9.3
	Measured & Indicated	**1,861**	**0.82**	**15.2**
	Inferred	742	0.60	4.5
Pilar District Underground Total	Measured	27,645	1.47	407.2
	Indicated	22,563	1.35	304.2
	Measured & Indicated	**50,208**	**1.42**	**711.3**
	Inferred	18,008	1.17	210.9
Vermelhos Mine	Measured	3,389	2.80	94.9
	Indicated	4,514	1.19	53.7
	Measured & Indicated	**7,903**	**1.88**	**148.6**
	Inferred	4,128	0.86	35.5
Vermelhos District, Other Underground *(Siriema, N8/N9)*	Measured	1,465	0.79	11.6
	Indicated	4,153	0.80	33.4
	Measured & Indicated	**6,676**	**0.91**	**61.1**
	Inferred	7,689	0.88	67.9
Vermelhos District Underground Total	Measured	4,402	2.33	102.4
	Indicated	8,667	1.00	87.1
	Measured & Indicated	**13,069**	**1.45**	**189.5**
	Inferred	13,781	0.93	127.6
Surubim District, Other Underground *(Surubim, C12, Cercado Velho, Lagoa da Mina, Terra do Sal)*	Measured	1,841	0.96	17.7
	Indicated	3,062	0.96	29.3
	Measured & Indicated	**4,904**	**0.96**	**47.0**
	Inferred	4,482	0.92	41.3
Surubim District Underground Total	Measured	1,841	0.96	17.7
	Indicated	3,062	0.96	29.3
	Measured & Indicated	**4,904**	**0.96**	**47.0**
	Inferred	4,482	0.92	41.3
Total, Underground	Measured	33,888	1.56	527.3
	Indicated	34,292	1.23	420.6
	Measured & Indicated	**68,180**	**1.39**	**947.9**
	Inferred	36,271	1.05	379.8

Underground Mineral Resource Notes:

1. Mineral resource effective date varies by deposit, with an effective date of August 8, 2020 except for P1P2 (July 24, 2020), R75 (July 9, 2019) and Suçuarana (July 3, 2020) within the Pilar District; Vermelhos Mine (July 29, 2020), Siriema and N8 (July 4, 2020), N9 (July 9, 2019) within the Vermelhos District; and Surubim District effective date of July 9, 2019 except for Terra do Sal (July 3, 2020).
2. Presented mineral resources inclusive of mineral reserves. All figures have been rounded to the relative accuracy of the estimates. Summed amounts may not add due to rounding.
3. Mineral resources have been constrained within newly developed 3D lithology models applying a 0.45% and 0.20% copper grade envelope for high and marginal grade, respectively. Within these envelopes, mineral resources for underground deposits were constrained using varying stope dimensions of up to 20m by 10m by 35m applying a 0.51% copper cut-off grade, as well as a 0.32% copper marginal cut-off grade. Mineral resources have been estimated using ordinary kriging inside 5m by 5m by 5m block sizes. The mineral resource estimates were prepared in accordance with the CIM Standards, and the CIM Guidelines, using geostatistical and/or classical methods, plus economic and mining parameters appropriate to the deposit.

Mineral resources which are not mineral reserves do not have demonstrated economic viability.

Table 6-8: 2020 Open Pit Mineral Resources

Open Pit Mine / Deposit	Classification	Tonnage (000 tonnes)	Grade (Cu %)	Cu Contained (000 tonnes)
Pilar District, Open Pit *(R22W, Suçuarana, R75)*	Measured	3,172	0.49	15.4
	Indicated	365	0.45	1.6
	Measured & Indicated	**3,537**	**0.48**	**17.0**
	Inferred	351	0.47	1.6
Pilar District Open Pit Total	Measured	3,172	0.49	15.4
	Indicated	365	0.45	1.6
	Measured & Indicated	**3,537**	**0.48**	**17.0**
	Inferred	351	0.47	1.6
Siriema Deposit	Measured	-	-	-
	Indicated	2,956	0.92	27.1
	Measured & Indicated	**2,956**	**0.92**	**27.1**
	Inferred	187	0.99	1.9
N8/N9 Deposits	Measured	7,420	0.55	41.1
	Indicated	13,562	0.48	64.9
	Measured & Indicated	**20,982**	**0.51**	**106.0**
	Inferred	858	0.40	3.4
Vermelhos North	Measured	-	-	-
	Indicated	-	-	-
	Measured & Indicated	**-**	**-**	**-**
	Inferred	121	0.88	1.1
Vermelhos District Open Pit Total	Measured	7,420	0.55	41.1
	Indicated	16,518	0.56	92.0
	Measured & Indicated	**23,938**	**0.56**	**133.1**
	Inferred	1,166	0.55	6.4
Surubim Mine	Measured	2,340	0.93	21.7
	Indicated	73	0.84	0.6
	Measured & Indicated	**2,413**	**0.92**	**22.3**
	Inferred	3	0.80	0.0
C12 Deposit	Measured	1,272	0.94	11.9
	Indicated	942	0.70	6.6
	Measured & Indicated	**2,214**	**0.84**	**18.6**
	Inferred	154	0.56	0.9
Surubim District, Other Open Pit *(Cercado Velho, Lagoa da Mina, Terra do Sal)*	Measured	1,067	0.61	6.5
	Indicated	1,436	0.67	9.6
	Measured & Indicated	**2,503**	**0.64**	**16.1**
	Inferred	1,255	0.15	1.9
Surubim District Open Pit Total	Measured	4,678	0.86	40.1
	Indicated	2,452	0.69	16.8
	Measured & Indicated	**7,130**	**0.80**	**56.9**
	Inferred	1,413	0.20	2.8
Total, Open Pit	Measured	15,270	0.63	96.6
	Indicated	19,335	0.57	110.5
	Measured & Indicated	**34,605**	**0.60**	**207.0**
	Inferred	2,930	0.37	10.8

Open Pit Mineral Resource Notes:

1. Mineral resource effective date varies by deposit, with an effective date of August 8, 2020, except for Suçuarana (July 3, 2020), R22W and R75 (July 9, 2019) within the Pilar District; Siriema and N8 (July 4, 2020), N9 and Vermelhos North (July 9, 2019) within the Vermelhos District; and an effective date of July 9, 2019, for the Surubim District except Terra do Sal (July 3, 2020).
2. Presented mineral resources inclusive of mineral reserves. All figures have been rounded to the relative accuracy of the estimates. Summed amounts may not add due to rounding.
3. Mineral resources have been constrained within newly developed 3D lithology models using a 0.21% copper cut-off grade for open pit deposits. Mineral resources have been estimated using ordinary kriging inside 5m by 5m by 5m block sizes. The mineral

resource estimates were prepared in accordance with the CIM Standards, and the CIM Guidelines, using geostatistical and/or classical methods, plus economic and mining parameters appropriate to the deposit.

Mineral resources which are not mineral reserves do not have demonstrated economic viability.

Table 6-9: 2020 Mineral Reserves

	Classification	Tonnage (000 tonnes)	Grade (Cu %)	Cu Contained (000 tonnes)
Reserves, Underground				
Deepening Extension Zone, Pilar UG Mine	Proven	-	-	-
(Pilar Mine below Level -965)	Probable	7,432	1.68	125
Pilar UG Mine Ex-Deepening Extension Zone	Proven	5,835	1.41	82
(Pilar Mine above Level -965)	Probable	7,725	1.09	84
Vermelhos UG Mine	Proven	3,359	2.09	70
	Probable	1,844	1.23	23
Surubim District, Underground	Proven	513	1.09	6
(C12 Underground)	Probable	515	0.83	4
Total Proven, Underground		**9,707**	**1.63**	**158**
Total Probable, Underground		**17,516**	**1.34**	**236**
Total Proven & Probable, Underground		**27,224**	**1.45**	**394**
Reserves, Open Pit				
N8/N9 OP Mine	Proven	7,355	0.55	40
(Vermelhos District)	Probable	8,012	0.54	44
Siriema OP Mine	Proven	-	-	-
(Vermelhos District)	Probable	3,011	0.88	26
Surubim District, Open Pit	Proven	2,778	0.82	23
(Surubim & C12)	Probable	123	0.55	1
Suçuarana South OP Mine	Proven	1,623	0.42	7
(Pilar District)	Probable	328	0.46	2
Total Proven, Open Pit		**11,757**	**0.60**	**70**
Total Probable, Open Pit		**11,474**	**0.63**	**72**
Total Proven & Probable, Open Pit		**23,230**	**0.61**	**142**

Mineral Reserve Notes:

1. Mineral reserve effective date of October 1, 2020.
2. All figures have been rounded to the relative accuracy of the estimates. Summed amounts may not add due to rounding.
3. Mineral reserve estimates were prepared in accordance with the CIM Standards, and the CIM Guidelines, using geostatistical and/or classical methods, plus economic and mining parameters appropriate for the deposit. Mineral reserves are based on a long-term copper price of US$2.75 per pound (“lb”), and a USD:BRL foreign exchange rate of 4.27, except for the C12 (Surubim District) and Suçuarana (Pilar District) open pit mines, whose design was not changed since 2019, and continued to assume a 3.70 USD:BRL foreign exchange rate. Mineral reserves are the economic portion of the Measured and Indicated mineral resources. Mining dilution and recovery factors vary for specific mineral reserve sources and are influenced by factors such as deposit type, deposit shape, stope orientation and selected mining method. Inferred resource blocks, where unavoidably mined, were assigned zero grade. Dilution occurring from Measured & Indicated resource blocks was assigned grade based upon the mineral resource grade of the blocks included in the dilution envelope.

7 GEOLOGICAL SETTING AND MINERALIZATION

7.1 REGIONAL GEOLOGY

The Caraíba Operation's active mining and development projects are within the Curaçá Valley mafic-ultramafic complex, located within the Curaçá high-grade metamorphic gneissic terrain, a part of the Salvador-Curaçá orogen, a northern extension of the Atlantic Coast Granulite Belt in the São Francisco Craton. The São Francisco Craton is made up of four Archean to Paleoproterozoic crustal segments ranging in age from 3.4 billion years ("Ga") in the western Gavião block of tonalite-trondhjemite-granodiorites ("TTG's"), to 3.0 Ga in the Jequié and Serrinha blocks comprising orthogneiss and migmatites and rift-related volcanic and sedimentary rocks dated between 2.5 to 2.1 Ga. The Itabuna-Salvador-Curaçá belt is characterized by deformed TTG's dated at 2.6 Ga (figure below). A suite of low-K calc-alkaline plutonic rocks intruded the Itabuna–Salvador–Curaçá belt and extends from southeast Bahia through Salvador along the Atlantic coast and then inland to northeast Bahia. The Proterozoic Transamazonian orogenesis occurred at approximately 2.0 Ga when the four crustal segments that make up the São Francisco Craton collided, resulting in mountain building and a regional metamorphic event (Barbosa and Sabatí, 2004).

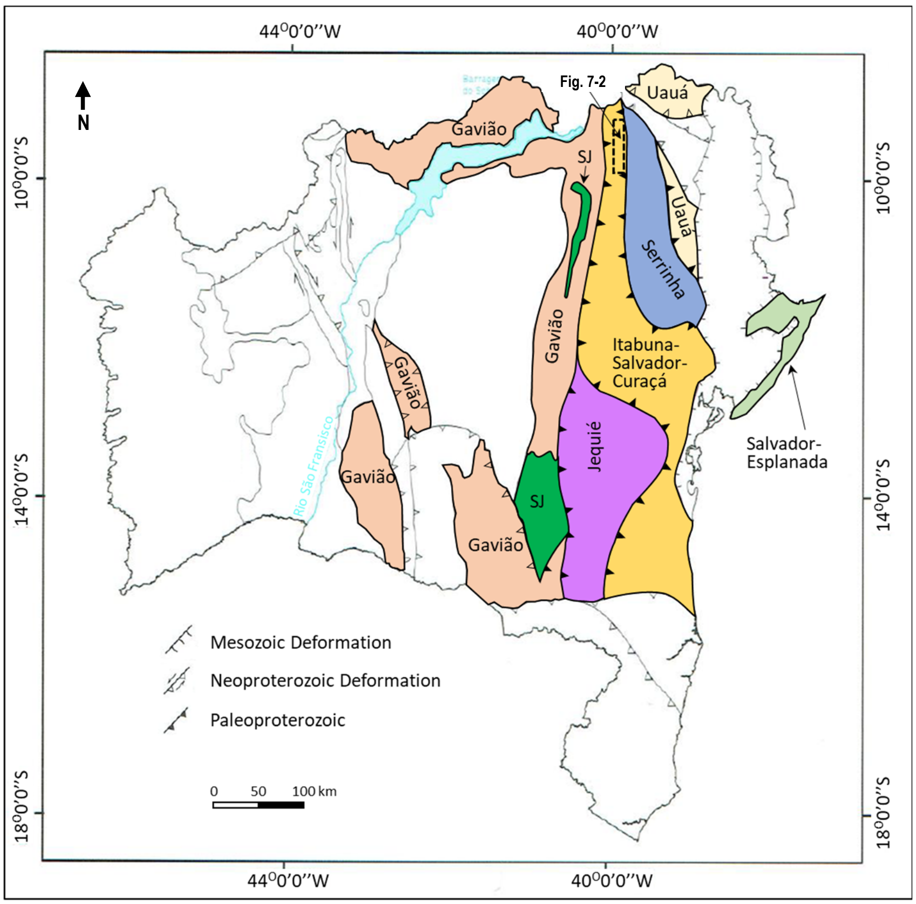


Figure 7-1: Simplified map showing the Archean to Paleoproterozoic Gaviao, Serrinha, Jequié and Itubuna-Salvador-Curaça blocks. Modified from Silveira (2015). The approximate location of Figure 7-2 is also shown.

The Curaçá high-grade gneiss terrain hosts copper-bearing mafic-ultramafic rocks that were intruded into a deformed supracrustal sequence now represented by granulite facies tonalite, granodiorite and banded gneiss (Caraíba Gneiss), by banded gneisses (Surubim Gneiss), by graphite gneiss, possible iron formation, calc-silicate rocks and alumina-rich gneisses (Bom Despacho Banded Gneiss), and by biotite hornblende-bearing quartz-feldspar gneiss with minor amphibolites and quartzites (Arapuá Banded Gneiss) (Oliveira,1995, Oliveira et al., 2004). The Curaçá Valley is bordered to the East by the Itiúba syenite (Figure 7-2)

Mafic-ultramafic units occur within the charnockite and biotite gneisses as lenses or sills with thicknesses generally less than 50m. The mafic-ultramafic lenses are composed of dunite, websterite, peridotite, hypersthenite (pyroxenite), norite, gabbro-norite, gabbro and rarely, anorthosite that are less than 1m thick. Extensive pyroxenite has been described within the mafic-ultramafic lenses at the Caraíba Mine and the Vermelhos UG Mine, whereas to date pyroxenite reportedly occurs as a minor part of the mafic-ultramafic lenses at the R22W Mine, Surubim Mine and the Angicos Mine. Biotite schist and amphibolite occur in shear zones, in contact with granite, or as isolated lenses within gneiss.

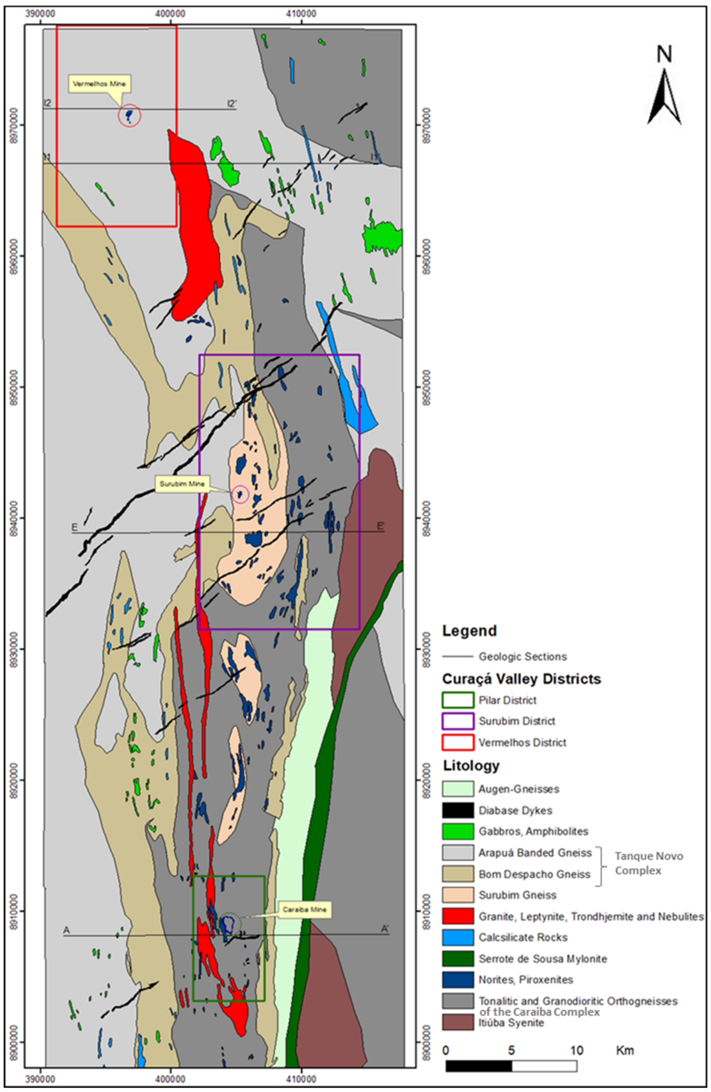


Figure 7-2: Regional geologic map of the Curaçá Valley and location of the Caraíba mine, Surubim, OP mine, Vermelhos UG mine. Note location of regional cross sections (AA', EE', I1I1' and I2I2') (prepared by Frugis 2017, modified by Ero Brasil, 2018)

7.2 LOCAL GEOLOGY

The geology of the north portion of the Curaçá Valley is divided into two major lithological complexes namely the Tanque Novo-Ipirá Complex to the west and the Caraíba Complex to the east. Several mafic-ultramafic intrusions and paleoprotozoic granitoid bodies intrude the deformed rock units of both complex.

The Caraíba Complex is composed of orthogneisses and migmatites metamorphosed to upper amphibolite and granulite facies (Figure 7-3). More specifically, the rock units are represented by hypersthene-gneiss tonalites, hypersthene-gneiss diorites, hypersthene-gneiss trondhjemites, monzodioritic gneisses and quartz diorites (Teixeira, 1997). Geochemical studies suggest that these rocks are a product of recycled igneous crust (active continental margin) with varied levels of participation of sedimentary material (Teixeira, 1997). Igneous crystals of zircon in enderbitic orthogneiss yielded an age of 2695 Ma and an age of 2634 Ma from the charnockitic orthogneiss. Peak granulitic metamorphism is estimated at 2072 Ma (Silva et al., 1997).

Figure 7-3: Orthogneissic migmatite - Amphibolite-clinopyroxene-biotite gneiss migmatite with magnetite (Frugis, 2017)

The Tanque Novo Complex was divided originally into two formations, namely the Bom Despacho Formation located immediately to the west of the Caraíba Complex and the Arapuá Formation located further to the west (Figure 7-4 and Figure 7-5). The Bom Despacho Formation is composed of quartz-feldspathic gneiss containing biotite-rich zones. zones and amphibolite units that are locally associated with and overprint ultramafic units (Figure 7-4). The iron formations that were previously mapped in the Bom Despacho Formation, and were used to qualify this formation as paragneiss, have been recently reinterpreted by Ero Brasil's geologists as weathered and altered ultramafic units comprising iron oxides with residual silica. The origin and characteristics of the Bom Despacho Formation are currently under review by Ero Brasil geologists as the units of this formation could corresponds to the continuity to the west of the Caraíba Complex units. The rock units are crosscut by many pegmatite dikes and intruded by granitic bodies.

Figure 7-4: Bom Despacho Gneiss: Qtz-feldspathic Gneiss with intercalated sub-meter amphibolite bands and greenish diopsíde (Frugis, 2017)

The Arapuá Formation is composed of quartz-feldspathic gneiss that is phlogopite-poor and presents rhythmic bands of amphibolite. The rock units of this formation are cut by pegmatite dikes and intruded by granitic bodies. It differs from Bom Despacho Formation by the absence of calc-silicate rocks and possible iron formation.

Figure 7-5: Arapuá Gneiss - Quartzo-feldspathic gneiss and levels of phlogopite-plagioclase-quartz gneiss with bands of amphibolite (Frugis, 2017)

The Mafic-Ultramafic bodies were intruded into the Caraíba Complex, the Surubim gneiss, as well as into the Tanque Novo complex. The bodies are generally elongated N-S and vary in geometry and dimension. In some cases (e.g., Toboggan and Sombrero bodies at the Vermelhos Mine), the mineralized mafic-ultramafic units are shallowly dipping and occupy a fold in the gneiss (Figure 7-6). Historically, most of the mafic-ultramafic bodies were identified as norite, gabbro, and pyroxenite but recent detailed underground mapping and core logging by Ero Brasil geologists led to the identification of dunite, peridotite, websterite, and anorthosite. Some of the Mafic-Ultramafic bodies contain sulphide copper mineralization mainly in the form of chalcopyrite and bornite, local nickel mineralization in pentlandite as well as Platinum Group Element ("PGE") mineralization. The copper mineralization is also associated with tellurides, abundant chromite, magnetite, and other oxides/spinels. Recent field and underground observations indicate that at least some norite and gabbro units are foliated and pre-date the pyroxenite intrusions. Igneous crystals of zircon in one norite unit intruded by pyroxenite, located in the northern part of the Pilar pit, yielded two main populations at 2580 ± 10 million years ("Ma") and 2103 ± 23 Ma respectively (Oliveira et al., 2004). The 2580 Ma age represents the age of the norite whereas metamorphic overgrowths on zircon result that returned a date of 2103 ± 23 Ma, interpreted to be a high-grade metamorphic event or could alternately be interpreted as the age of the pyroxenite dykes. Additional detailed mapping, geochemical characterization work, and additional age dating are needed to document the exact significance of the age dates.

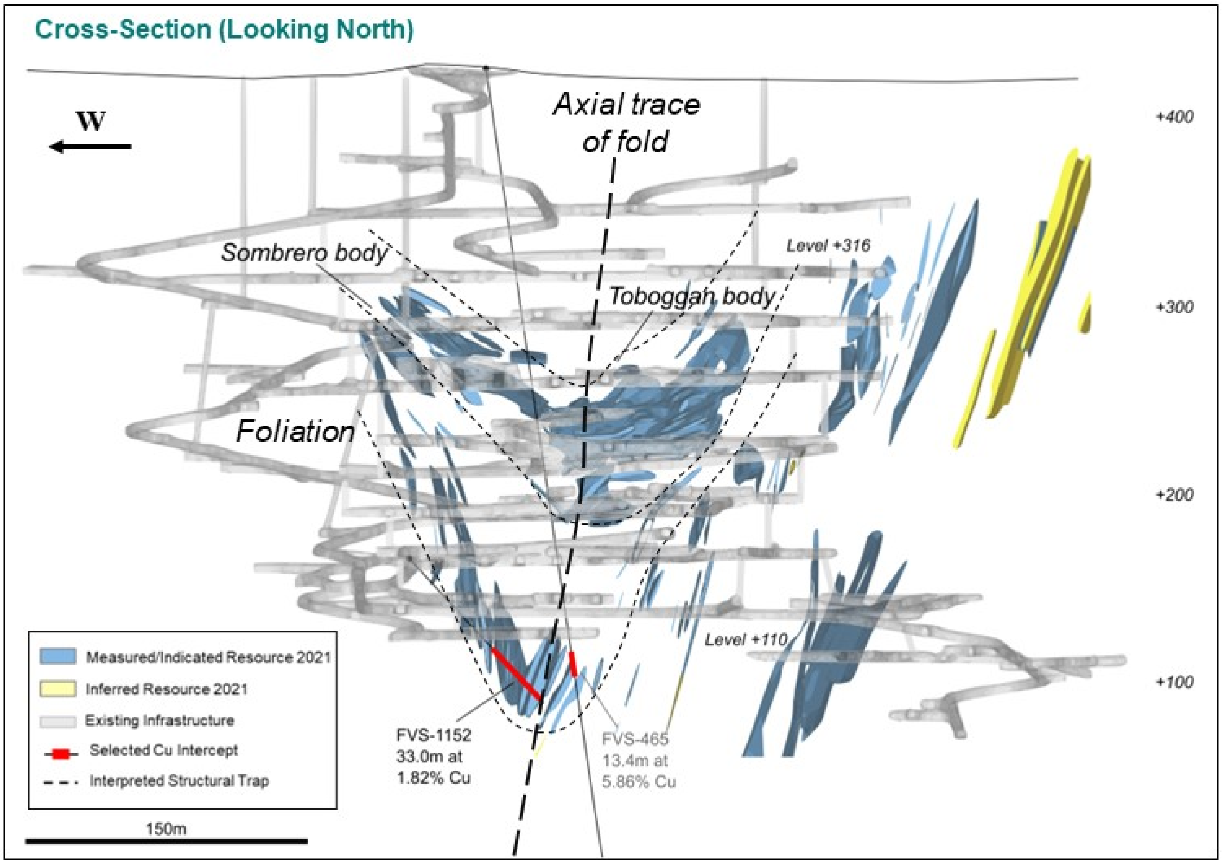


Figure 7-6: Vertical Cross-section of Toboggan and Sombrero mineralized bodies in ultramafic rock units from the Vermelhos Mine showing shallowly dipping mineralized zones associated with fold hinges in the gneiss (Ero Brasil, 2021)

The Augen Gneiss is a grey unit displaying a mylonitic (nebulitic) anastomosed fine foliation. It occurs with mafic units and pockets of pegmatitic rocks with monolithic foliation and represent a late feature in the valley (Figure 7-8).

Syn to late and post-tectonic granitoids of various dimensions were intruded into the gneissic rock units (Figure 7-9) (Teixeira et al., 2010). The Itiúba Syenite is approximately 150 km in length, has a N-S orientation and is spatially associated with a NNE-striking shear zone. Zircon crystals yielded a SHRIMP U-Pb zircon age of 2084 ± 9 Ma (Oliveira et al., 2004).

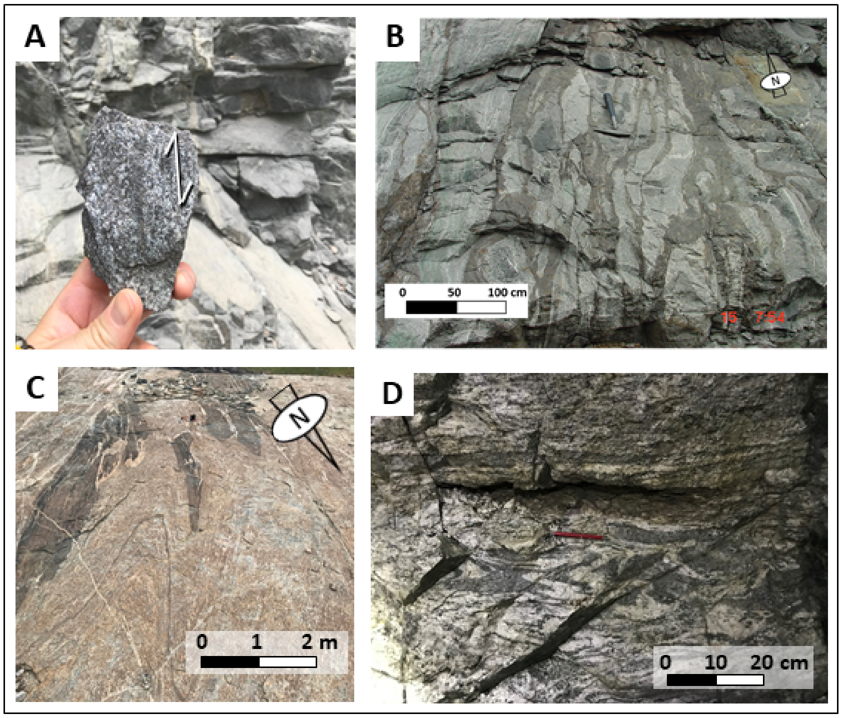


Figure 7-7: Photos of deformed norite and gabbro units, locally injected by pyroxenite dykes. A) Foliated norite in Pilar open pit, north wall, B) Pyroxenite dykes injecting foliated norite and gneiss, Pilar open pit, north wall, C) Deformed gabbro in gneiss at airport outcrop, D) deformed gabbro units in gneiss at Vermelhos mine (Ero Brasil, 2018)

Figure 7-8: Augen Gneiss – Grey mylonític (nebulític), granitic-gneiss with finely anastomosing, monolithic foliation (Frugis, 2017)

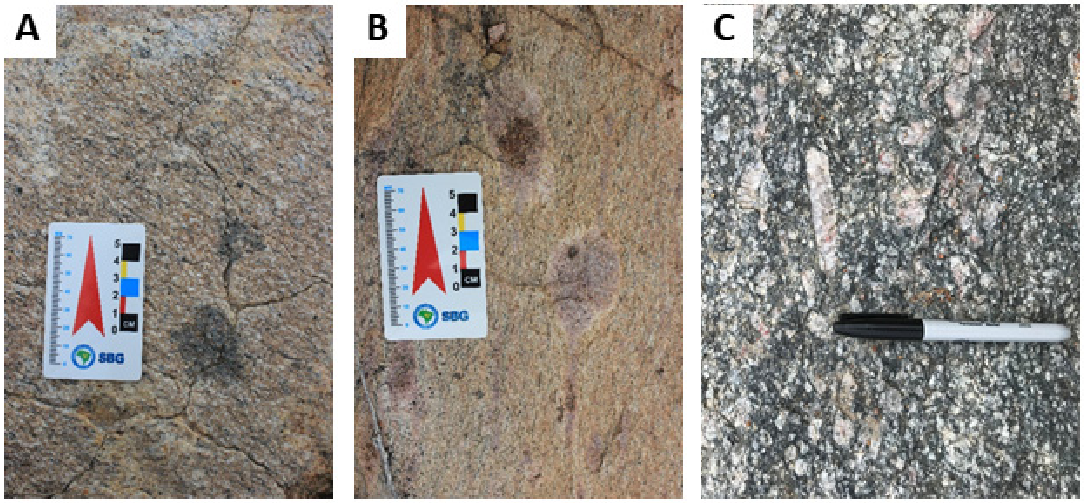
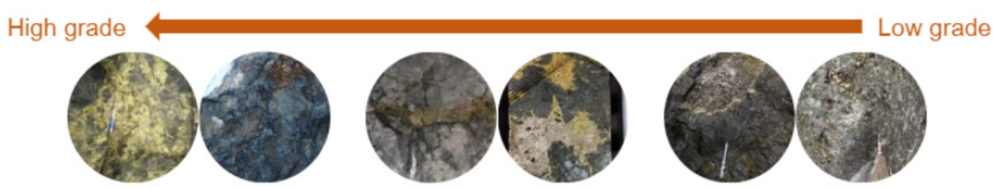


Figure 7-9: Granitoid or "Granite G3" – A) Reddish grey biotite granite containing tourmaline and B) Granite with garnet xenoliths and C) Itiúba syenite (Frugis, 2017)

7.3 MINERALIZATION

The style of mineralization in all known deposits of the valley correspond to sulphide dissemination, veins and stringers, and breccias (Figure 7-10). The higher-grade copper mineralization is generally associated with the sulphide breccia. Although the mineralization is spatially associated with the mafic-ultramafic units, there are frequent occurrences of copper mineralization for a few meters in the adjacent gneiss units.



Type	Sulphide breccias	Sulphide veins and stringers	Disseminated and blebby sulphides
Key Minerals	Chalcopyrite, bornite-rich, +/- pentlandite	Chalcopyrite, bornite, pyrrhotite, pentlandite	Chalcopyrite, bornite-rich, pentlandite
Geometry	Irregular, flat to vertical, in mafic-ultramafic bodies and gneiss	Irregular/planar, various orientations, in mafic-ultramafic and gneiss	Irregular zones in mafic-ultramafic bodies and gneiss
Geochemistry	Strong Cu +/- Te +/- Ni, Pt, Pd	Strong Cu, Ni, Te, Pt, Pd	Strong Cu +/- Te +/- Ni, Pt, Pd
Geophysics	Moderate-high EM conductors; locally magnetic	Weak EM conductors; IP response; locally magnetic	Low to high IP response

Figure 7-10: Characteristics of Mineralization within the Curaça Valley Deposits (Ero Brasil, 2022)

7.4 REGIONAL STRUCTURE

The Cu-rich deposits are hosted within irregular-shaped intrusive bodies of pyroxenite (hypersthenite) and minor gabbro-norite that were intruded into granulite facies gneiss and migmatite at the northern margin of the São Francisco Craton. The geometry of the pyroxenite intrusions has been interpreted as either deformed sill-like bodies (Silva et al, 1996), irregular shaped intrusion into an anastomosing shear zone (Caraíba Exploration team and Frugis, 2017), or more recently as later intrusions injected into deformed gneiss (Desrochers, 2019).

The gneiss units in the valley have experienced at least 3 phases of deformation (Silva, 1984). The first phase of deformation produced a composite tectonic foliation (S_0-S_1) characterized by centimetric quartz, k-spar and plagioclase bands alternating with centimetric hornblende, plagioclase, biotite, and pyroxene bands. The S_0-S_1 foliation occurs frequently as centimetric intrafolial folds between the stronger S_2 foliation planes (Figure 7-11).

The second phase of deformation (D_2) produced a variably oriented gneissic foliation (S_2) that trends NW-SE to E-W to NE-SW with shallow northerly or southerly dips depending on the sector in the valley. This S_2 foliation is mostly observed in segments where it is less affected by the D_3 event. It is locally well marked by alternating leucocratic and melanocratic centimetric bands. A series of deformed granodiorite and tonalite are interpreted to have been intruded during the D_2 deformation event (Silva, 1984).

The third phase of deformation (D_3) produced centimetric to kilometric scale, gentle to tight fold, striking NNW to NNE. The S_3 foliation is generally absent to only weakly developed. Where observed, it corresponds to a steep westerly dipping, northerly-striking, foliation comprising quartz-plagioclase, biotite, and hornblende that re-oriented the S_0-S_1 and S_2 foliation... The superposition of the D_2 and D_3 phases of deformation created interference pattern of the type 2 of Ramsay (1967) (Figure 7-12).

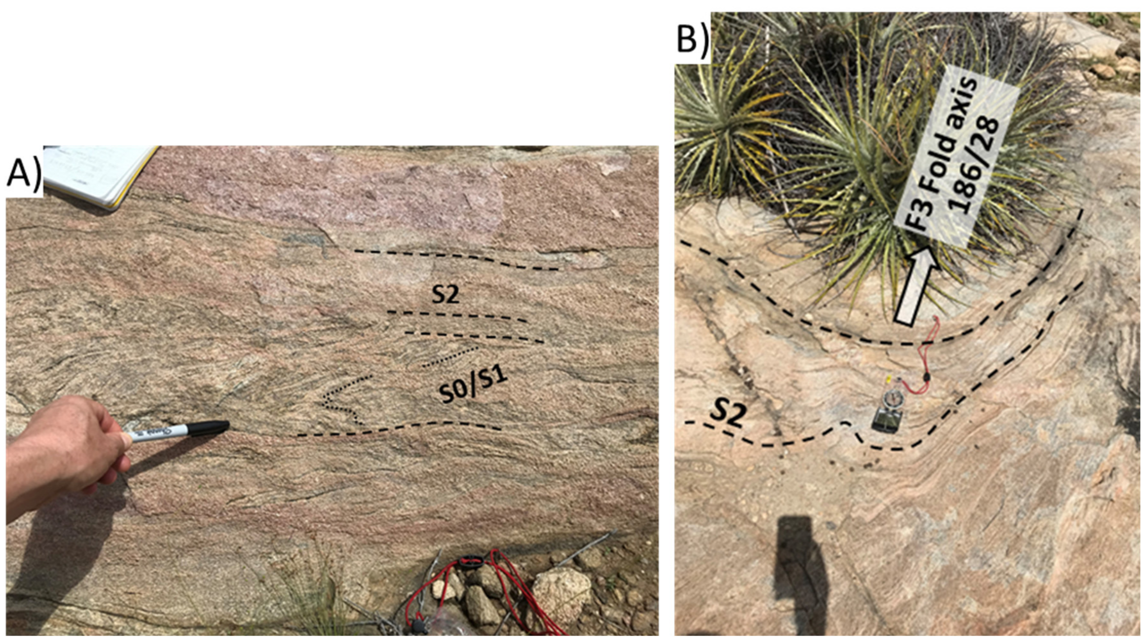


Figure 7-11: Outcrops of gneiss showing the tectonic foliations and folds. A) the composite S0-S1 foliation forms intrafolial folds between NW-striking S2 foliation planes; B) the S2 foliation is folded by F3 fold plunging gently southerly (Desrochers, 2019)

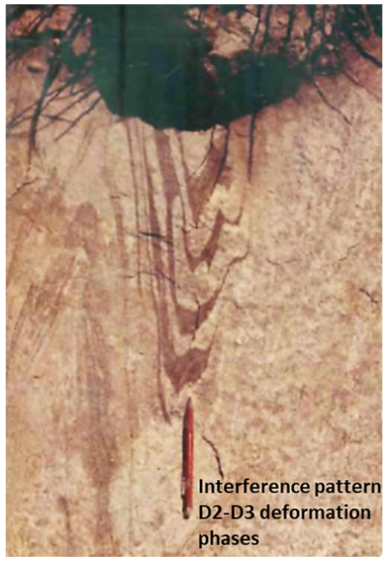


Figure 7-12: Interference pattern of type 2 (Ramsay, 1967) highlighted by the deformed mafic units. Photo from Silva (1984), airport outcrop, north of the Pilar UG Mine

Gabriela Frugis (2017) interpreted the geometry of structures in the northern portion of the Curaçá Valley as related to a transpressional flower structure characterized by west-vergent thrust faults to the west and east-verging thrusts to the east. Folds tend to be tighter with vergences to the east and to the west in the internal portions the flower structure.

A dextral shearing component is associated with the D_3 deformation. D_3 and associated S_3 exhibit anastomosed (directions that vary from NW-SE to the NE-SW) subvertical folding, with angles that vary from ~65 to 90 degrees plunging to the east and to the west where the steeper dips tend to concentrate in the center of the flower structure. D_2 and associated S_2 foliation is visible in the migmatitic gneiss outcrops where it occurs folded with sheared limbs that are transposed by the S_3 foliation.

D_4 is minor and causes flexures of the S_3 foliation from N-S towards NE-SW. Evidence of D_4 are visible in the north portion of the valley, near Vermelhos. The pyroxenite units appear to be late-tectonic as they are generally not foliated, except in shear zones, and were intruded into the folded gneiss sequence after the D3 deformation phase. The shape of the intrusions appears, at least in part, to be controlled by preexisting structures.

Further detail on observed foliation and fold orientations is outlined below:

Geologic Section AA' – Pilar District (Figure 7-13)

- S_3 subvertical foliation with NNE-SSW primary direction.
- S_2 foliation with medium angles, folded, with B axis constructed oriented to the NE (axis B measured oriented NE and to the South).
- Main vergence of the folds to the west within the flower structure.
- Towards the limits of the transpressional flower, folds are more open and with vertical axial planes.

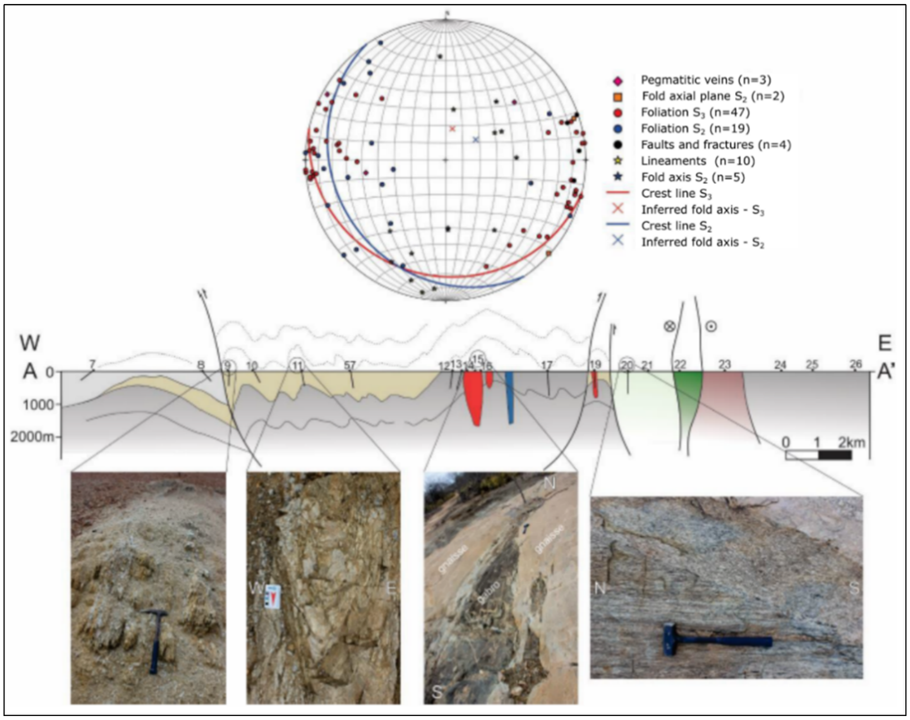


Figure 7-13: Geological section A-A' in the south portion of the Curaçá Valley (Frugis, 2017)

Geological Section E-E' – Surubim District (Figure 7-14)

- Tighter folds in the interior of a flower-like structure.
- Main vergence of the folds to the west.
- More open and smooth folds to the west of the flower-like structure.
- S_3 subvertical foliation with a principal NE-SW direction.
- S_2 fold foliation with B axis dipping to the SSW

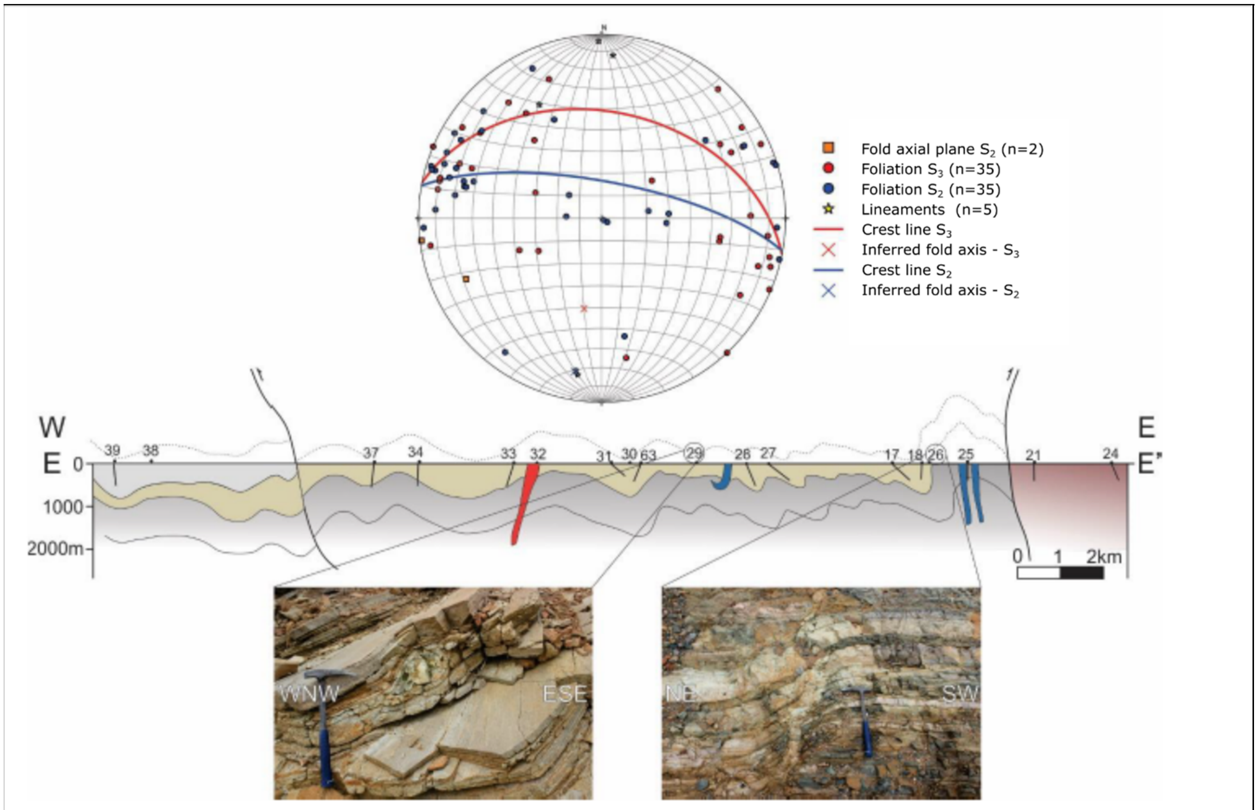


Figure 7-14: Geologic section E-E' in the central portion of the Curaçá Valley (Frugis, 2017)

Geologic Section I-I' – Vermelhos District (Figure 7-15)

Geologic Section I-I' is shown as two parallel EW cross sections: I1-I1' (to the south) and I2-I2' (to the north),

- Main vergence of the structures towards the west, with a few folds showing vergence to the east.
- S_3 foliation with a preferential direction to the NNE-SSW.
- Mineral lineation dipping preferentially to the S-SSE.
- Mylonitic foliation parallel to S_3.
- Here the Sergipe section unconformably overlies the Bom Despacho formation, of Salvador-Curaçá Orogen, probably in the form of klippe.

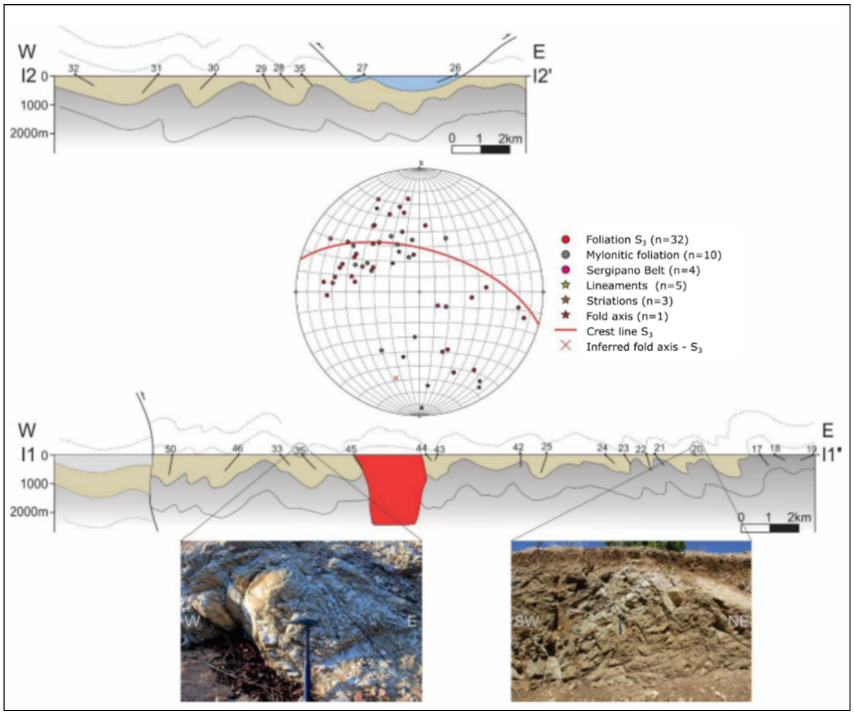


Figure 7-15: Geologic sections I1-I1' and I2-I2' in the north portion of the Curaçá Valley (Frugis, 2017)

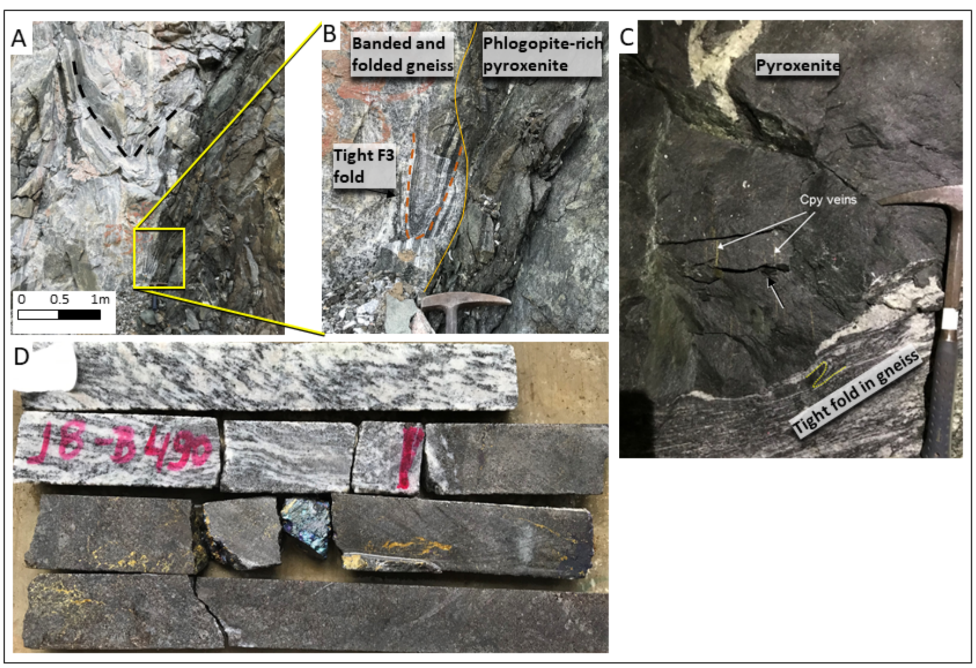


Figure 7-16: Contact relationships between pyroxenite dykes and folded gneiss. A) P3 folds crosscut at angle by the phlogopite-rich pyroxenite unit in the Suçuarana pit; B) detailed of the lower fold of figure A); C) unfoliated mineralized

pyroxenite cross-cutting a tight fold in gneiss, and D) mineralized pyroxenite dyke cross-cutting foliation in gneiss at high angle, Pilar mine (drillhole FC4989 at 289.0m) (Desrochers et al., 2019)

7.5 GEOCHRONOLOGY

Table 7-1 summarizes age dates obtained on samples from various units of the Curaçá Valley.

Silva et al. (1997) dated enderbitic orthogneiss (2695 ± 12 Ma), charnockites (2634 ± 19 Ma), and deformed norites (2580 ± 10 Ma) with U-Pb on zircon method (SHRIMP). These rock units represent the oldest rocks dated in the valley (also refer to Figure 7-17).

The first phase of deformation is estimated to have occurred between 2.35-2.28 Ga (Silva et al., 1996) and reached amphibolite facies as preserved in local boudins of metamorphosed mafic rocks. The second phase of deformation occurred around 2.25 Ga and was coeval with intrusions of G2 tonalite in the Curaçá valley (2248+-36 Ma, D'el-Rey Silva et al. 1996). The east-west gneissic foliation, including cordierite-sillimanite-garnet-biotite assemblage with local sapphirine, was developed at high temperature under granulite conditions (possibly as high as 900^{o}C; Barbosa et al., 2016). The third phase of deformation (D3) occurred around 2.10 Ga (2103+-23 Ma, Oliveira et al., 2004) during a continent-continent collision involving the Gavião, Jequié, and Serrinha blocks, and the Itabuna-Salvador-Curaçá belt. The northerly-trending D3 foliation is marked locally by biotite and hornblende which indicates amphibolite metamorphic conditions. The superposition of the D3 on D2 deformation produced fold interference patterns of type 2 (Ramsay, 1967).

The Itiuba syenite is located to the east of the Valley and was dated at 2084+-9 Ma (Oliveira et al., 2004). A later magmatic event includes the undeformed G3 granites at the Caraíba mine (2044.5 +- 2.5 Ma in Garcia, 2017), a pyroxenite unit within the Baraúna zone on the southern extent of the Pilar UG Mine (2056+-9.2 Ma in Garcia, 2017), and a norite at the Surubim mine (2047 +- 11 Ma in Garcia et al., 2018). Zircon from quartz-microcline metasomatite in Caraíba mine, which returned similar ages (2042 +- 15 Ma in Garcia, 2013), may represent partial melts related intrusion of orthopyroxenite and sulphide concentration or alteration events related to external fluids. The reported ages appear to reflect broadly contemporaneous mafic/ultramafic intrusions, partial melts or alteration related to their emplacement, and granites all of which cut fabrics related to the major deformation events in the gneiss. It is likely that this also represents the age of the primary Cu-Ni mineralization in the Curaçá valley.

Dating of phlogopite by Ar-Ar methods returned younger ages between 1.95 and 2.01 Ma (2011+-16 Ma and 1952+-15 Ma, Teixeira et al., 2010) that may reflect late alteration events, or cooling during initial exhumation. Late alteration may have introduced or remobilized copper but currently there is no direct evidence to document a specific event.

Table 7-1: Geochronologic synthesis of the Curaçá Valley and north portion of OISC (Orogeno Itabuna-Salvador-Curaçá). The ages of Vlach & Del Lama (2002) were extracted from Teixeira et al., 2010.

Synthesis of Geochronology of Vale do Curaçá and north portion of OISC						
Unit	**Lithology**	**Location of Sample**	**Method**	**Age Date**	**Interpretation**	**Author**
Caraíba Complex	Orthogneiss TTG	Mina da Caraíba	U-Pb SHRIMP	2695 ± 12 Ma	Magmatism	Silva et al., 1997
Caraíba Complex	Orthogneiss Charnockite	Mina da Caraíba	U-Pb SHRIMP	2634 ± 19 Ma	Magmatism	Silva et al., 1997
Caraíba Complex	Orthogneiss Granulite	São José de Jacuípe	U-Pb SHRIMP	2089 ± 11 Ma	Metamorphism	Silva et al., 1997
Ultramafic Bodies	Norite	Mina da Caraíba	U-Pb SHRIMP	2580 ± 10 Ma	Magmatism	Oliveira et al., 2004
Corpos ultramáficos	Norite	Mina da Caraíba	U-Pb SHRIMP	2103 ± 23 Ma	Metamorphism	Oliveira et al., 2004
Itiúba Syenite	Syenite	Itiúba	U-Pb SHRIMP	2084 ± 9 Ma	Magmatism	Oliveira et al., 2004
Caraíba Complex	Enderbite	Riachão de Jacuípe	U-Pb SHRIMP	2785 ± 11 Ma	Xenocryst or Magmatism?	Silva et al., 2002
Caraíba Complex	Enderbite	Riachão de Jacuípe	U-Pb SHRIMP	2215 ± 11 Ma	Magmatism	Silva et al., 2002
Caraíba Complex	Enderbite	Riachão de Jacuípe	U-Pb SHRIMP	2150 ± 18 Ma	Metamorphism	Silva et al., 2002
Caraíba Complex	Enderbite	Riachão de Jacuípe	U-Pb SHRIMP	2028 ± 13 Ma	Migmatization	Silva et al., 2002
Jacurici Complex	Pegmatite	Vale do Jacurici	U-Pb SHRIMP	2084 ± 6 Ma	Crystalization	Marques et al., 2010
Caraíba Complex	Charnockite	Itatim	U-Pb LA ICP-MS	2664 ± 27 Ma	Magmatism	Corrêa-Gomes et al., 2012
Caraíba Complex	Charnockite	Itatim	U-Pb LA ICP-MS	2029 ± 21 Ma	Orogenic Collapse	Corrêa-Gomes et al., 2012
Caraíba Complex	Amphibolite	Aeroporto de Pilar	U-Pb TIMS	2,08-2.05 Ga	Metamorphism	D'el-Rey Silva et al., 2007
Caraíba Complex	Diorite	Mina da Caraíba	U-Pb TIMS	2235 Ma	Magmatism	D'el-Rey Silva et al., 1996
Caraíba Complex	Tonalite	Mina da Caraíba	U-Pb TIMS	2248 ± 36 Ma	Magmatism	D'el-Rey Silva et al., 1996
Caraíba Complex	Tonalite	Mina da Caraíba	U-Pb TIMS	2051 ± 16 Ma	Metamorphism	D'el-Rey Silva et al., 1996
Caraíba Complex	Aluminous Granulite		Th-U-Pb microprobe	2,07-2,08 (±0,02 Ga)	Metamorphism	Vlach & Del Lama, 2002
Caraíba Complex	Orthogneiss Charnockite	~7,5 km a SE de Tanquinho	Pb-Pb Evaporation	2096 ± 3 Ma	Metamorphism	Barbosa et al., 2008
Caraíba Complex	Norite	Mina da Caraíba	Sm-Nd (TDM)	2,82/2,85/2,86 Ga	Primary Extraction	Oliveira et al., 2004
Caraíba Complex	Granito G3 "Pinions"	Pinhões	Sm-Nd (TDM)	2,90 Ga	Primary Extraction	Oliveira et al., 2004
Caraíba Complex	Waldemar Metapelite		Sm-Nd (TDM)	2,72 Ga	Primary Extraction	Oliveira et al., 2004
Caraíba Complex	Caraíba migmatite	Mina da Caraíba	Sm-Nd (TDM)	2,65 Ga	Primary Extraction	Oliveira et al., 2004
Caraíba Complex	Granodiorite G2		Sm-Nd (TDM)	2,44 Ga	Primary Extraction	Oliveira et al., 2004
Sienito de Itiúba	Syenite	Serra de Itiúba	Sm-Nd (TDM)	2,85 Ga	Primary Extraction	Oliveira et al., 2004
Sienito de Itiúba	Syenite	Serra de Itiúba	Sm-Nd (TDM)	2,70 Ga	Primary Extraction	Oliveira et al., 2004
Post-tectonic Granite	Granitoid		Rb-Sr - whole rock	1915 Ma	Magmatism	Otero & Conceição, 1996
Post-tectonic Granite	Granitoid		Rb-Sr - whole rock	1897 Ma	Magmatism	Otero & Conceição, 1996
Ultramafic Bodies	Mafic Ultramafic rocks	Vale do Jacurici	Re-Os	Pyrrhotite 2084 ± 0,9 Ma	Metamorphism	Marques & Carlson, 2008
Ultramafic Bodies	Mafic Ultramafic rocks	Caraíba	Ar-Ar - phlogopite	2011 ± 16 Ma	Early Metasomatism	Teixeira et al., 2010
Ultramafic Bodies	Mafic Ultramafic rocks	Caraíba	Ar-Ar - phlogopite	1952 ± 15 Ma	Late Metasomatism	Teixeira et al., 2010

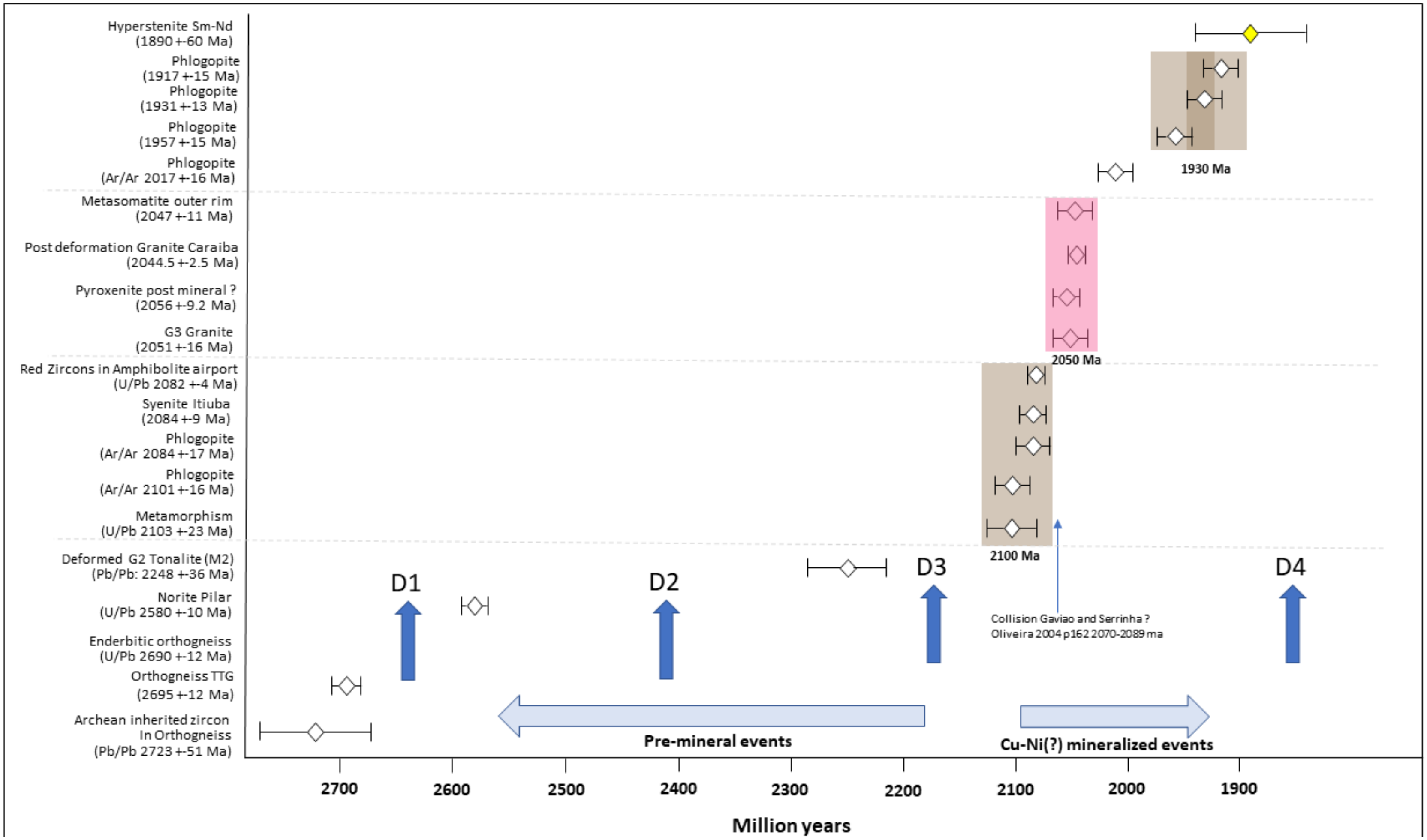


Figure 7-17: Chart of age dates from the Curaçá Valley showing main episodes of magmatism and alteration/metamorphism (Desrochers et al., 2019)

7.6 LOCAL GEOLOGY OF THE PILAR MINE

7.6.1 Lithology, Structure, and Alteration

The Pilar Mine is located in the southern part of the Caraíba Operations within the Curaçá Valley. The geology of the mine consists of a high-grade metamorphic terrain, composed of gneiss and migmatite of the Caraíba Complex that were intruded by mafic, ultramafic and late granitic rocks (Figure 7-18). The mafic and ultramafic intrusions are mainly composed of pyroxenite, norite, and gabbro. The melanorite is a term used for logging purpose to describe a host rock, either a gneiss, a gabbro or a norite, that is intruded by several mafic-ultramafic dykes that are too small individually to be logged separately (Figure 7-7, B).

The gneissic country rocks have gone through 3 phases of deformation and show fold-interference patterns. The ultramafic units as well as the late granitic and pegmatite intrusions were emplaced after the 3 phases of deformation in the gneiss and generally dip steeply to the west and strike northerly (Figure 7-18 and Figure 7-19). Underground mapping indicates that some of the pegmatite dykes were emplaced along faults (Ero Brasil, 2020). The NW-striking diabase dykes and quartz veins crosscut the metamorphic and intrusive units. A series of shear zones, oriented NNE and NNW with moderate westerly dip, represent a late deformation event but their relative displacement is not well documented (D’El Rey Silva, 1984, Frugis, 2017). Finally, a series of late faults, oriented NE to ENE and NW, are also reported by D’El Rey Silva (1984) but with unclear sense and amount of displacement.

The gneiss and migmatites, together with some intrusive bodies are affected by various alteration assemblages including potassic (phlogopite and K-feldspar), sodic (albite), calcsilicate (diopside), carbonate, as well as epidote and lesser garnet (Figure 7-20). The alteration variably overprints the original texture of the rock units and it obliterates the gneissic foliation where the alteration is more intense. The phlogopite was generally developed later than the k-feldspar and the diopside alteration and is frequently associated with the copper mineralization.

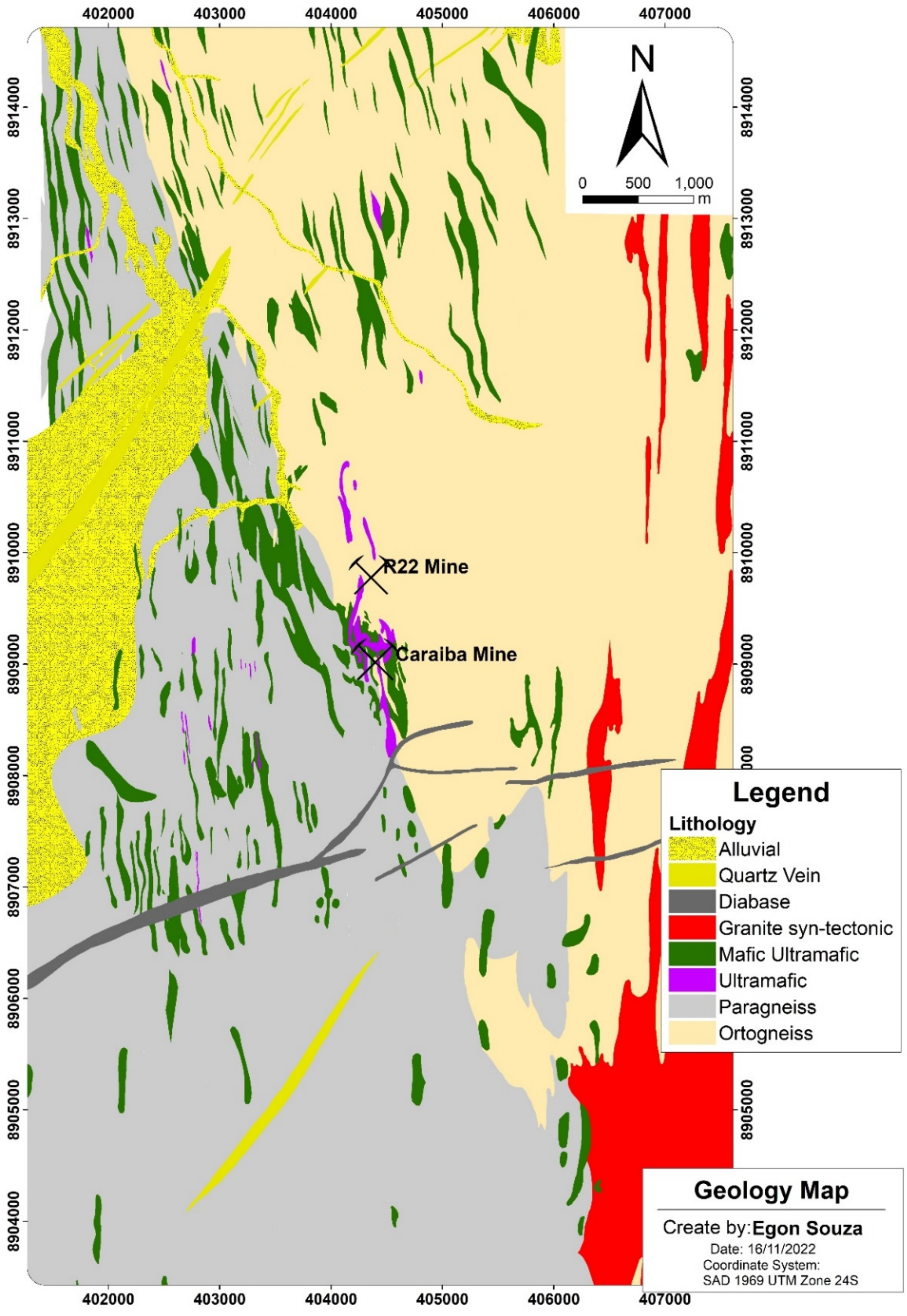


Figure 7-18: Surface geology map of Pilar Mine sector (Ero Brasil, 2022)

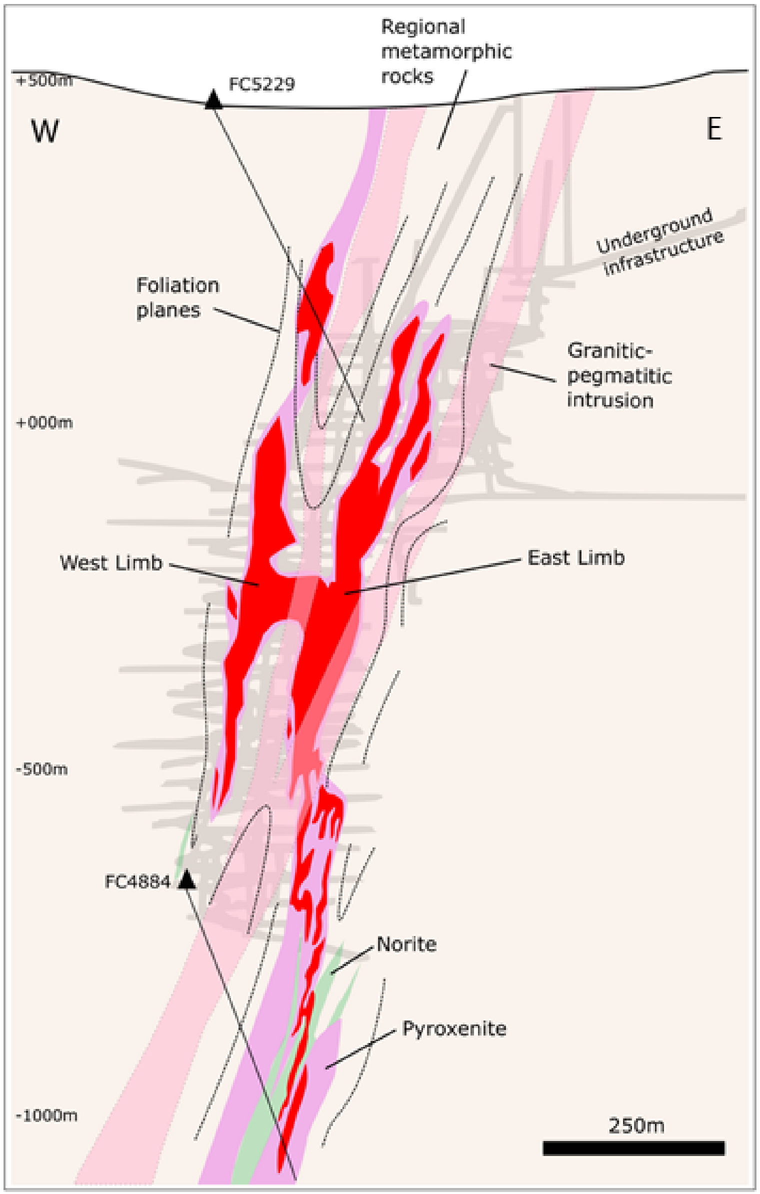


Figure 7-19: Simplified vertical cross-section of the Pilar Mine with red and pink mafic / ultramafic units. Looking north (Ero Brasil, 2019)

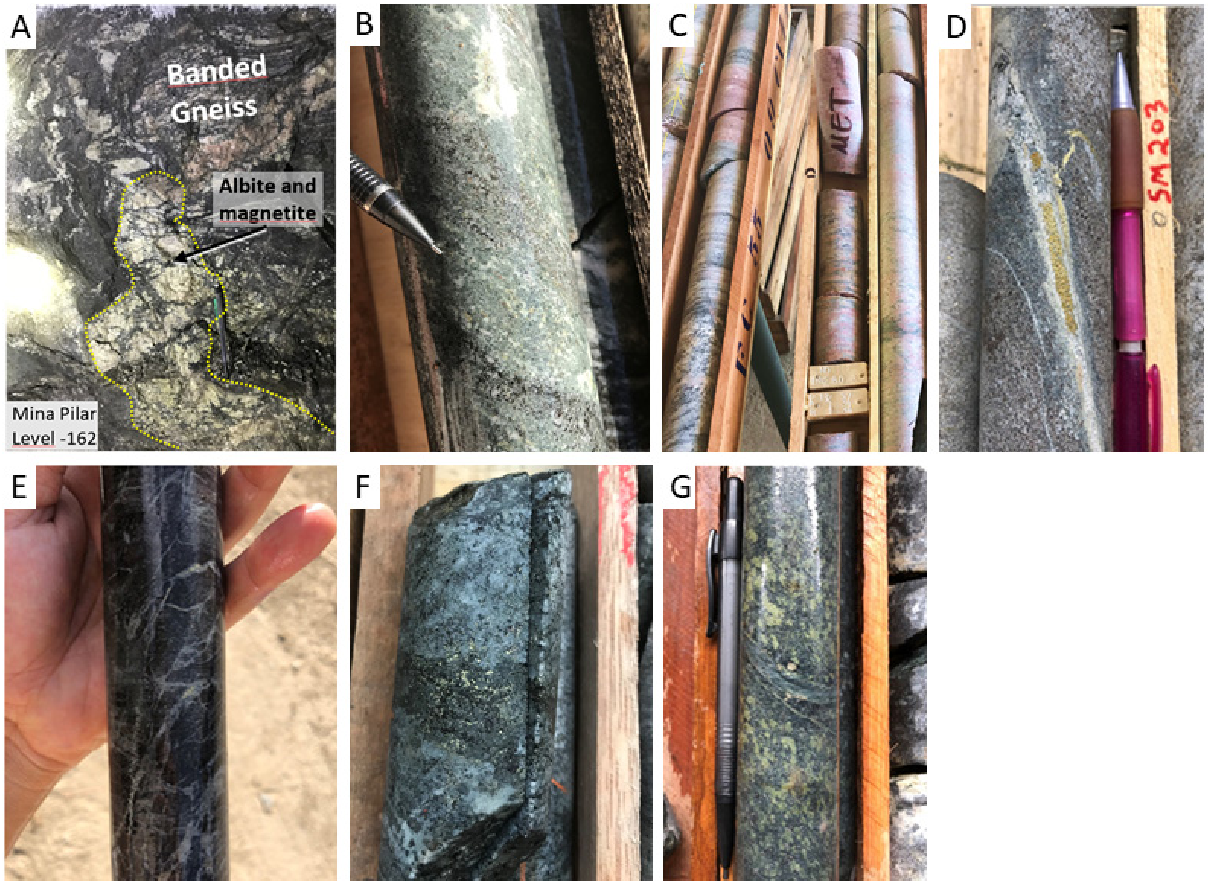


Figure 7-20: Photo of the types of alteration at the Pilar mine: A) albite and magnetite cross-cutting the gneissic fabric; B) Diopside alteration overprinting gneissic fabric; C) K-feldspar alteration; D) carbonate in halo of chalcopyrite veinlet; E) serpentinization; F) Phlogopite band associated with chalcopyrite mineralization; G) epidote alteration (Ero Brasil, 2018)

7.6.2 Mineralization

Mineralization at the Pilar UG Mine is composed of copper sulphides in the form of chalcopyrite, bornite and rarely chalcocite that occur in four different styles: disseminated, veins, massive, and brecciated (Figure 7-21, A-E). Other sulphide minerals include millerite, pyrite and pyrrhotite. Magnetite is the dominant oxide mineral and occurs intergranular together with chalcopyrite and bornite (Tappert, 2020 and Figure 7-21, F). The sulphides are heterogeneously distributed in the pyroxenite units in the form of lenses that trend N-S, dip steeply to the west and range from less than 1 meter to 20 meters thick. The known copper mineralization at Pilar extends for 1.2 km N-S, up to 170 m E-W, and has been drilled to a depth of more than 1.6 km along its steep northerly plunge (Figure 7-22). The mineralized bodies occur in sharp contact with migmatites and at variable angle to the main foliation of the host-rock. In the P1P2 sector of the mine, located in the upper levels of the Pilar UG Mine, mineralization is distributed around an interpreted steeply west dipping tight syncline plunging shallowly to the south. The fold hinge is interpreted as a structural trap for high-grade copper mineralization. Strongly foliated sub-vertical anastomosing shears as well as brittle faults crosscut and locally displace the mineralization.

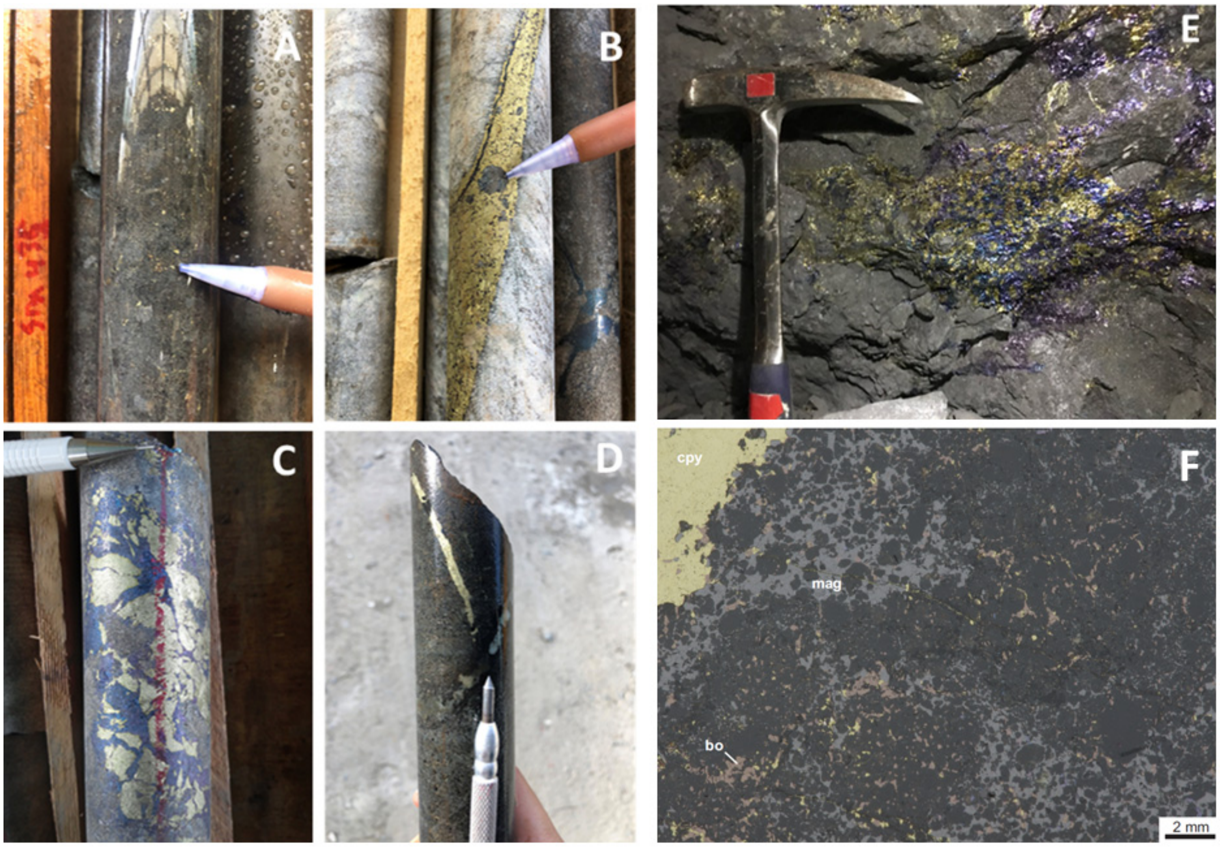
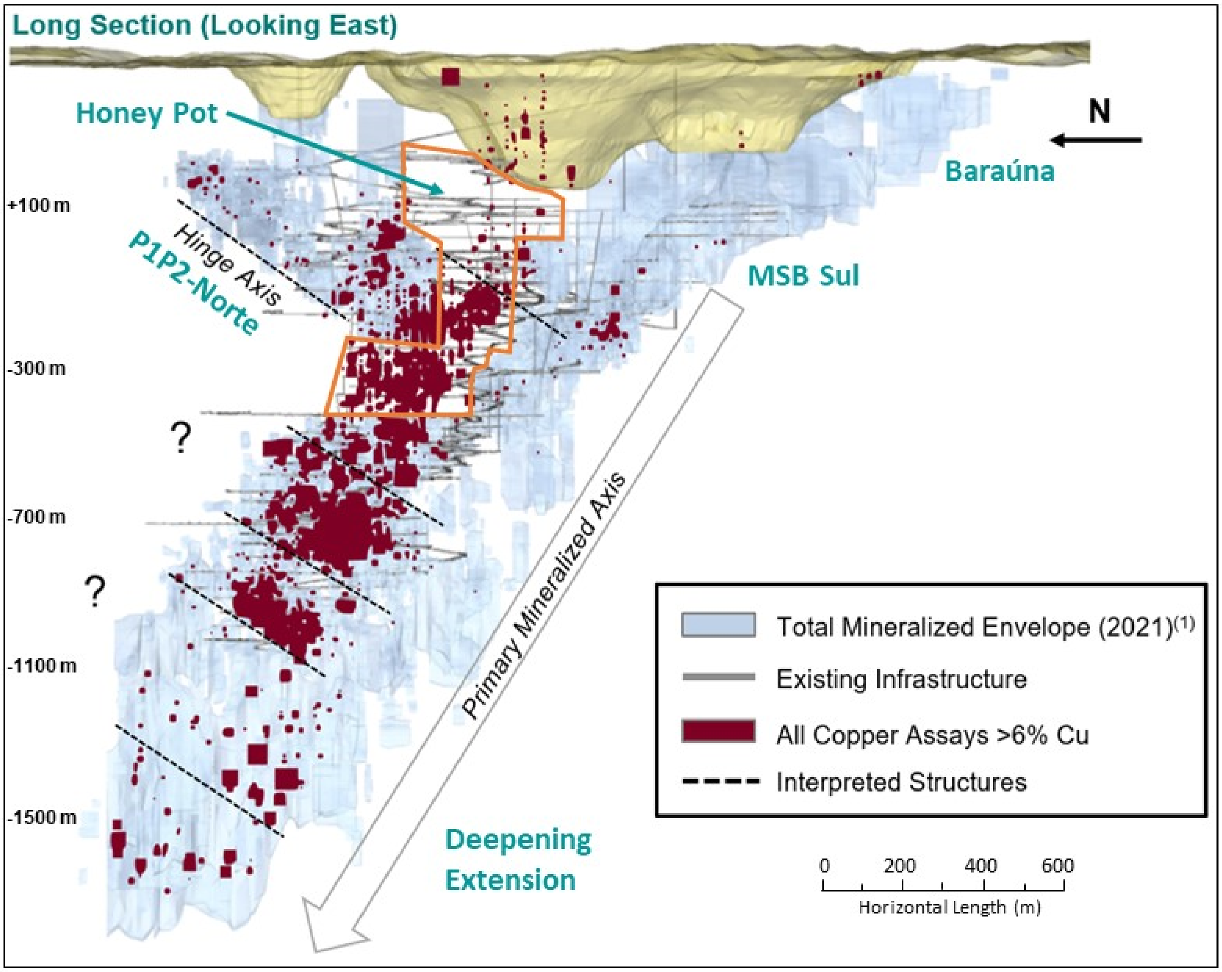


Figure 7-21: Mineralization styles: A) Pyroxenite showing primary disseminated chalcopyrite; B) Vein of chalcopyrite cross-cutting gneiss; C) Massive chalcopyrite and bornite; D) Pyroxenite with phlogopite; E) Mining front with chalcopyrite and bornite in the pyroxenite (Ero Brasil, 2018) and F) Polished section showing abundant intergranular magnetite (mag), bornite (bo), and minor chalcopyrite in contact with massive chalcopyrite vein (cpy) (Tappert, 2020)



(1) 2021 Mineralized Envelope based on the Company's press release dated January 6, 2022.

Figure 7-22: Vertical longitudinal section of the Pilar UG Mine showing the extent of the Cu mineralization as well as Deepening Extension Zone, Project Honeypot and the Upper Areas (Ero Brasil, 2021)

7.7 LOCAL GEOLOGY OF THE SUÇUARANA DEPOSIT

7.7.1 Lithology, structure, and alteration

The Suçuarana copper deposit is located in the southern part of the Curaçá Valley and 14 km to the SSW of the Pilar Mine (Figure 7-2). The copper mineralization is associated with a regionally interpreted steep westerly dipping, northerly trending, 100-meter-wide amphibole-rich unit that extends for over 1.35 kilometers in a N-S direction (Figure 7-23). This unit represents most probably a series of sub-parallel mafic and ultramafic dykes that are strongly altered. The amphibolite unit is hosted in gneiss and migmatites that are intruded by late granite and pegmatite dykes.

A series of phlogopite-rich units, that possibly represent altered mafic-ultramafic units, trend northerly and cross-cut the folded gneiss (Figure 7-24, A, B). At the local scale, the phlogopite-rich units are injected in an anastomosed pattern with dominant vertical and horizontal contacts (Figure 7-24, C).

Alteration consists of green hornblende and intense brown phlogopite flakes that are generally randomly oriented.

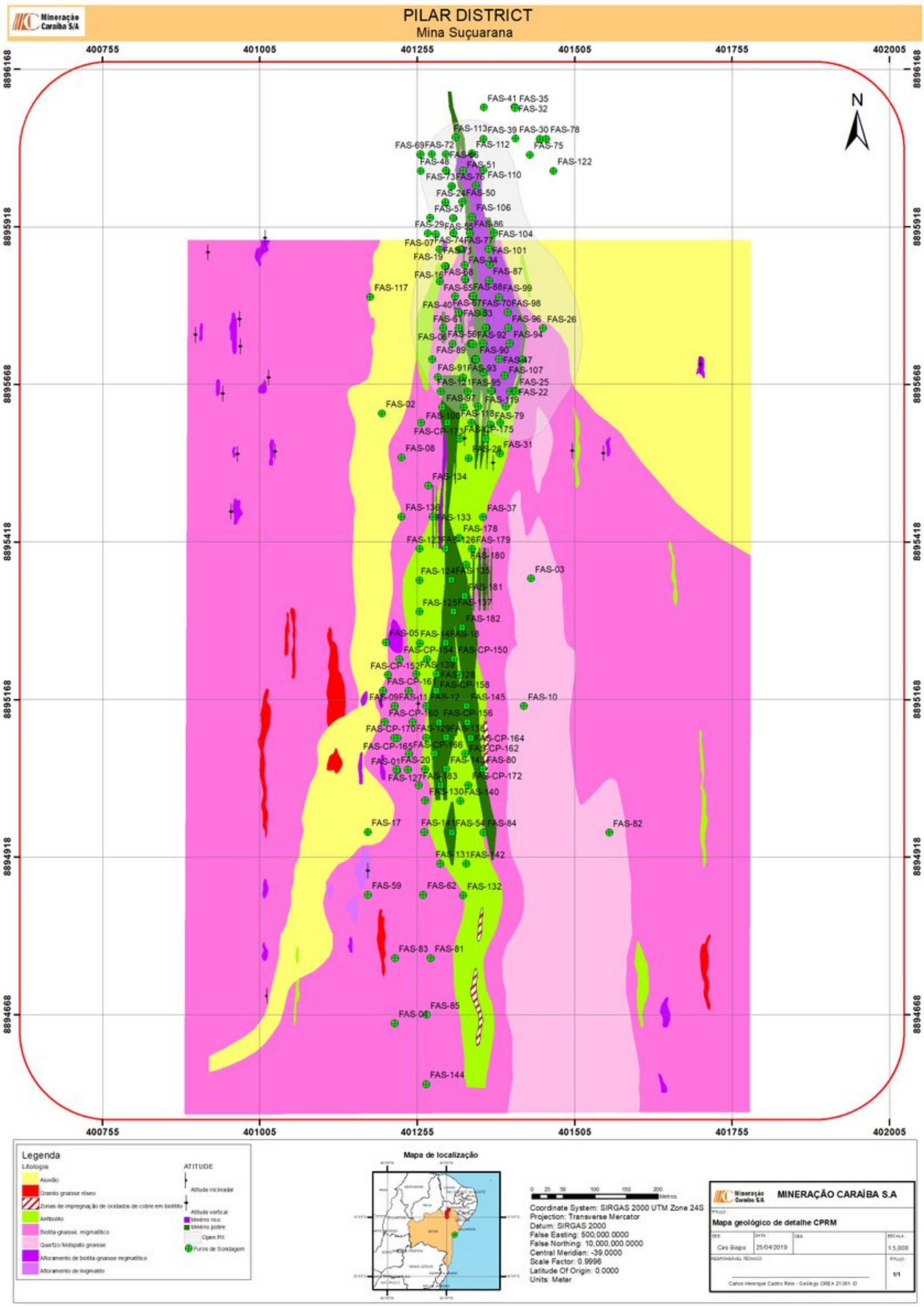


Figure 7-23: Surface geology map of the Suçuarana mine sector (Ero Brasil, 2019)

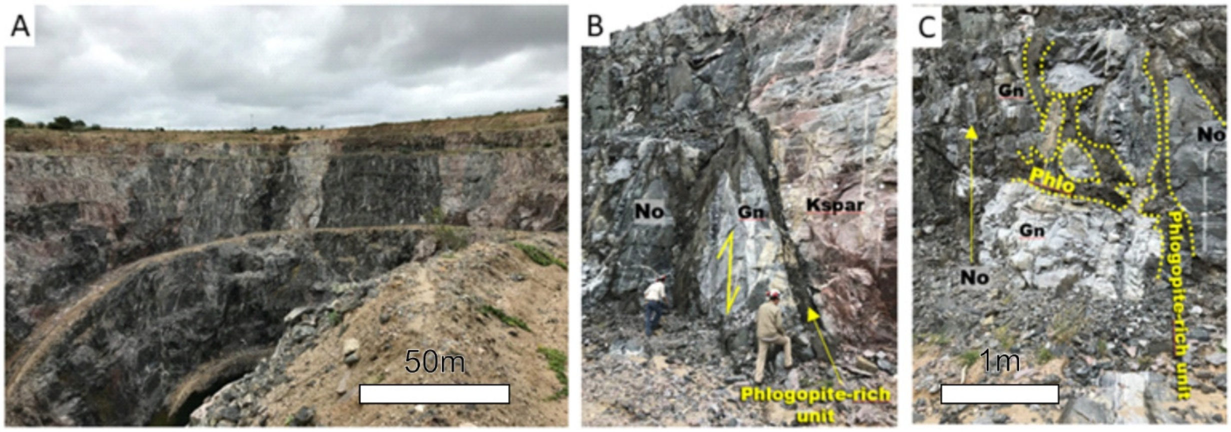


Figure 7-24: Photos of the geology of the Suçuarana Open Pit. A) general view of the historical open pit with altered mafic-ultramafic rock units injected into partly k-feldspar altered gneiss, looking south; B) Phlogopite-rich unit that cross-cuts the foliated gneiss, a norite, and a k-feldspar altered gneiss; C) Irregular injection of the phlogopite-rich unit that cross-cuts the gneiss and norite. (Desrochers et al. 2019)

7.7.2 Mineralization

The known copper mineralization extends over 2.0 km, including mineralization of the historical Suçuarana pit. Mineralization is dominated by chalcopyrite with minor bornite that is mostly associated with the phlogopite-rich units. The copper mineralization is irregularly distributed over approximately 100 m E-W and has been drill-tested to a depth of 250 meters and remains open at depth.

7.8 LOCAL GEOLOGY OF THE SURUBIM DISTRICT (SURUBIM MINE, C12, CERCADO VELHO, LAGOA DA MINA, TERRA DO SAL)

7.8.1 Lithology, structure, and alteration

The Surubim District is located in the central part of the Curaçá Valley (Figure 7-2). The C12 deposit is located 1.2 km to the SW of the Surubim Mine. The Cercado Velho and Lagoa da Mina deposits are approximately 10 km to the NE of the Surubim Mine whereas the Terra do Sal deposit is situated 8 km to the SE of Surubim Mine. The Surubim Mine and C12 Deposits are hosted in the Surubim gneiss (alternating tonalitic and granorioditic bands with gabbro and diorite bands) whereas the other three deposits of the Surubim District are hosted in the Caraíba gneissic complex (biotite orthogneiss with local migmatite). The geology of the Surubim Mine and C12 deposit consists of large gabbro-dominant units with minor pyroxenite units and remnants of gneiss that are at least 400m wide (Figure 7-26 and Figure 7-27). In both deposits, the mafic-ultramafic units are intruded by late north-striking granite and pegmatite dykes. The geology of the Cercado Velho, Lagoa da Mina and Terra do Sal consist of orthogneiss and migmatites intruded by ultramafic units measuring a few centimeters up to 15mthick.

In all the deposits of the Surubim District, the mafic-ultramafic lithological units are generally northerly oriented, and they dip steeply to moderately the west (Figure 7-28, A, B). Two main systems of easterly dipping anastomosing faults occur at the Surubim mine and are oriented NNE-SSW and NNW-SSE respectively. The movements along those faults, and their importance to the copper mineralization, are not well documented.

The mafic-ultramafic intrusive rocks and the gneiss were subjected to variable alteration, including phlogopite, silica, chlorite, K-feldspar, epidote, serpentine, and carbonate. Moderate to intense phlogopite alteration is characteristic of the Surubim deposit whereas k-feldspar, diopside and silica alteration zones are dominant in the Cercado Velho and Lagoa da Mina deposits (Figure 7-29 and Figure 7-30).

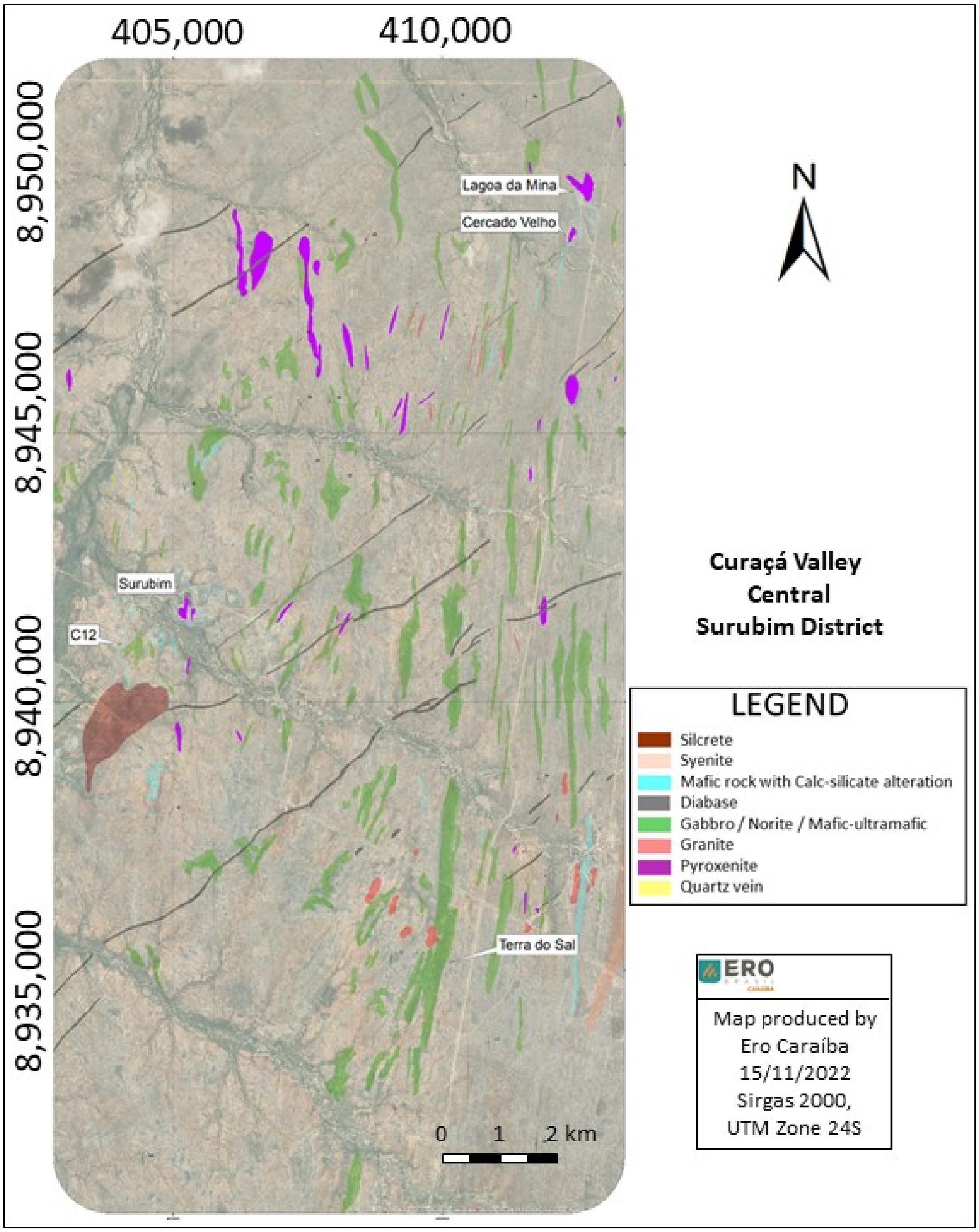


Figure 7-25: Geology of the Surubim district over satellite image with location of Cu deposits (Ero Brasil, 2022)

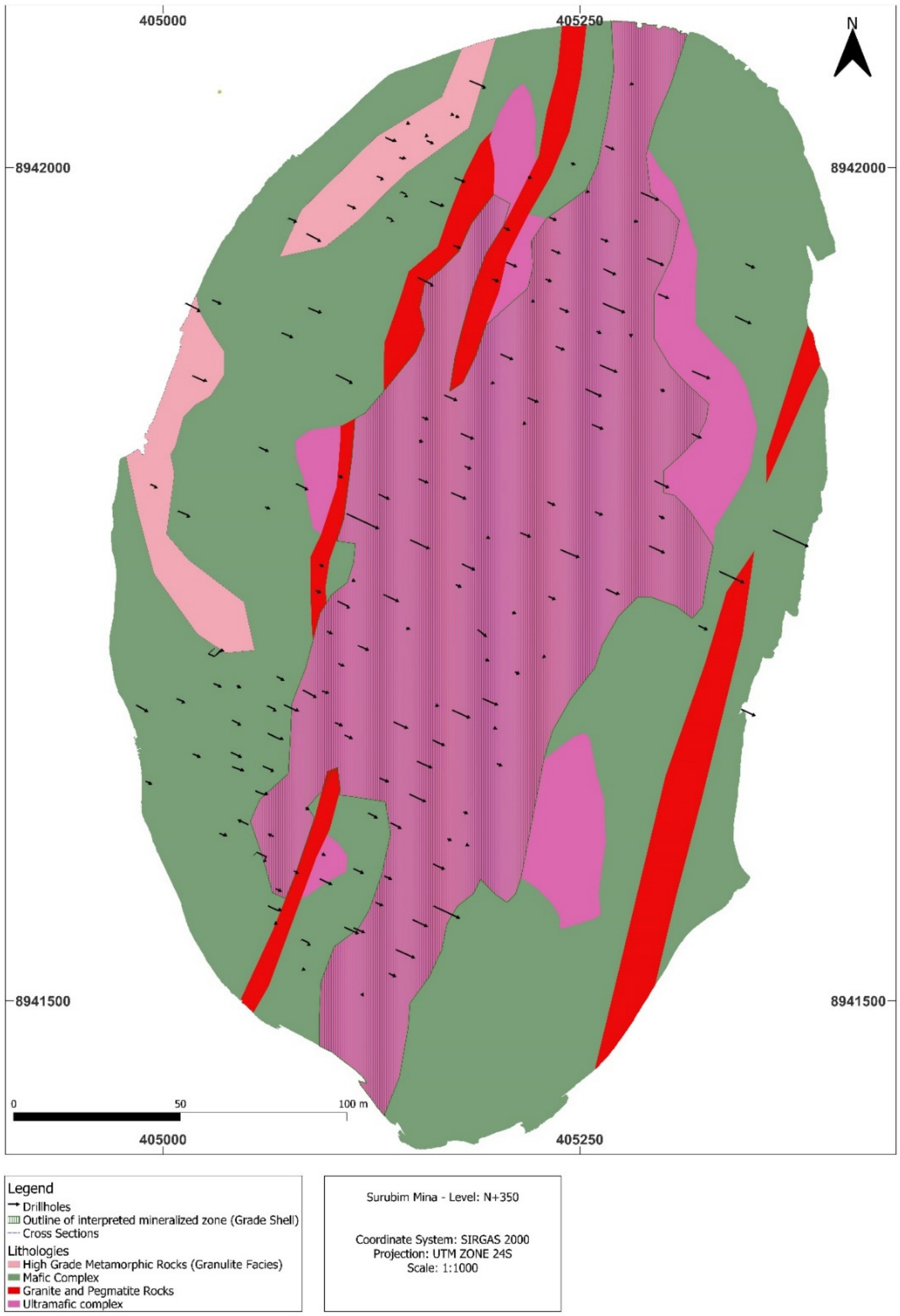


Figure 7-26: Level plan, +350 m Level, Surubim Mine (Ero Brasil, 2022)

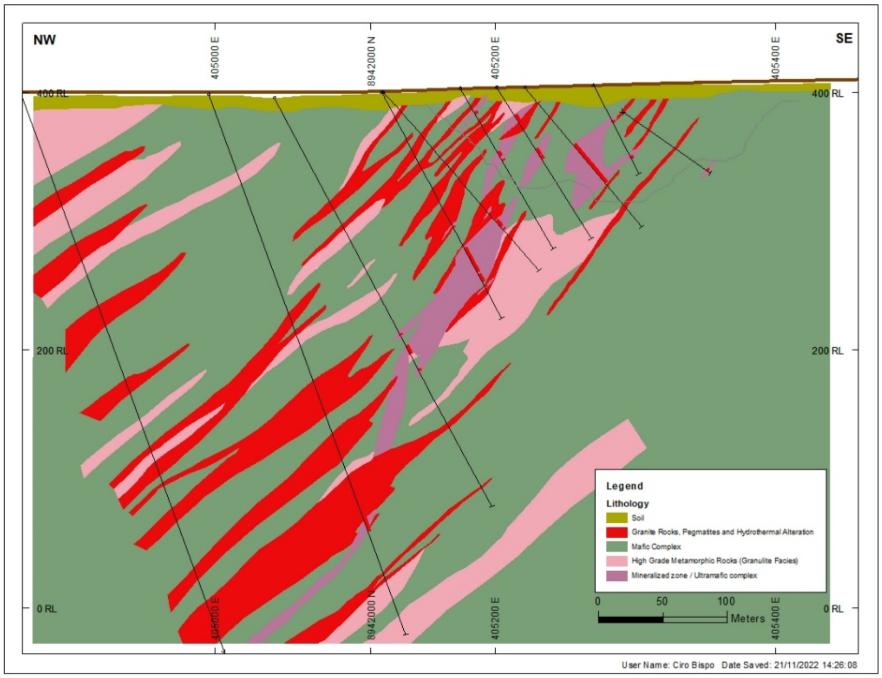


Figure 7-27: Vertical cross-section of the Surubim Mine, looking NE. The main geological units are shown. A portion of the Cu mineralization has been mined out as shown by the open pit contour (Ero Brasil, 2022)

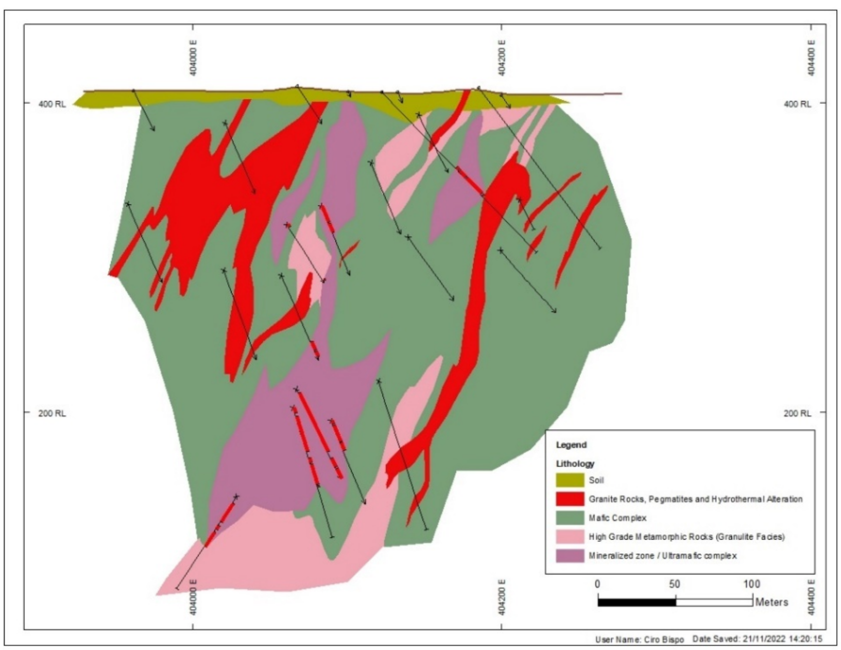


Figure 7-28: Vertical cross-section for the C12 deposit, looking North. The major geological units are shown (Ero Brasil, 2022)

7.8.2 Mineralization

The copper mineralization of the Surubim Mine and C12 deposit occurs as lenses that are hosted by phlogopite-altered gabbro injected by pyroxenite dykes to form what is designated as the ultramafic complex. Sulphide minerals are chiefly chalcopyrite and bornite in a ratio of 4:1 that mainly occur as disseminations and veins (Figure 7-33). Chalcocite, covellite and cubanite also occur as minor sulphides associated with the mineralization surrounding the Surubim Mine. Magnetite and minor pyrite and pyrrhotite are also associated with the mineralization with pyrrhotite being an important sulphide at the Lagoa da Mina and Cercado Velho deposits. The Terra do Sal deposit is characterized by disseminated and veinlets of pyrrhotite, chalcopyrite with minor bornite, pyrite and pentlandite. Specifically:

- At Surubim, the Cu mineralization is hosted in a series of moderately NW-dipping, NNW-SSE striking lenses measuring a few meters up to 45 m thick. Mineralization is known over 300 m in the N-S direction and 100 m E-W and extends to 400 m below surface. The mineralization remains open at depth and to the NNE extension.

- At C12, the Cu mineralization occurs as several interpreted N-S striking lenses measuring a few meters and up to 75 m thick. However, the general trend of the higher-grade Cu mineralization extends for over 170 m to the NW, approximately 50 m in the NE-SW direction, and is known to a depth of 300 m below surface. The mineralization remains open along the NW and NE extensions and at depth.

- The Cu mineralization at Lagoa da Mina corresponds to a series of steep westerly-dipping, northerly-striking lenses associated with melanorite and pyroxenite and measuring from 10 to 50 m thick and up to 110 m long. The deposit covers an area of 200 m N-S by 80 m E-W and is know to a depth of 430 m. The Cu mineralization remains open in its NW-SE strike extensions and at depth.

- At Cercado Velho, the Cu mineralization is hosted in a series of northerly-trending lenses associated with gabbro and norite and measuring from 5 to 30 m thick by up to 110 m long. The deposit covers an area of 455 m N-S by 200 m wide and is known to a depth of 220 m. The Cu mineralization remains open to the north, the south, and at depth.

- The Cu mineralization at Terra do Sal is hosted in several northerly-trending lenses associated with pyroxenite and gabbro and varying between 10 and 50 m thick and reaching up to 120 m in length. The deposit covers an area of 180 m N-S by 130 m in its E-W extension and is known to a depth of 380 m. The Cu mineralization remains open in all directions except to the west.

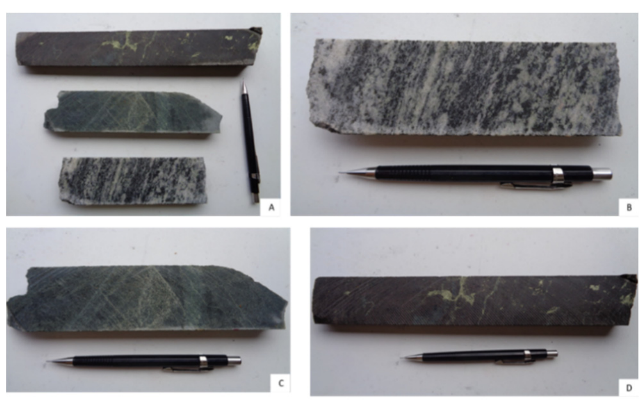


Figure 7-29: A) Main hydrothermal alteration styles associated in the mineralization. B) Silicified/albitized gneiss; C) Calcite epidote gabbro D) Phlogopite schist with chalcopyrite veinlets (Ero Brasil, 2018)

Figure 7-30: K-feldspar alteration of the ultramafic unit, south wall of the Cercado Velho open pit (Jacutinga, 2020)

Figure 7-31: A) Chalcopyrite in veinlets; B) disseminated chalcopyrite; C) Disseminated bornite and massive chalcopyrite veins (Ero Brasil, 2018)

7.9 LOCAL GEOLOGY OF THE VERMELHOS DISTRICT (SIRIEMA DEPOSIT, VERMELHOS MINE, N8/N9 AND N10 DEPOSITS)

7.9.1 Lithology, Structure and Alteration

The Vermelhos District is located 60 km north of the Caraíba Mine (Figure 7-2). In this district, copper mineralization has been identified over 4.5 km in a NNE direction including the Siriema deposit (N5), the Vermelhos Mine (N7), the N8, N9, and N10 deposits. The Vermelhos Mine area is largely covered by quartz-rich colluvium with rare outcrops occurring along drainages. Geological relationships of deposits within the Vermelhos District are shown in Figure 7-32.

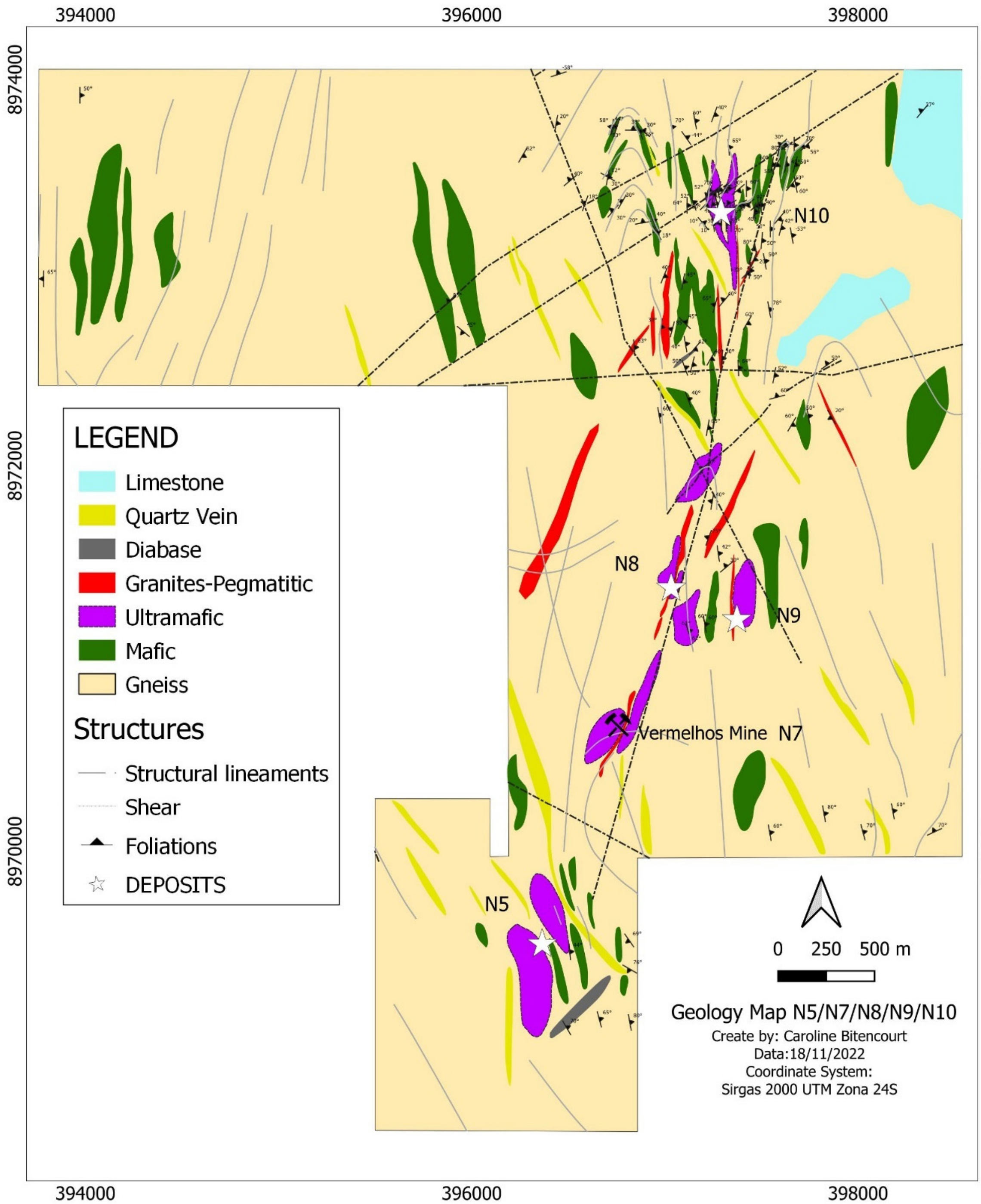


Figure 7-32: Geology map of the Vermelhos District with location of known Cu deposits (Ero Brasil, 2022)

The deposits are located within the gneiss of Tanque Novo Complex, comprising orthogneiss (enderbitic and tonalites gneiss with local garnet gneiss units) which have undergone granulite facies metamorphism and were cross-cut by mafic to ultramafic intrusions. The well-foliated enderbitic gneiss is characterized by plagioclase, quartz, microcline, orthopyroxene, and biotite with minor magnetite (Figure 7-34-A). The garnet gneiss is formed by plagioclase, quartz, phlogopite, and garnet and gneissic fabric is marked mostly by phlogopite and stretched plagioclase crystals. This unit is not magnetic (Figure 7-34-B). The mafic rocks are composed of the norites, gabbros, and gabbro-norites. The ultramafic rocks are the main ore host of the copper mineralization and are composed by pyroxenites, and melanorites. The gneiss and mafic-ultramafic rocks are cross-cut by late, steep westerly-dipping, N-S to NNE-SSW trending, granite and pegmatite dykes measuring a few centimeters up to 40m thick. The pegmatite dykes extend from the Siriema deposit to the N8 deposit. Minor late quartz veins and diabase dykes cross-cut all lithologies.

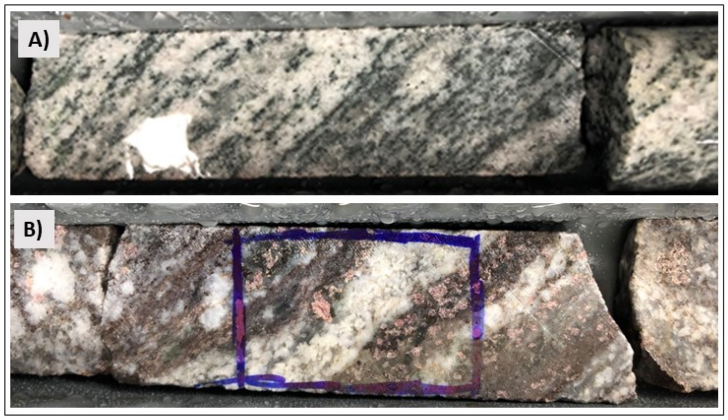


Figure 7-33: Photographs of NQ-size core showing the A) enderbitic gneiss and B) garnet gneiss.

The gneissic country rocks show a migmatitic texture with a fabric that is moderately northerly dipping (45° to 30º) grading to sub-horizontal gneissic banding. The mineralized mafic-ultramafic rock units in the Siriema, Vermelhos Mine and N8 are trending generally N-S to NNE-SSW and dip steeply to the west. However, in the high-grade Sombrero and the Toboggan zones of the Vermelhos UG Mine, the ultramafic units dip moderately to the East and the West respectively in a synform shape and contains generally higher grade and thicker copper mineralization, together with locally elevated Ni grades. In those zones, the ultramafic units are following the trend of the gneissic foliation and locally, the ultramafic units are injected at the contact between the enderbitic gneiss and the garnet gneiss. In addition to the shallow- to moderately dipping Sombrero and Toboggan there is another mineralized ultramafic unit that occupies the contact between the footwall garnet gneiss and the hanging wall enderbitic gneiss, making this lithological contact, in a hinge zone of a synform, a potential structural trap favoring the migration and deposition of the mafic-ultramafic-related mineralization (Figure 7-35). A series of sub-vertical N-S, NW-SE and NE-SW faults and mylonitic shear zones occur in the Vermelhos district. These faults and shear zones may represent structures developed during the D_3 deformation phase described by Frugis (2017) or later structures that locally displace the mineralization with minor movements.

Similar alteration mineralogy to the Pilar UG Mine is present in the Vermelhos District and include potassic (phlogopite and K-feldspar), sodic (albite), carbonate (calcite), calcsilicate (diopside), serpentine, as well as silica and garnet. The alteration also variably obliterates and locally crosscuts the gneissic banding. An important silica alteration zone overprints the large pegmatite unit to the east of the mine and contains disseminated chalcopyrite (Figure 7-35). Silica is also an important alteration phase in the deepest parts of the Siriema deposit (Figure 7-37).

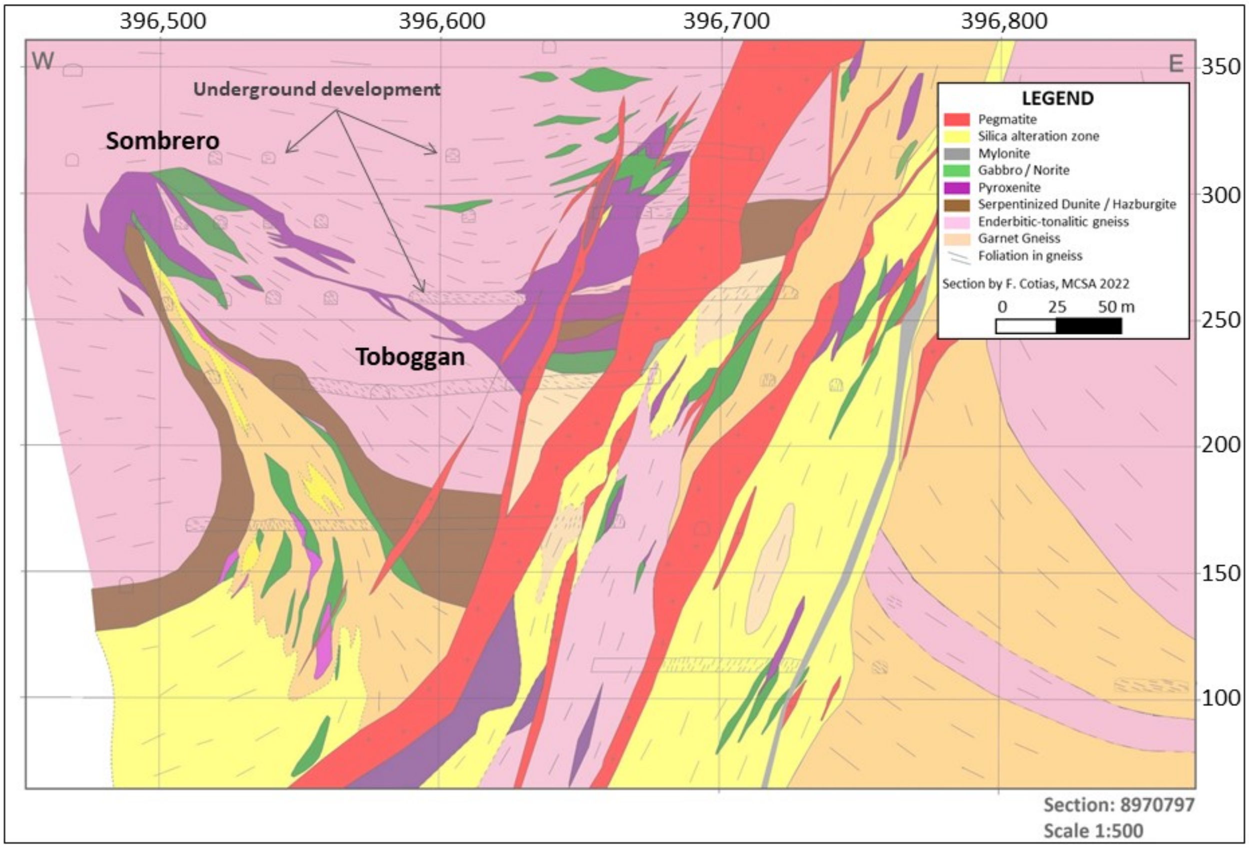


Figure 7-34: Vertical geological cross-section at Vermelhos Mine, looking North. The pyroxenite bodies and Cu mineralization of the Toboggan and Sombrero are sub-parallel to the foliation of the gneiss in the syncline fold sector

Figure 7-35: Alteration facies at Vermelhos mine. A) K-feldspar alteration overprinting gneissic fabric; B) Dark serpentinite alteration of ultramafic unit; C) Intense garnet alteration; D) Silica alteration on East side of the Vermelhos Mine overprinting the pegmatite unit; D) Silica alteration on East side of the Vermelhos Mine with disseminated chalcopyrite; and F) Phlogopite-rich alteration (darker) and pyroxenite (grey) with chalcopyrite veinlet (Ero Brasil, 2019)

7.10 MINERALIZATION

The main sulphides of the deposits in the Vermelhos District consist of chalcopyrite (approximately 70 to 75%), bornite (20 to 25%) and minor chalcocite. The chalcopyrite contains low concentration of nickel (Tappert, 2020). Copper sulphides are associated with minor pyrite, pyrrhotite, pentlandite as well as chromite and magnetite. Sulphide textures include interstitial, net-textured, stringer and sulphide-rich matrix breccias mostly concentrated in the mafic-ultramafic units but can also occur as veins and dissemination in the adjacent gneiss (Figure 7-36. Evidence throughout the Curaçá Valley of sulphide zonation, characterized as pyrrhotite +/- pentlandite zoning to pyrrhotite +/- pentlandite plus chalcopyrite and finally to chalcopyrite plus bornite is more common in the Vermelhos District (Figure 7-38), both within the Vermelhos UG Mine and at Siriema. High-grade mineralization in the Vermelhos District is often closely associated with phlogopite enrichment. The nickel, cobalt and PGE content tends to be higher in the Siriema deposit than in Vermelhos and the N8 and N9 deposits, but further analytical work is needed to confirm these observations. The detailed textures observed on polished slabs of sulphides show intergrowths of chalcopyrite, pentlandite, chromite, pyrrhotite and bornite (Figure 7-3940). Oxidized mineralization occurs as malachite (Figure 7-39) and chrysocolla within the weathered zone that occurs from 15 m to 40 m depth and, to date, is only associated with mafic-ultramafic rocks in the Vermelhos District.

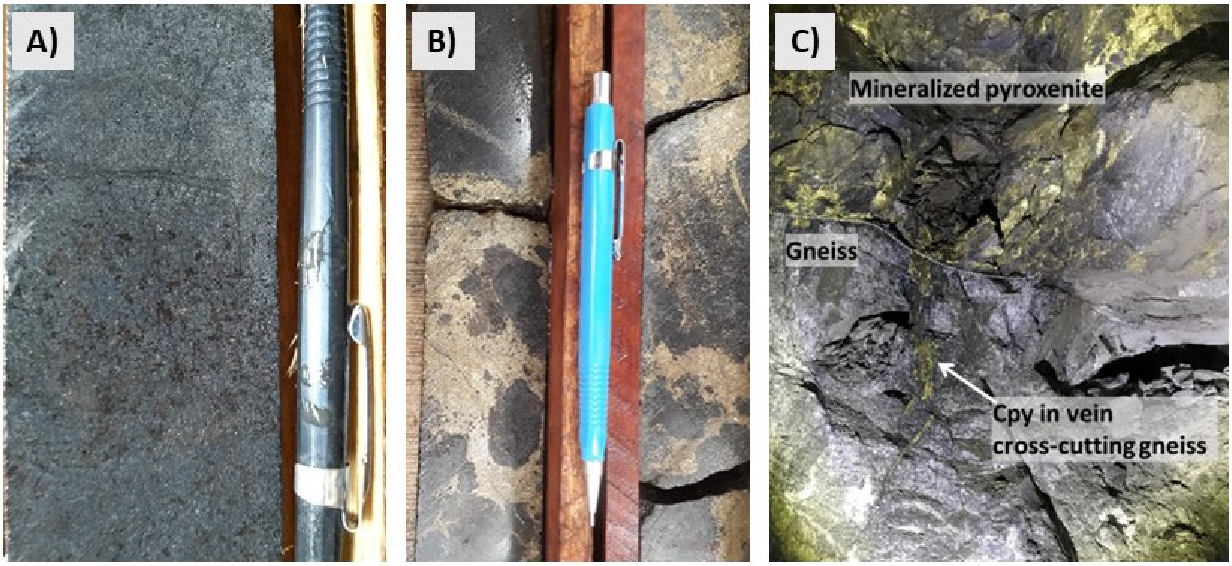


Figure 7-36: Type of mineralization at Vermelhos Mine. A) Typical disseminated chalcopyrite and bornite mineralization in pyroxenite grading to norite (top of the photo) (Ero Brasil, 2019). B) Typical brecciated mineralization showing angular pyroxenite clasts within a chalcopyrite matrix (Ero Brasil, 2019), C) Sub-horizontal mineralized pyroxenite in contact with enderbitic gneiss. Copper mineralization is extruded in veins from the mineralized pyroxenite into the gneiss and crosscuts the gneissic fabric (Ero Brasil, 2022).

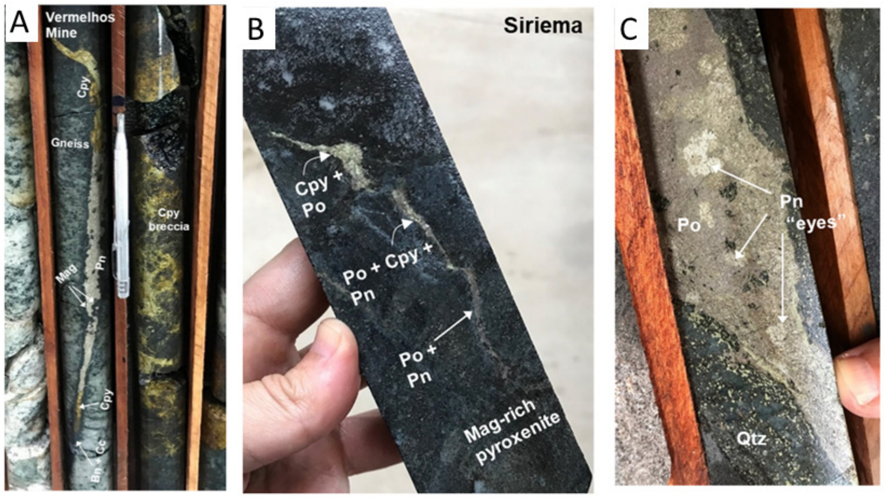


Figure 7-37: Sulphide zonation within the Vermelhos District. A) Vermelhos UG Mine and B) and C) Siriema deposit (Ero Brasil, 2019)

Figure 7-38: Malachite, typical copper mineralization in weathered zone (Ero Brasil 2019)

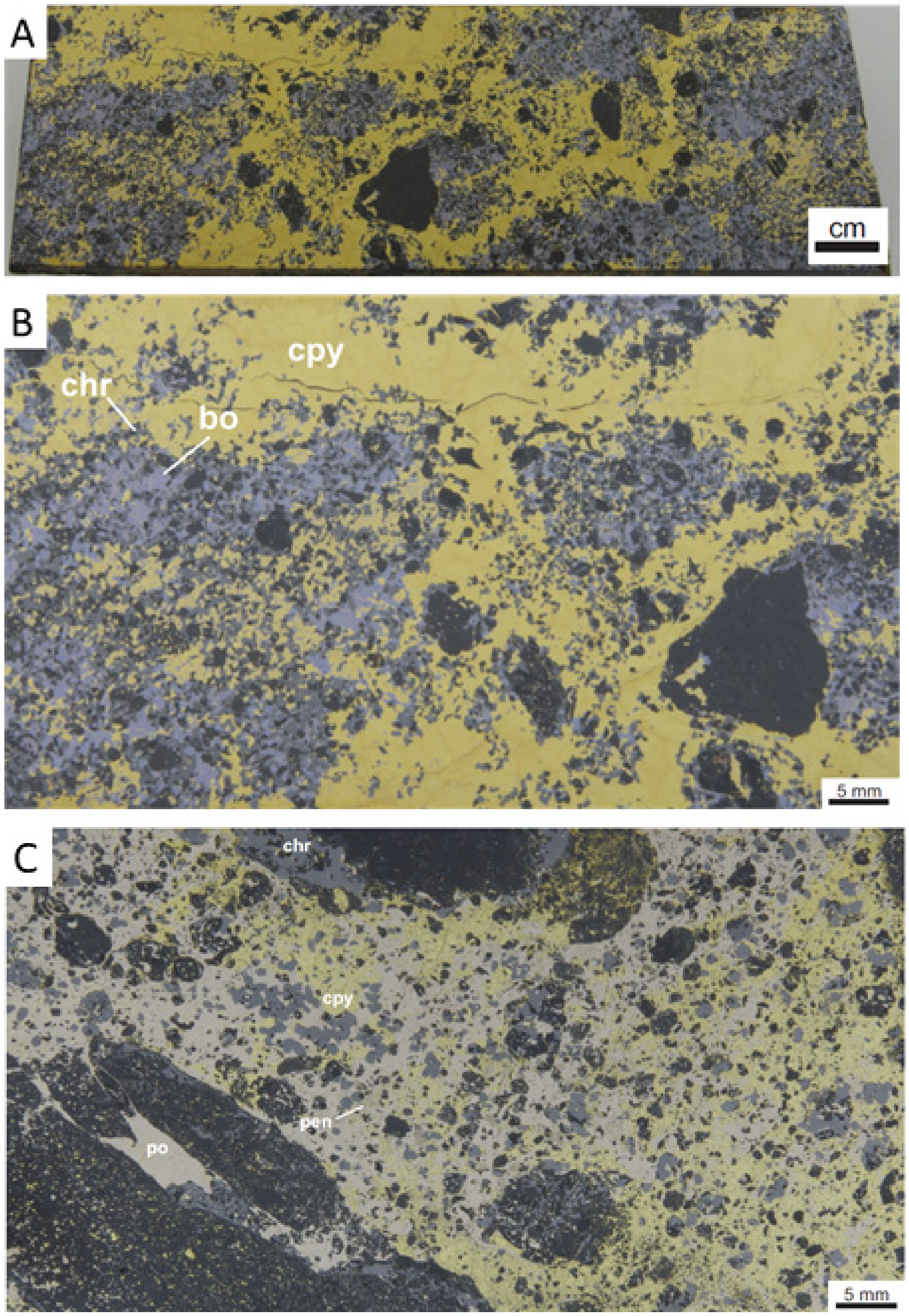


Figure 7-39: Polished slab of Vermelhos mineralization. A) Massive chalcopyrite in diffuse veins containing ultramafic country rock clasts and segregations of chromite and bornite in drillhole FVS-163 at 157.8 m at Vermelhos deposit; B) Detail of polished slab in FVS-163 at 157.8 m; and C) Dispersed chromite in massive chalcopyrite and pyrrhotite. Pyrrhotite contains some pentlandite (Tappert, 2020)

8 DEPOSIT TYPES

The Curaçá Valley deposits are complex with features that do not conform to conventional deposit models. The strong spatial association of mineralization in the Curaçá Valley deposits with mafic-ultramafic bodies, dominated by orthopyroxenite, and the common occurrence of some of the sulphide interstitial ("intercumulus") to orthopyroxene, led several researchers to conclude that mineralization formed through orthomagmatic processes (e.g., Maier and Barnes, 1996), and hence invoked a modified magmatic sulphide model. A number of features, however, are unusual for classical magmatic sulphide deposits including the high Cu/Ni ratio; significant amounts of bornite in many deposits; significant amounts of magnetite, most of which contains elevated Al, Cr, V, Ni and Zn; the abundance of phlogopite in the orthopyroxenite and wall rocks locally associated with sulphides and in some cases also containing concentrations of apatite and zircon; as well as the low S/Se ratio in sulphides. Maier and Barnes (1996) suggest various mechanisms to explain some of these features including sulfur loss resulting in the abundance of magnetite and the low S/Se ratio.

In addition to phlogopite, potentially of more than one generation, extensive hydrothermal alteration has been recognized in some of the deposits in the Curaçá Valley, and in structures throughout the districts. Alteration includes zones of feldspar +/- biotite (K-alteration) and albite-diopside (Na-Ca alteration), and siliceous alteration particularly in structures. The style of alteration and its local association with mineralization has been used as evidence for a potential iron oxide copper gold ("IOCG") affiliation for deposits in the Curaçá valley (Garcia et al., 2018; Teixeira et al., 2010). In addition, the presence of two generations of magnetite, reported scapolite, and elevated light rare earth elements ("LREE") support a potential IOCG model (Teixeira et al., 2010). It is important to note that Ni-rich IOCG deposits are recognized in the Carajás district and thus Ni is not a discriminant between magmatic sulphide and IOCG deposits.

As with the magmatic model, there are features in the Curaçá valley that are not consistent with the IOCG model, particularly the spatial association of the majority of known mineralization with orthopyroxenites, the relatively restricted alteration compared to major IOCG districts and the uncertain timing relationship of alteration with mineralization, and the lack of a multi-signature that is characteristic of IOCG mineralization (e.g., U, Ba, F, REE in addition to Cu-Au-Ni-Co). In the Curaçá valley, the majority of the magnetite contains highly elevated Al, Cr, Ti and V which is characteristic of magmatic magnetite (possibly reflecting crystallization under high pressures), while the second generation of magnetite contains very low concentrations of these elements. The second generation of magnetite occurs in veins, locally with bornite (Vazelhes, 2018) and is typical of hydrothermal magnetite. Multiple generations of magnetite with varying Ti+V contents have been documented in several IOCG deposits (e.g., Mustafa et al., 2020), but the concentration of these trace elements is significantly lower than first generation magnetite from the Curaçá valley. Recent studies on copper mineralization by Holwell et al. (2022) indicate that the Cu/Te ratio of the sulphide in the Curaçá valley of 500 to 1,000 are much lower than that of the IOCG (greater than 5,000) and the PGE content of the Curaçá valley deposits are much higher than that of the IOCG, which led the authors to favor the magmatic model.

The depth of formation of the Curaçá Valley deposits has important implications for ore genetic processes and deposit models. The gneissic units have undergone granulite facies metamorphism and three deformation events. Granulite metamorphic mineralogy imply temperatures above 850^{o}C and pressures above 7 kbar (>25 km) at approximately 2.07-2.08 Ga (Barbosa, 2002; Barbosa et al, 2016). The mafic-ultramafic intrusions, dominated by orthopyroxenites, postdate most of the deformation and presumably peak metamorphism, however there are no clear constraints on pressure and temperature ("P-T") conditions. Both orthopyroxene and magnetite mineral chemistry suggest elevated P-T, but existing data do not define precise conditions. If P-T conditions are elevated, there are potential implications for conventional magmatic sulphide and IOCG deposit models.

Phlogopite is common in orthopyroxenite units in general and is abundant with sulphide both in orthopyroxenite and in gneissic wall-rocks. Phlogopite occurs with orthopyroxene crystals as well as with plagioclase and olivine in some cases without any indication of replacement, and is present in sulphide clots, where it also appears to be in equilibrium with chalcopyrite and bornite (Maier and Barnes, 1996). Phlogopite therefore appears to have a close relationship to sulphide concentration in orthopyroxenite, and as currently understood, is distinct from K-alteration zones in gneiss.

Recent mineralogical studies identified frequent presence of carbonate and apatite, that together with the abundance of phlogopite, are suggestive of a volatile-rich alkalic magmatic sulfide system. Geochemical studies suggest that the source for the mineralized mafic-ultramafic units corresponds to an enriched and metasomatized mantle source that underwent a low degree of partial melting (Blanks and Holwell, 2021, Nunes et al., 2022).

There are number of potential analogues for the Curaçá valley deposits, depending on the preferred deposit model but the most similar analogue is the O'okiep district, Cape Province, South Africa. Other deposits that also contain some characteristics that are reminiscent to that of the deposits in the Curaçá Valley include the Nova Bollinger Ni-Cu deposit of Western Australia, the Coldwell deposit, Lake Superior, Canada, and the Santa Rita Deposit, in the southern part of the Itabuna-Salvador-Curaçá Belt in Brazil.

The O'okiep deposits are also associated with orthopyroxenites and have high bornite and magnetite contents, and low S/Se in sulphides (Clifford and Barton, 2012; Born et al., 1994; Cawthorn and Meyer, 1993). Born et al. (1994) and Cawthorn and Meyer (1993) suggested that oxidation and desulfurization of a primary pyrrhotite-chalcopyrite resulted in the magnetite-bornite assemblage. This is not consistent, however, with the magnetite compositions in the Curaçá Valley deposits (elevated Cr, Ti and V), lack of hematite, and limited evidence for widespread replacement of pyrrhotite by magnetite (Maier and Barnes, 1996), and similar lack of evidence for chalcopyrite by bornite (observed in complex intergrowths in petrography). Regardless, any model for the Curaçá Valley deposits must be broadly applicable to the O'okiep district given the number of similarities.

The Nova Bollinger Ni-Cu deposit of Western Australia was formed by the injection of small tube-shaped mafic-ultramafic intrusions emplaced at mid- to lower crust into granulite facies migmatite gneisses. The mineralization consists of net-textured and leopard next-textured Ni-Cu sulphides within the mafic-ultramafic intrusions as well as sulphide veins, sulphide-matrix breccias, and infiltrations of disseminated sulphides in the foliated and folded gneisses. The depth of emplacement, potential slow cooling under high grade metamorphic conditions, and the late emplacement of the mineralized mafic-ultramafic units relative to the deformed host gneiss are very similar to the overall general setting of the Curaçá valley deposits.

The setting of the Curaçá Valley is further complicated by the presence of significant alkaline intrusions. The most important is the Itiúba syenite complex located to the east of the main concentration of deposits in the Curaçá valley at the boundary between the Serrinha block and the Itabuna-Salvador-Curaçá belt. Alkaline intrusions of various types are known to host copper mineralization and generate fluids that may produce extensive K-Ca-Na-rich alteration similar to that found in IOCG districts. Limited available geochronology suggests that the Itiúba complex is approximately 30 Ma older than the Curaçá Valley deposits, and therefore is an unlikely source of fluids and metals in the district. Syenitic intrusions, however, occur throughout the Curaçá Valley and while they may be related to the Itiúba complex, currently there are no geochronological or petrological data to confirm this. If an alkaline intrusion is the source of fluids that generated K- and Na-Ca-rich alteration, the same arguments for and against an IOCG model will apply, particularly the importance of the orthopyroxenite and the relationship between alteration and mineralization.

There are a variety of potential magmatic processes to explain for the Cu-dominant mineralization. The current working hypothesis invokes low degree partial melts, but regardless, protracted sulphide fractionation under regional high P-T metamorphic conditions was a probable mechanism for further separation of Cu, Ni and PGE-Au. Volatiles were clearly important in this process, explaining the abundance of phlogopite-carbonate. In additional, fluids may have been generated by granite-pegmatites and syenites in the region, at least some of which appear to be contemporaneous with mafic-ultramafic magmatism and sulphide crystallization. These fluids may have modified, remobilized, and added mineralization.

Given uncertainties with the most likely deposit models for the Curaçá Valley copper deposits, it is quite possible that previously undocumented processes were responsible for mineralization and a new deposit model is required.

Current research argues in favor of a modified classic magmatic Cu+-Ni. The deposits would have formed during magma crystallization and fractionation, possibly involving mixing of mafic-ultramafic with alkaline magmas either derived from a primary source or during crustal contamination (Nunes et al., 2022) or alternatively could represent the Cu-rich parts of a highly fractionated system where the Ni-rich deposits are not discovered yet (Holwell et al., 2022).

In late 2022, subsequent to the Effective Date, Ero Copper announced the first documented nickel sulphide discovery in the Curaçá Valley as part of its ongoing regional exploration program. The nickel system, known as the "Umburana System", is located approximately 20 kilometers from the Caraíba Mill. The system was discovered using detailed field mapping and soil geochemistry collected during the Company's 2021 and 2022 exploration programs in conjunction with the Company's airborne electromagnetic ("AEM") survey. The ongoing program identified large intervals of disseminated and interstitial nickel sulphides as well as zones of high-grade semi-massive (containing approximately 30% to 60% sulphides) and massive sulphides (containing approximately 60% to 80% sulphides), with massive sulphide intercepts up to 1.5 meters in thickness grading up to 6.59% nickel. Nickel mineralization has been identified as outcropping at surface, as evident in trenches and remains open down-plunge. As at the date of this Report, maximum depth of drilling was approximately 300 meters below surface.

Ero Copper's discovery of the Ni-rich Umburana System in 2022 supports the modified classic magmatic Cu+-Ni interpretation.

9 EXPLORATION

The first well documented accounts of copper mineralization in the Curaçá Valley date back to 1871 and 1874 (Projeto Especial Caraíba, Relatório Final, Docegeo 1978). However, exploration work was not conducted until 1944 by the DNPM. Results from these programs were published in 1964 (J.L. Melo Jr. and Ernesto B. Pouchain, 1964) who provided a historic estimate of 10,795 tonnes grading 1.0% Cu at the Caraíba Mine. The parameters and assumptions used to determine this estimate are unknown. Additionally, this material was most likely contained within the mined-out open pit. Accordingly, Ero Copper is not treating this historical estimate, nor any portions of it, as relevant to the current mineral resources.

From 1952 to 1953, Northfield Mining Inc. conducted trenching and drilling at the Caraíba Mine and in 1960, the Pignatari Industrial Group conducted systematic exploration work over the Caraíba Mine in association with T. Janer and Mitsubishi Metal Mining. In parallel, systematic investigations were carried throughout the Curaçá Valley by the DNPM (Projeto Especial Caraíba, Relatório Final, Docegeo 1978).

In 1965, the "Projeto Cobre do Vale do Curaçá" was created by the DNPM and in 1974 the "Financiamento de Insumos Basicos SA" assumed control of the concessions and created the "Caraíba Project". In 1975 Docegeo was contracted for the planning and execution of exploration of the area.

Once open pit operations began in 1979, very little exploration work was conducted outside of the main Caraíba Mine area. The open pit operated until 1998 and underground operations began in 1986.

The Caraíba operation was privatized in 1994 and again, between 2004 and 2007, very little formal exploration work was conducted until the Codelco JV. Codelco conducted work on several prospects outside the Pilar UG Mine area including an airborne VTEM geophysical survey over the Vermelhos District. Oxide leach operations started in 2006 and operated continuously from 2007 to 2015. Most of the exploration work was focused on (i) replacing mined reserves annually, and (ii) where they were performed regionally, they were focused on individual properties to maintain tenure ownership.

Details of the exploration work and programs conducted at the Caraíba Operations by the Company since its acquisition of Mineração Caraíba in December, 2016 are set out in subsections below.

9.1 GEOCHEMICAL SURVEYS

Near-surface copper mineralization in the Curaçá Valley is well-defined by geochemical sampling techniques including drainage (stream sediments) and soil surveys. Since there are very few outcrops in the valley and most of the area consists of thin soil cover, the soil sampling represents an effective exploration method. Mineralized ultramafic-mafic intrusions show anomalous Cu, Ni, Co, Cr, and Mg. Several drainage and soil geochemical surveys were conducted along the Curaçá Valley and soil sample collection is still an ongoing process.

In 2017, Ero Copper engaged Infotierra, specialists in geo-focused remote sensing and database management, to compile and validate geochemical data from the various surveys. Heberlein Geoconsulting, specialists in exploration geochemistry, were then contracted by Ero Copper in 2017 to further validate and perform levelling analysis on the historical soil and drainage sediment geochemistry datasets.

Given the long history of the sampling programs, interpretation of anomalies and targets would not be possible without appropriate data levelling to remove artifacts caused by differences in laboratories and analytical methods across discrete surveys. The reinterpretation of copper results in soil based on historic geochemical surveys after z-score levelling has been performed.

In 2020, Ero Copper engaged Alexandre Rocha da Rocha (via FUNCERN), specialist in geochemical exploration in tropical terrains, to execute a multi-element soil sampling campaign in the Curaçá Valley and interpret the results. The program consisted of just over 20,000 samples collected dominantly in the Surubim district from March to September 2020. Data processing and interpretation included factor analysis to support the target generation process. Given the positive results of this exploration method, Ero Copper continued the soil sampling program. At the end of June 2022, a total of 75,144 soil samples had been collected and integrated to generate and prioritize additional exploration targets (Table 9-1). Since the soil thickness above bedrock is generally less than 1 meters, the samples are considered as representative of the bedrock

Table 9-1: Summary of all geophysical surveys executed in the Curaçá Valley (Ero Brasil, 2022)

Regional Projects	Soil	Stream Sediments
	Total Samples	Total Samples
Previous surveys - Up to end 2020		
Curaçá Valley South	4 225	436
Curaçá Valley Center	18 801	709
Curaça Valley North	11 833	521
Total Curaça Valley	**34 859**	**1 666**
Surveying in 2021 - 2022		
Curaçá Valley South	19893	-
Curaçá Valley Center	16565	-
Curaça Valley North	3827	-
Total Curaça Valley	**40 285**	**-**
TOTAL TO DATE		
Curaçá Valley South	24 118	436
Curaçá Valley Center	35 366	709
Curaça Valley North	15 660	521
Total Curaça Valley	**75 144**	**1 666**

Geophysical Surveys

In addition to geochemical surveys, several geophysical surveys have been carried out along the Curaçá Valley prior to Ero Copper's acquisition of Mineração Caraíba. Most surveys were conducted on specific targets or properties. These surveys included ground magnetic, gravity and Induced Polarization ("IP") surveys. Historic regional airborne geophysical surveys included a magnetic and radiometric survey that was flown by the CBPM ("Companhia Baiana de Pesquisa Mineral"). An airborne VTEM survey was flown over the Vermelhos District by Codelco who also conducted follow-up Ground EM and BHEM. The EM survey data is currently being analyzed and re-processed. Mineração Caraíba also conducted ground surveys of gravity, magnetics and induced polarization over the years as shown in Table 9-2, Figure 9-1, Figure 9-2 and Figure 9-3.

In 2020, Ero Copper/Ero Brasil increased the IP and ground gravity survey coverage to improve target generation and prioritization coupled with the multi-element soil sampling results.

Mineralized mafic-ultramafic intrusions respond well to gravity, IP, EM and BHEM. As of the Effective Date, Ero Copper was conducting physical property surveys of drill core from the Pilar, Vermelhos and Surubim Districts in order to better characterize ore types and optimize geophysical detection methods for use in re-interpretation of historic results and in guiding future geophysical and exploration surveys.

Table 9-2: Summary of all surveys executed in the Curaçá Valley (Ero Brasil, 2020)

Regional Projects	Soil	Stream Sediments	Ground Gravity	Ground Magnetometry	IP
	Total Samples	Total Samples	Line meters (m)	Line meters (m)	Line meters (m)
Curaçá Valley South	4225	436	717850	438150	291450
Curaçá Valley Center	18801	709	802235	385500	376200
Curaçá Valley North	11833	521	749180	583300	280400
Total Curaçá Valley	34859	1666	2269265	1406950	948050

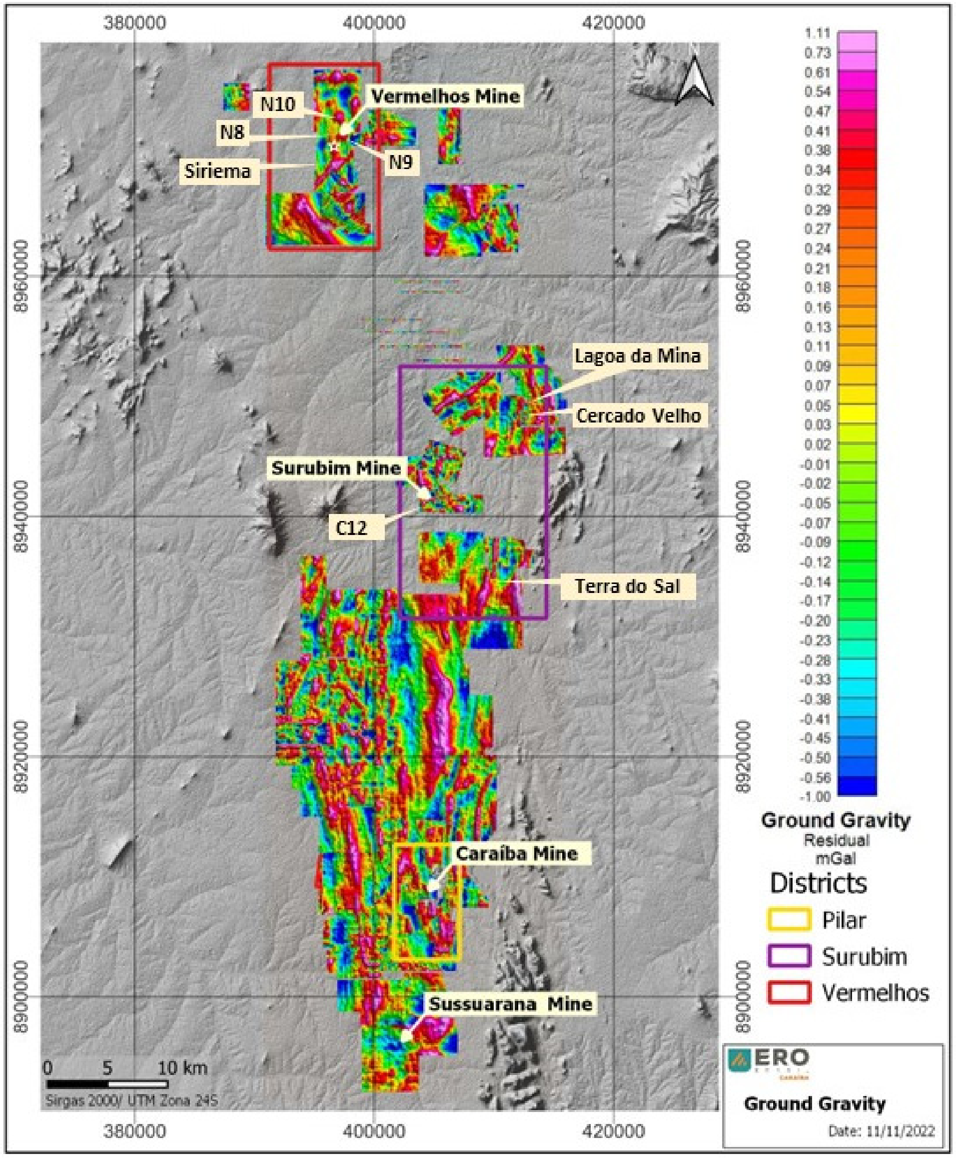


Figure 9-1: Map of the ground gravity surveys in the Curaçá Valley overlain on grey digital elevation model (DEM) (Ero Brasil, 2022). Denser material shown in red to purple colors.

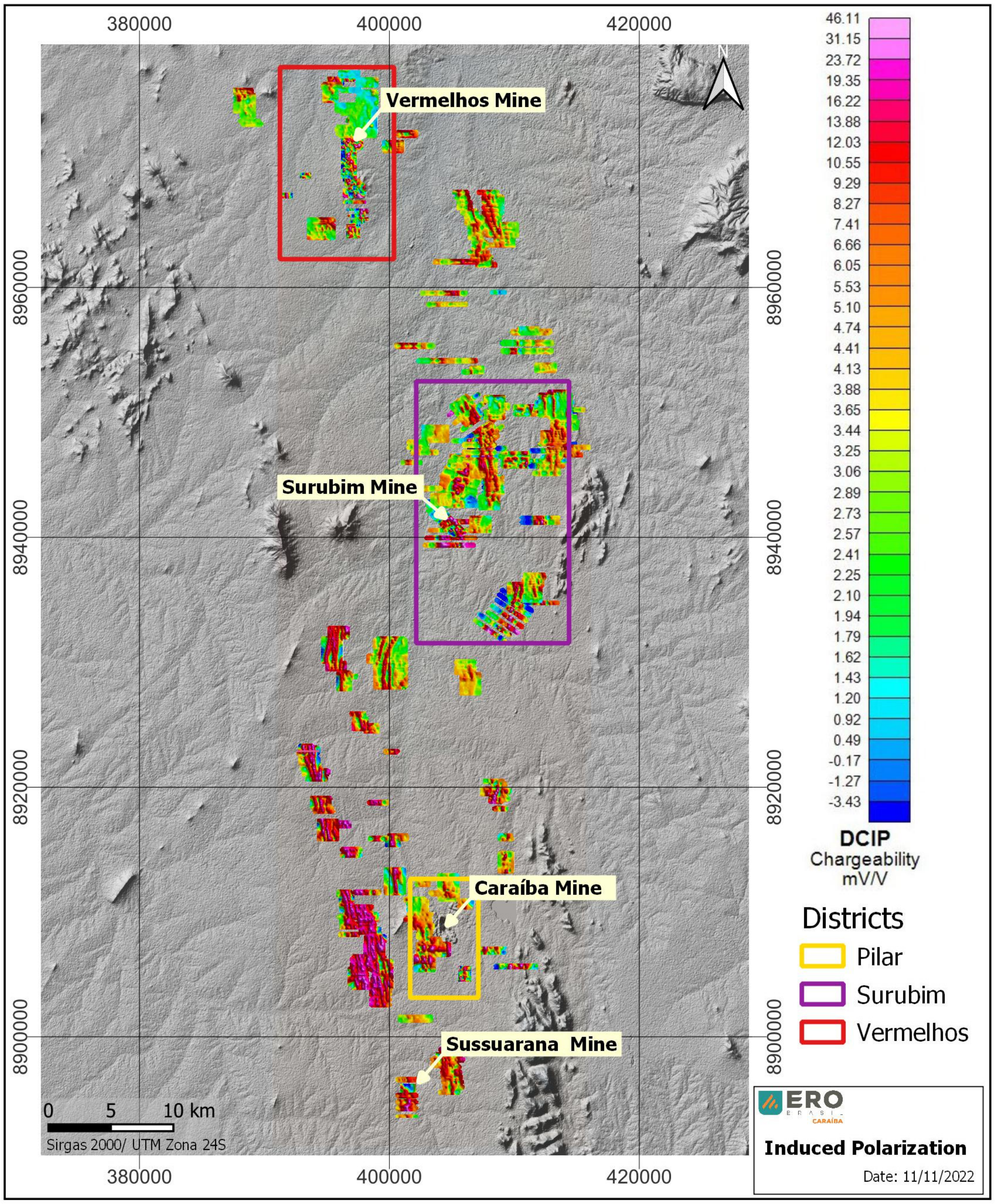


Figure 9-2: Regional Induced Polarization (IP) map of the Curaçá Valley overlain on grey digital elevation model (DEM) (Ero Brasil, 2022). Most chargeable material related to red and purple colors.

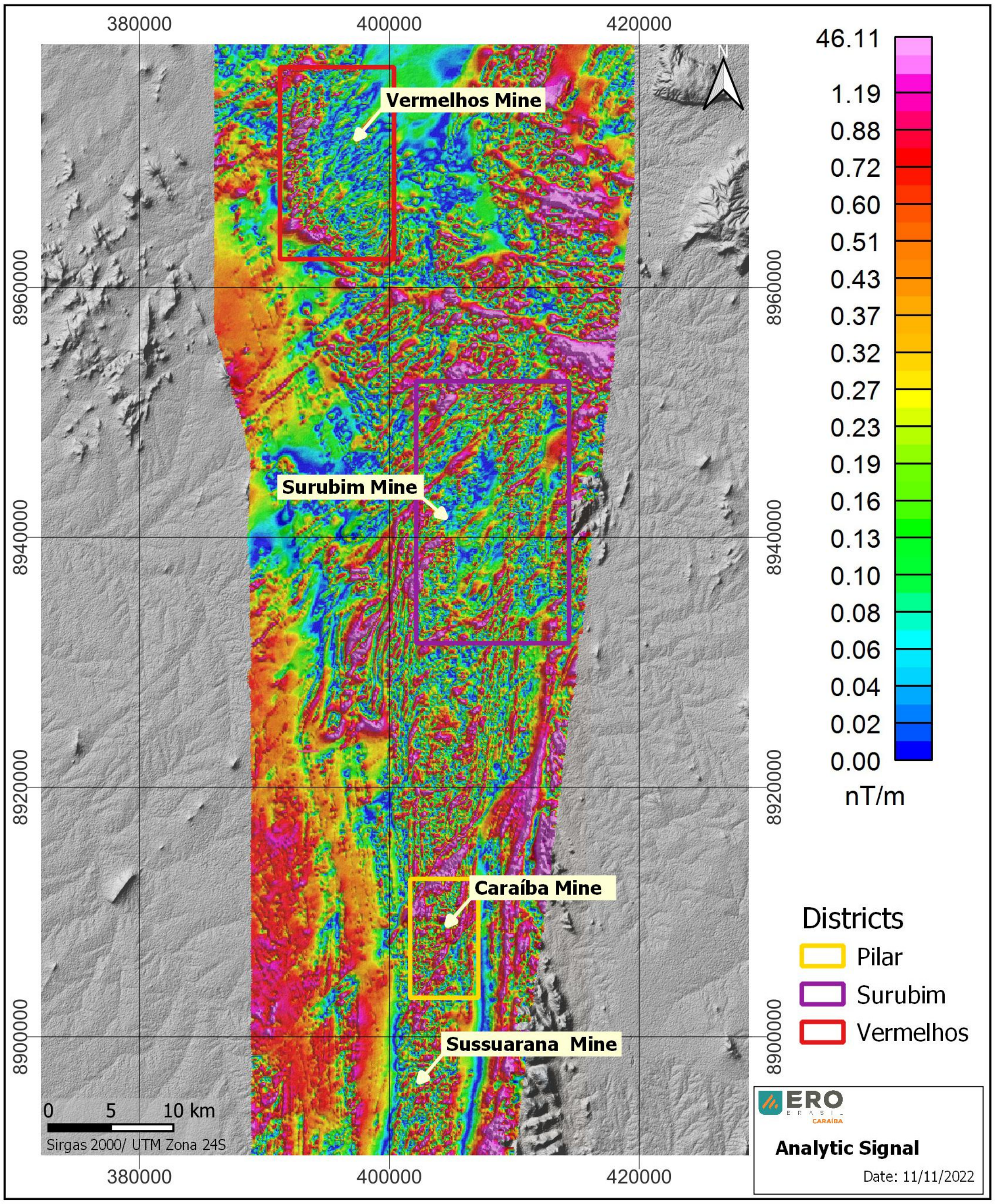


Figure 9-3: Regional map of the magnetic analytical signal in Curaçá valley overlain on grey digital elevation model (DEM) (Ero Brasil, 2022).

9.2 GEOLOGICAL MAPPING, PROSPECTING AND TRENCHING

Since 2019, Ero Brasil has increased the prospection, geological mapping, and trenching activities in the entire valley. In general, the prospection focusses on anomalous soil sectors and notably where soil anomalies coincide with positive geophysical signatures for mineralization. In the most promising sectors, the geologists prepare a trenching program to expose bedrock. The trenches are designed to cross-cut the trend of the favorable geology and / or mineralization at high angle.

The trenches are dug to a depth varying between 1 and 2 meters, to expose bedrock and for widths of approximately 1.5 m. Trenches vary between 70 and 200 m long. All trenches are mapped in detail and rock samples are collected for assaying. Approximately 80% of the trenches expose geology that is of sufficient merit to be sampled. In each individual trench, the percentage of samples averages 50%. After completion of trench mapping and sampling, the trenches are filled with the material that was excavated for environmental and safety purposes. The combined geological mapping of the trenches and outcrops are used to produce detailed geology maps of exploration targets (Figure 9-5).

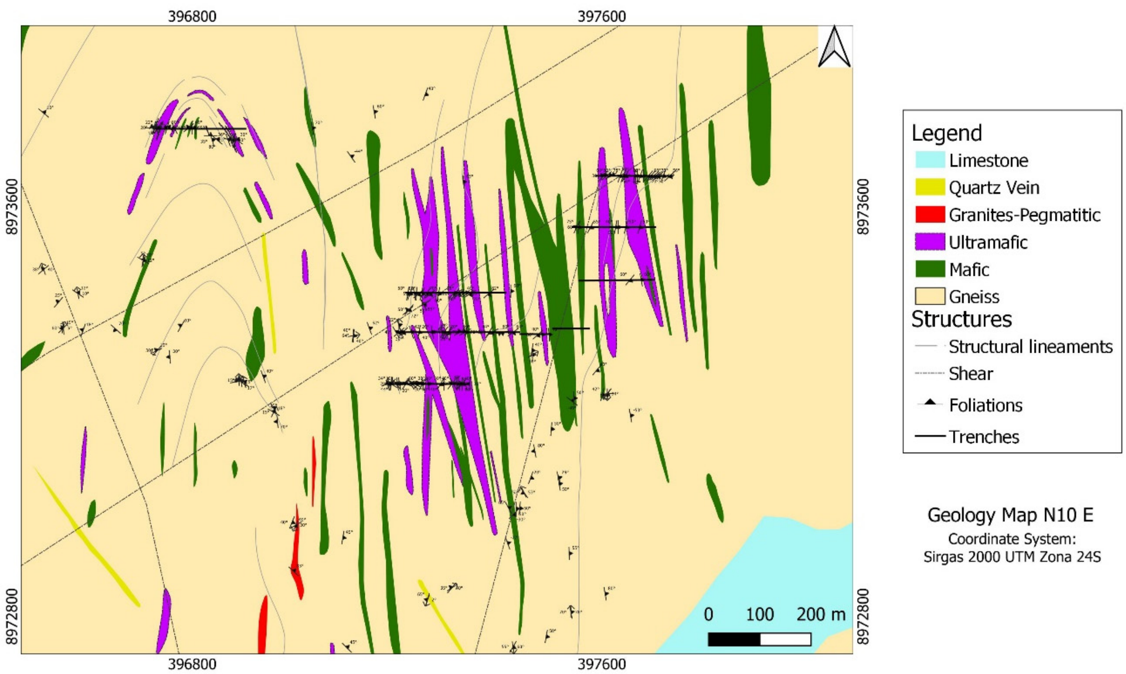


Figure 9-4: Example of a detailed geology map in the N10E exploration target, Vermelhos District. Individual foliation measurements reflect outcrops and thick E-W black lines cross-cutting the ultramafic units are mapped and sampled trenches (Ero Brasil, 2022).

9.2.1 Pilar District Exploration

Data compilation work suggests that the Pilar District is 7 km long by 5 km wide centered upon the Pilar UG Mine. Priority drill targets are defined on coincident magnetic, gravity, IP and soil geochemical anomalies. Further IP survey grids and additional drill testing is planned along the northwest corridor, to the northwest of the R22W Mine, and along the southeast corridor, southeast of the Pilar UG Mine towards S10 and S5 (Figure 9-5 and Figure 9-6). The Company continues to evaluate and prioritize all regional targets for further exploration work.

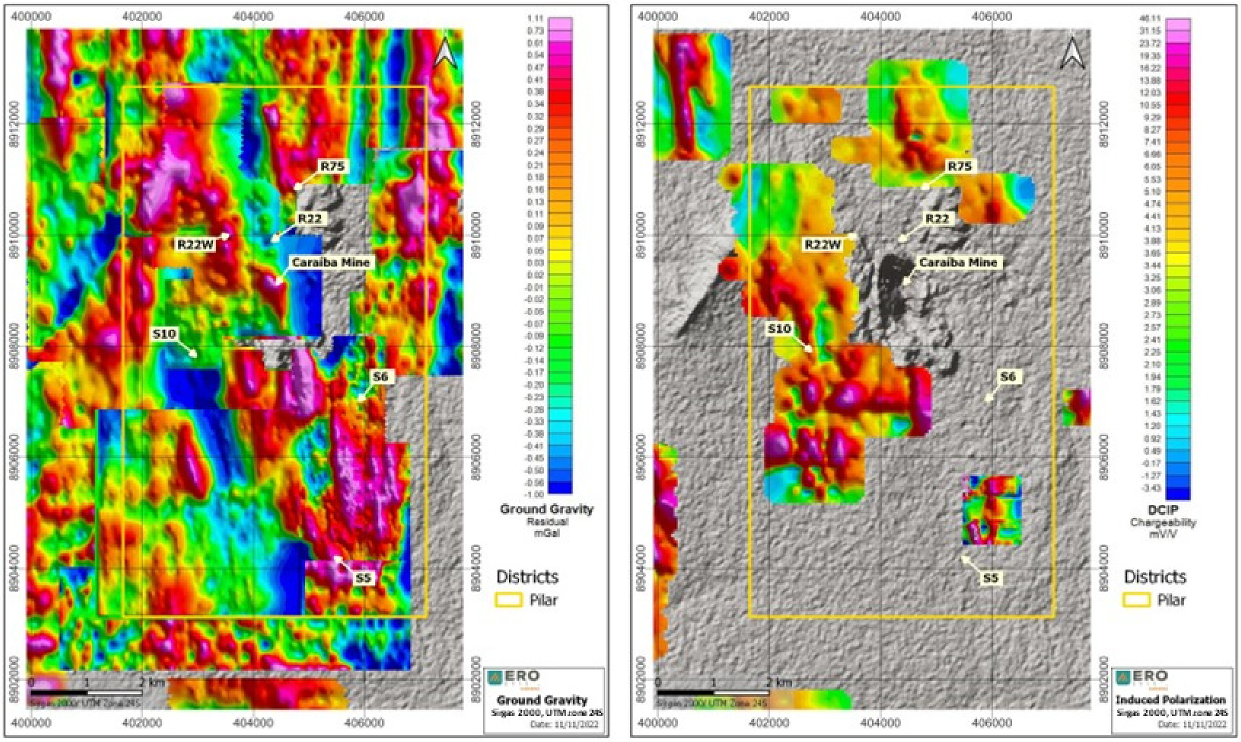


Figure 9-5: Detailed ground gravity (left) and IP (right) surveys overlain on grey digital elevation model (DEM) for the Pilar District with location of the exploration targets and the Caraíba Mine. Denser material that may represent mineralization and/or ultramafic bodies are highlighted by red to purple colors on the ground gravity map. Most chargeable material highlighted by red to purple colors on the IP map (Ero Brasil, 2022).

9.2.2 Surubim District Exploration

The data compilation work suggests that the district of Surubim can be divided into a western corridor containing the Surubim and C12 deposits, and an eastern corridor containing the Lagoa da Mina, Cercado Velhos, and Terra do Sal that together cover an area of approximately 20 km north south and a width of approximately 12 km (Figure 9-7). Exploration targets such as those extending from the past producing Lagoa da Mina (Angicos) and Surubim mines as well as new exploration areas including Terra do Sal, C4, Cercado Velho were all considered as high priorities within the District, as detailed in Figure 9-7. Data integration work, target prioritization and drill testing in the Surubim District remains ongoing.

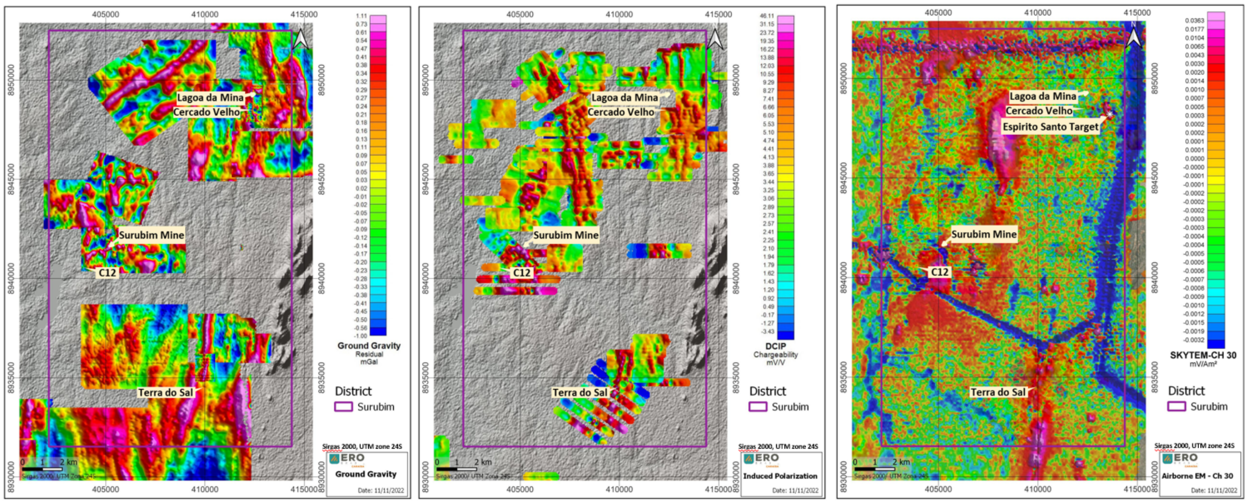


Figure 9-6: Map of ground gravity survey (left), IP (center), and airborne EM survey (right) in the Surubim District overlain on grey digital elevation model (DEM) with location of the known Cu deposits (Ero Brasil, 2022). Red to purple colors on all maps represent anomalies that could be associated with mineralized ultramafic units.

9.2.3 Vermelhos District Exploration

Data compilation work shows that the Vermelhos District is over 10km in strike length along a north-south trending zone (Figure 9-7) of coincident IP and soil geochemistry, which includes several anomalies and high-priority drill targets that remain to be tested (collectively, the “Vermelhos System”) as shown in Figure 9-7. Exploration drilling in the Vermelhos District is primarily focused on the Southern Vermelhos Corridor; however, systematic evaluation and prioritization of other coinciding soil and geophysical anomalies remains ongoing through mapping, trenching, sampling and drilling of priority targets.

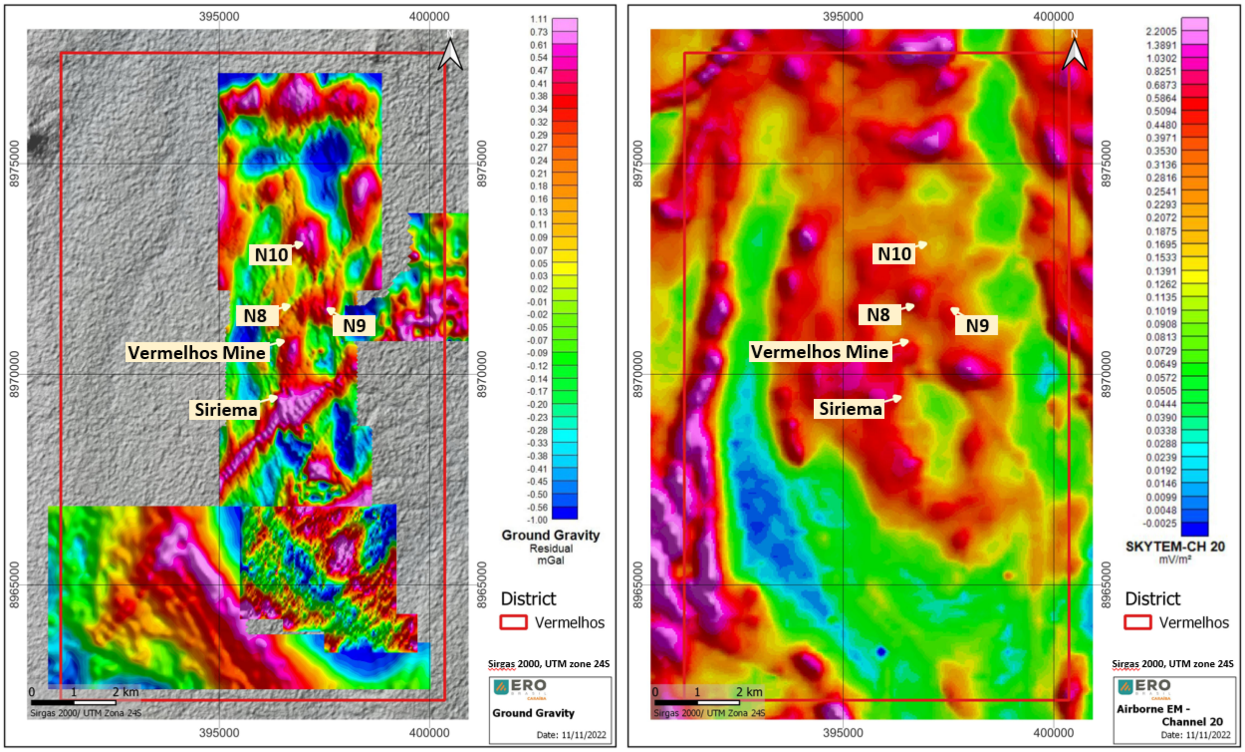


Figure 9-7: Map of detailed ground gravity survey (left) and airborne EM survey (right) in the Vermelhos District overlain on grey digital elevation model (DEM) with location of the known Cu deposits (Ero Brasil, 2022). Red to purple colors on all maps represent anomalies that could be associated with mineralized ultramafic units

10 DRILLING

Ero Brasil has conducted surface and subsurface drilling with its own drill machines and employees as well as with the following third parties:

- Bahia and Drillgeo, based in Salvador, Bahia;
- Geocontrole BR Sondagens S.A;
- Layne do Brasil Sondagens, based in Rio de Janeiro;
- Major Drilling based in Belo Horizonte; and,
- Tamarama Sondagens Ltda.

Drill pad locations are located on a grid map and sited on the ground by an Ero Brasil geologist. The planned drill sites are located using a portable GPS.

When drill holes are completed, they are sealed with cement and an aluminum plate is set showing the drill hole number, azimuth, angle, depth and date. The cement marker is surveyed to give the final location of the drill hole.

1.875-inch diameter drill holes ("NQ") are used for surface drilling and in underground exploration while 1.433-inch diameter drilling ("BQ") is commonly used for short term stope definition (production drilling) in the underground mines.

Figure 10-1: Surface drill rig operated by third-party (Ero Brasil, 2022)

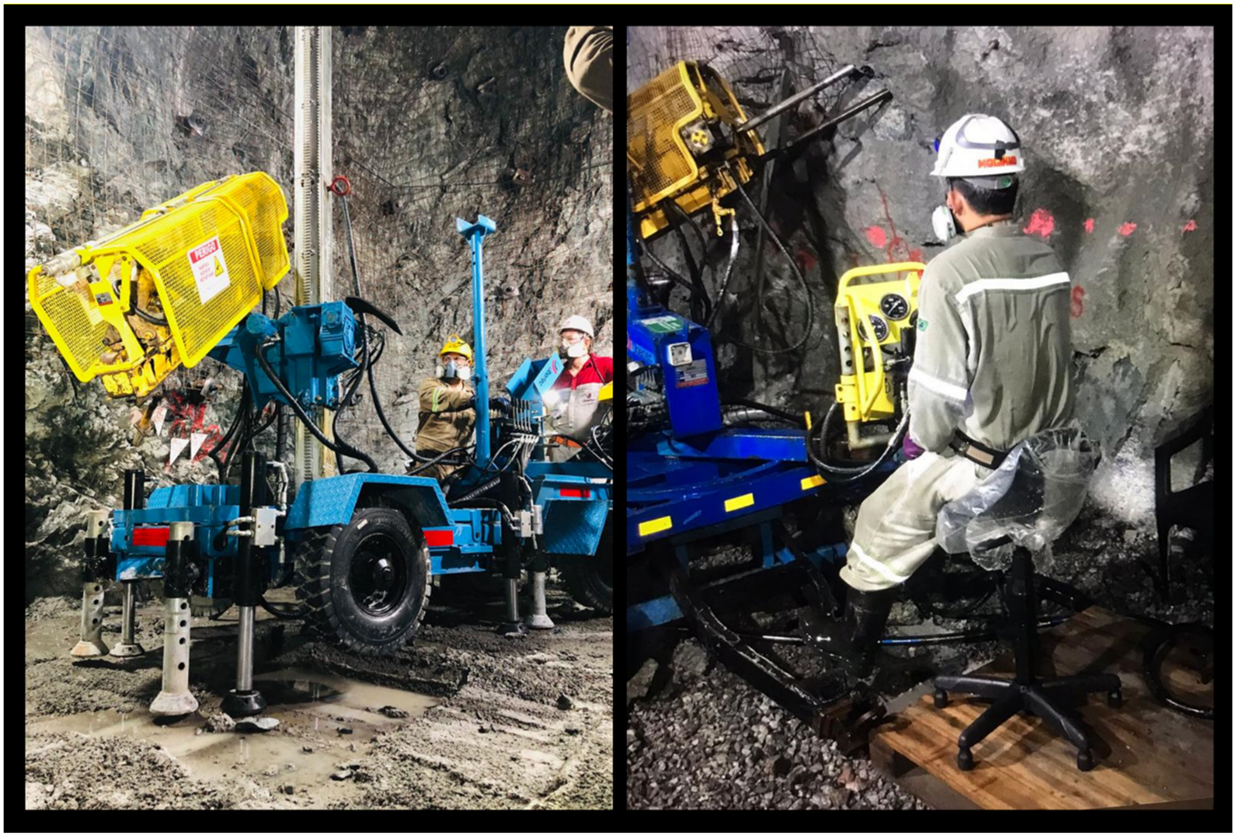


Figure 10-2: Underground drill-hole being performed by Caraíba personnel (Ero Brasil, 2022)

Drill core recoveries are measured by the drilling contractor, when drilling is not being performed by Ero Brasil own drill rigs and is checked by an Ero Brasil technician. Core recoveries are generally good, averaging approximately 90%.

For inclined surface holes, stakes are set in the ground marking the azimuth and the drill rig is then aligned with the stakes. The drill supervisor uses an inclinometer to ensure the drill mast is aligned with the intended angle of the drill hole.

Throughout the Curaçá Valley, drilling to achieve indicated mineral resource drill spacing is generally set on approximately 45m centers whereas the measured mineral resource grid is approximately 22.5m on center. Infill drilling for mine planning is typically set on approximately 12.5m centers. Due to the dominant orientation of the mineralization, sections are east-west oriented and drill angles are arranged in a fan position targeting perpendicular intersection, to the extent possible, along the north–south trending mineralization.

In support of the current mineral resource and mineral reserve estimate, a total of 1,413,124 m of diamond core drilling was used. The allocation of meters for each mineral district is set out in the table below.

Table 10-1: Ero Brasil Drilling in Support of Mineral Resource and Mineral Reserve Estimate

Mineral Districts	Diamond Drilling	
	Qty	Meters
Vermelhos	2,014	396,608
Surubim	807	174,722
Pilar	4,485	841,794

For all diamond drilling, deviation surveys are conducted using Giro Master equipment at 3.0m intervals, and later analyzed using SPT Survey software following the completion of the survey. Two measurements are performed in the upper movement (out) to validate the readings, with a 3.0% deviation between measurements admitted as the maximum permissible deviation according to the Company's adopted standard operating procedures.

Figure 10-3: Maxibor equipment preparing for drill hole deviation readings (Ero Brasil, 2022)

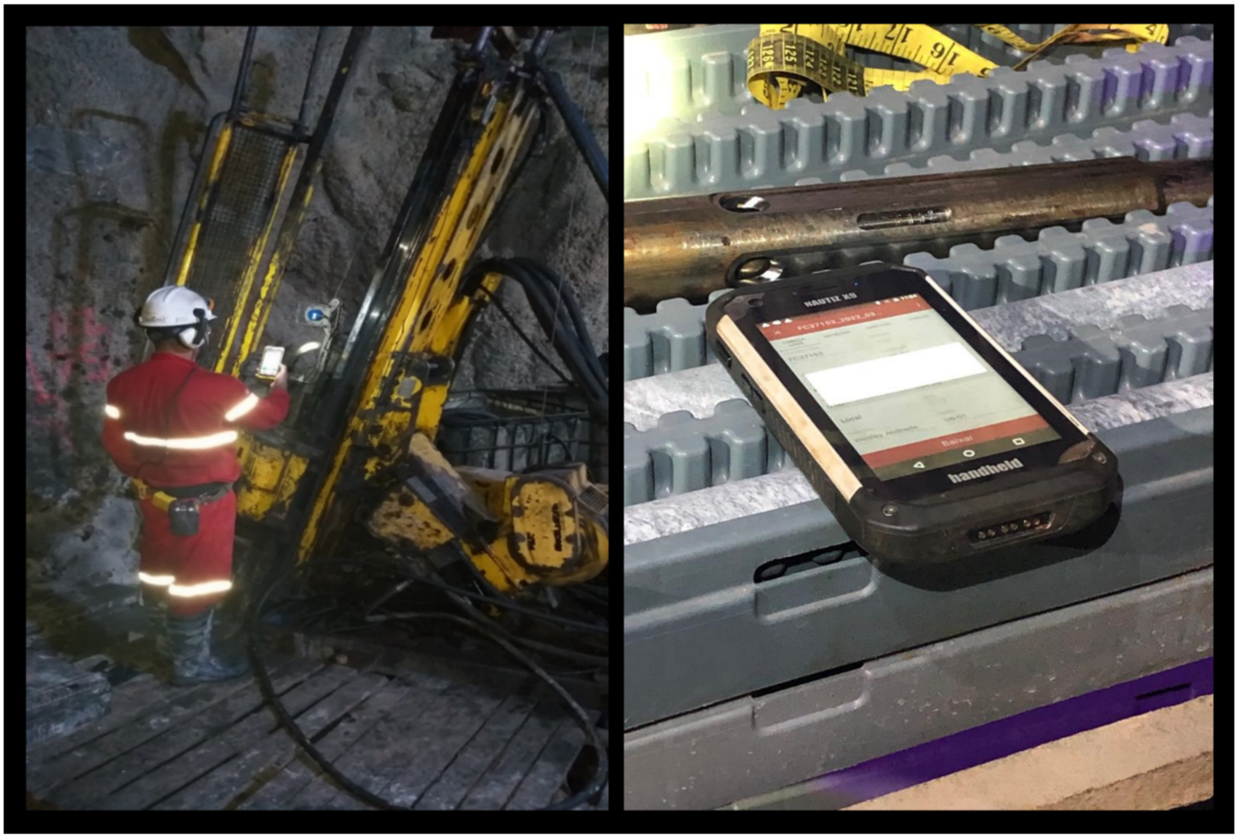


Figure 10-4: Giro Master equipment preparing for drill hole deviation readings (Ero Brasil, 2019)

Diamond drill core is stored in wooden and plastic core boxes with 4m or 5m of capacity (for BQ diameter core considering running with 100% recovery). All drill core is photo registered. Photos are stored in a centralized database. The wooden plastic boxes are stored in steel shelves specially built for the purpose within the Ero Brasil core shed, where they are identified with permanent aluminum tags affixed to each box.

Core logging is performed by the Ero Brasil geology team according to industry best practices and follows well-defined standard operating procedures.

The following information is registered by the Ero Brasil geology team for each drill log:

- main lithology;
- geological contacts, including recorded angles if possible measured with a protractor;
- presence of magnetism;
- presence of carbonate material performed using hydro-chloric acid (“HCL”) of 10%;
- presence of foliation, including recorded angles if possible;
- any other geological structures such as faults, folds, shearing and banding;
- fractured zones or faults and their representation in the drill core; and

- presence of copper or other elements, indicating the sampling interval used for chemical analysis (50 centimeters ("cm") to 150cm within mineralized zones, defined by prevalent geologic features).

Drill hole logs are organized in Ero Brasil's geology file room in physical form and are also stored in the GEOEXPLO geological database management software. Information available in the geological database system includes drill hole coordinates, deviation survey, logging, density, recovery data, photos and all chemical analyses.

10.1 DENSITY

Rock density is determined using the Arquimedes method. The standard operating procedures for the method are detailed below and shown in Figure 10-5:

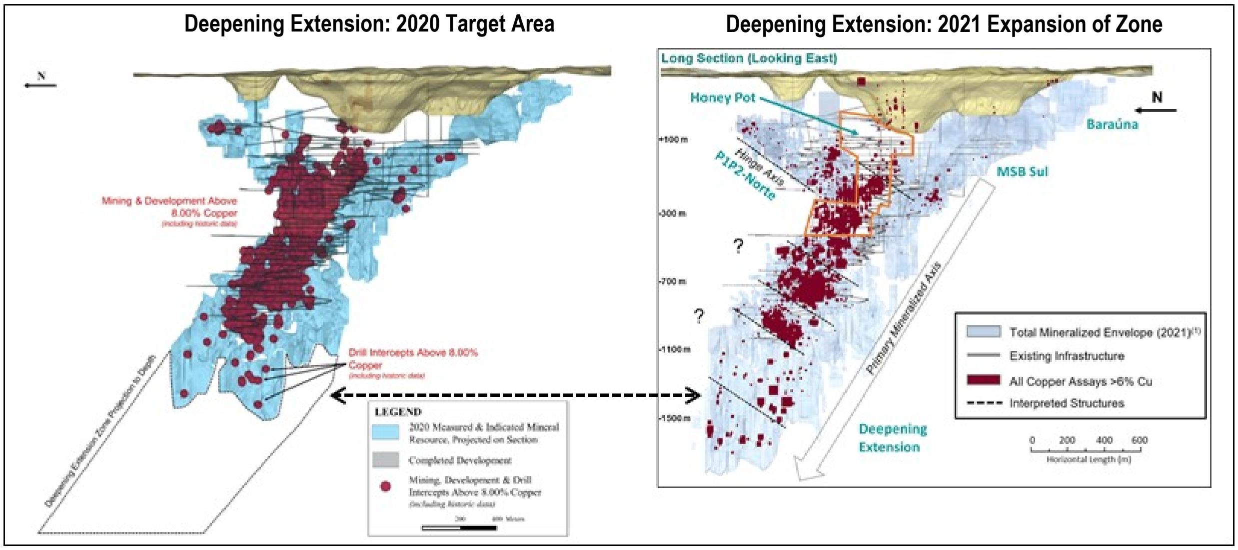
- selection of core interval for testing;
- length measurement (10 cm to 14 cm) and project association;
- lithology logging, mineralization and mineral type;
- record dry core weight in air – defining the Mass in Air ("MRxAR");
- submerge core in melted paraffin to create a thin waterproof layer;
- repeat core weighing to calculate mass of paraffin coating ("MParaf");
- core underwater weighing (the difference between the mass of the paraffin coated sample in air and mass of the paraffin coated sample in water corresponds to the mass of the water displaced by the core or the volume of the core sample); and
- the procedure considers the paraffin effect on the measurement (specific density ±0.9). For high precision, the following formula is used:

$$\text{Density} = \frac{M_{RxAr}}{(M_{R\ x\ Paraf\ .Air} - M_{R\ x\ Paraf\ .\ water}) - (M_{Paraf.} / 0{,}9)}$$

Figure 10-5: Density testing procedure (Ero Brasil, 2022)

10.2 PILAR MINE EXPLORATION

Exploration in the immediate Pilar UG Mine area focused successfully at extending known mineralization to depth, following the high-grade trend of mineralization which has been based upon a review of historical data and new drilling that intercepted mineralization above 8.0% copper, including in previously mined areas. Using this information, the Company has developed an interpolated north-plunging structural zone of high-grade potential extending to depth, as shown in Figure 10-6. Drilling from underground and surface utilizing directional drilling technology was completed to better evaluate mineralized continuity of this high-grade target area. During the Company's 2021-2022 drill program, focus was on validating the mineralization within the Project Honeypot area of the Pilar UG Mine, where several zones were not extracted in the past and are now part of the new resource estimation (Figure 10-6).



(1) 2021 Mineralized Envelope based on the Company's press release dated January 6, 2022.

Figure 10-6: Longitudinal Section of the Pilar UG Mine Comparing Interpreted Primary Exploration Target Area Projected from the Deepening Extension Zone in 2021 and expansion realized in 2021 (Ero Brasil, 2022)

10.3 SURUBIM DISTRICT EXPLORATION

The drilling at the Surubim Mine during 2021-2022 aimed at testing a zone located up to 200 m below the bottom of the pit. Best results within this zone include 0.87 % Cu and 0.1 g/t Au over 17.0 m and 2.01% Cu over 7.2 m approximately 200 m and 150 m respectively below the bottom of the pit. The Cu mineralization has not been closed and remains open at depth and along strike. Review of historical assay results and new analysis for PGE elements indicate that some portions of the Cu mineralization are also enriched in gold and platinum (for example 2.04% Cu, 0.22 g/t Au over 27.0 m ,including 3.03% Cu and 0.7% Au over 6.0 m and 1.27% Cu, 0.38 g/t Au, 0.11 g/t Pd over 16.5 m). The significance of the local elevated gold and PGE content of the copper mineralization is currently being evaluated.

Drilling mineralized zones in the eastern corridor during 2021-2022 returned significant intercepts that extended the mineralization for each of the zones. At Lagoa da Mina, the drilling expanded the copper mineralization for over 150 m in its down-dip extension with 0.99 % Cu over 67 m and infill drilling was successful at intersecting 2.69 % Cu over 32.2 m to confirm continuity of the mineralization (Figure 10-7).

At the Terra do Sal deposit, located 8.0 km to the SE of the Surubim Mine, drilling has returned an interval assaying 1.02% Cu over 25.0 m to extend the known copper mineralization for another 100 m in its down-dip extension.

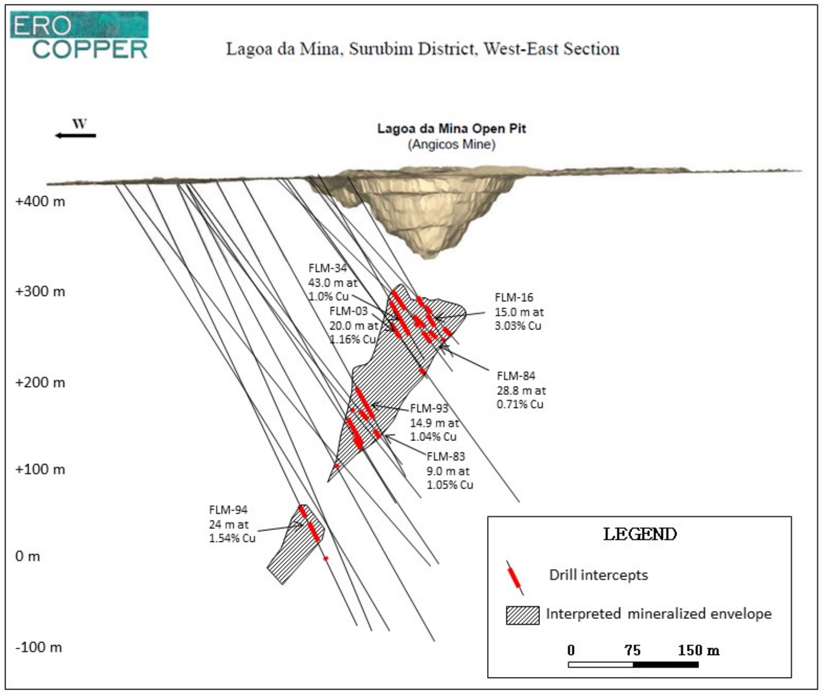
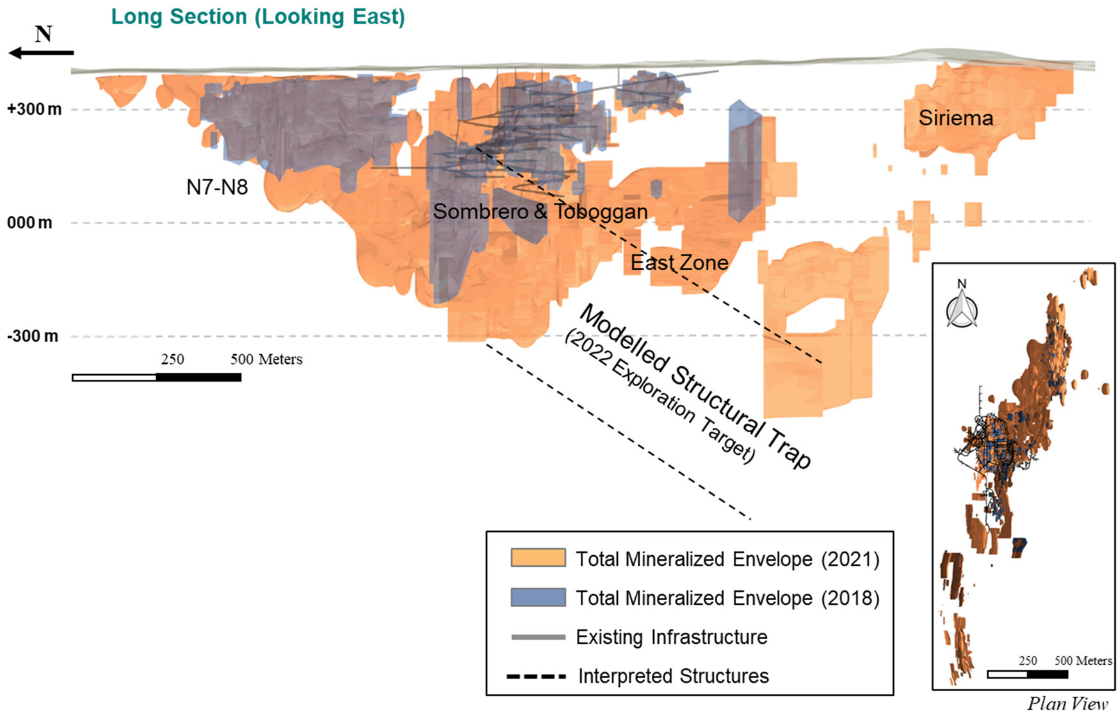


Figure 10-7:Vertical cross-section looking North with recent drill intersections below the historic Lagoa da Mina Open Pit (Ero Brasil, 2021).

10.4 VERMELHOS MINE AND NEAR MINE EXPLORATION

Exploration potential within the Vermelhos UG Mine itself is primarily focused on extensions of known mineralization down plunge to the north as well as beneath the main orebodies of the Vermelhos UG Mine. In 2020 and 2021, new near-mine target areas were identified near the Vermelhos UG Mine, known as the “Southern Vermelhos Corridor” which extends from Siriema to the UG1 mining area, located at the southern limits of the Vermelhos UG Mine (Figure 10-8). The target zone has a north-south strike length of approximately 700 meters. Drilling continues to demonstrate positive results highlighted recently by the Company’s drilling identified new copper mineralization below Toboggan and Sombrero bodies along the same fold trace with intercepts of 1.82% Cu over 33.0 m and 5.86% Cu over 13.4 m. Drill testing of the Southern Vermelhos corridor, and in-particular a modelled south-plunging structural trap continues to demonstrate the occurrence of high-grace copper mineralization at depth. The Company continues to conduct systematic BHEM beneath the Vermelhos main orebodies and has made Vermelhos UG Mine a top exploration priority for the 2023 exploration program.

Mineralization of the Vermelhos UG Mine remains open to depth and along strike to the north and the south over a 5.5km trend extending from the N8/N9 OP Mine to the Siriema OP Mine to the south.



(1) 2021 Mineralized Envelope based on the Company's press release dated January 6, 2022.
(2) 2018 Mineralized Envelope based on the 2018 Technical Report.

Figure 10-8:Vertical longitudinal section, looking East, showing envelopes of mineral resources (2018 and 2021) and modelled structural trap exploration target (Ero Brasil, 2022).

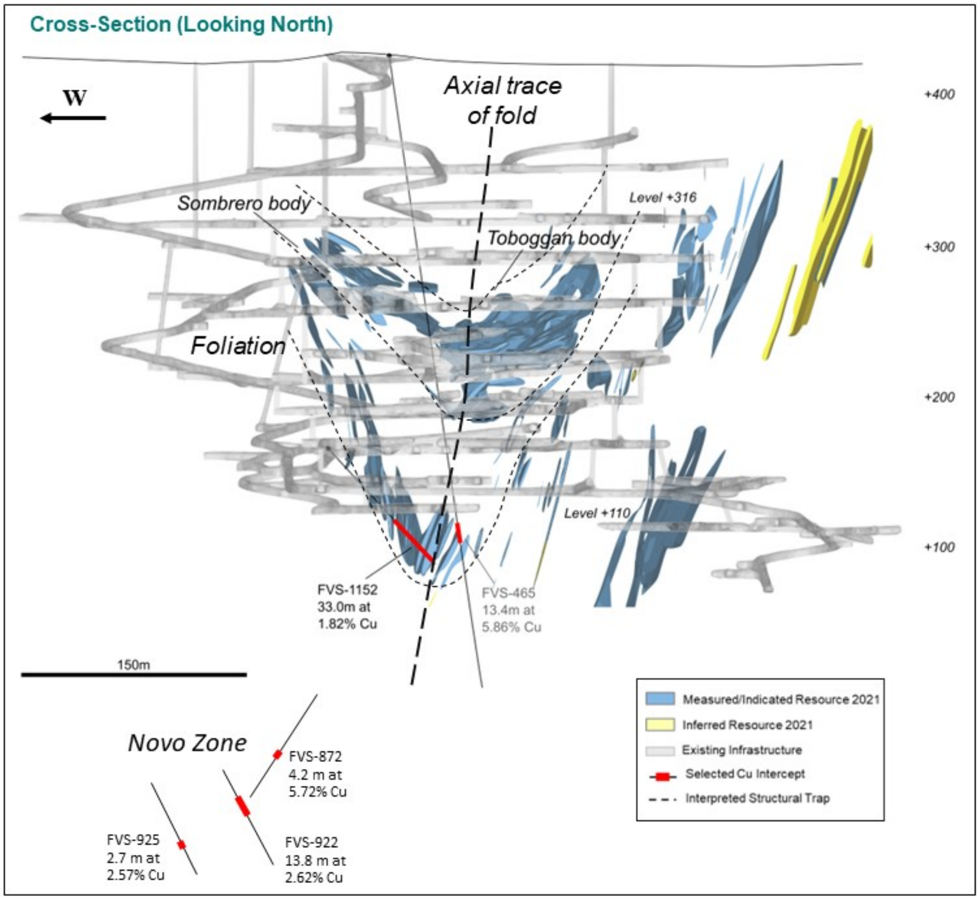


Figure 10-9:Vertical cross-section of the Vermelhos Mine with new drill intersections below current underground development. Section looking North (Ero Brasil, 2022).

11 SAMPLE PREPARATION, ANALYSES AND SECURITY

Sampling procedures in Ero Brasil installations, both Pilar and Vermelhos, are executed in accordance with mining industry best practices and well-defined standard operating procedures.

Core boxes are transported to the core shed by an Ero Brasil technician or a designated representative from the drilling company. After the drill hole and meterage are confirmed by an Ero Brasil geology technician and logging is performed by an Ero Brasil geologist, all core boxes are photographed. The intervals and the sample numbers are clearly labeled on all core boxes. A diamond core saw is used to split the drill cores in half lengthwise as shown in the figure below. A spatula is used in core sections where the rock has deteriorated due to intense alteration or is highly fractured. Sample intervals are between 50cm and 150cm within the mineralized zone as defined by geological features. The only exception to this rule was within the Surubim Mine deposit where three-meter sample intervals were adopted within the near-surface oxidized zones.

Once the core has been cut, half of the drill core is placed in plastic bags and sent to the Ero Brasil laboratory at the Caraíba Operations for physical preparation and chemical analysis, as shown in the figure below. The remaining half-core is retained for storage in Ero Brasil's core shed.

Due to the limited size of the drill core shed, Ero Brasil must regularly discard older drill core sample material. The criteria for selecting core for disposal is well defined and limited to:

- drill core from areas of the deposit that have already been mined; and
- drill core obtained from duplicated zones via fan drilling for production definition are discarded, provided that a confirmed representative drill core from each mineralized zone is kept.

Figure 11-1: Core Sampling Procedures (Ero Brasil, 2022)

Figure 11-2: Transportation and Storage of Drill Core Samples (Surubim District) (Ero Brasil, 2022).

The following standard operating procedures are undertaken at the Caraíba Operation's on-site laboratory for completion of the physical preparation and chemical analysis of the core samples:

Physical Preparation:

- arrival, verification and logging of samples;
- crushing and drying of the samples in an oven at 105°C;
- crushing of the samples in a ½" jaw crusher;
- further crushing in a cone crusher to a particle size of minus #6 mesh;
- homogenization and quartering of the material in a rotary splitter. Half of the sample is utilized in the process and half is sent to be stored in the core shed;
- the half used in the process is sent to a disk mill to be milled to minus 20 mesh;
- the material is then homogenized and quartered to ±70g;
- the material is then pulverized in a pan mill to minus 150 mesh;

Quantitative Determination:

- weigh 0.250g using an analytical scale and transfer the material to a 250 milliliter ("ml") beaker; weigh one duplicate sample for every five samples weighed;
- apply an acid mixture to the material (5 ml of HNO_3 and 10 ml of HCl);
- heat the solution on a hotplate for 10 minutes;
- after 10 minutes, the solution is removed from the hotplate and 25 ml of distilled water is added. The solution is then allowed to cool for about five minutes until it reaches room temperature;
- filter paper, held in place by a retention band, is used to filter the solution and the filtered material is then homogenized; and
- the analysis for copper and nickel is conducted using an atomic absorption spectrometer ("AAS").

Ero Brasil has recently installed and implemented the use of multi-element Inductively Coupled Plasma - Optical Emission Spectrometry ("ICP-OES") and X-Ray Diffraction ("XRD") analysis that are being used primarily to further evaluate the recently observed presence of platinum group metals and for use in ongoing geometallurgical studies.

GE21 has evaluated the sample collection, analysis and security procedures, as well as the procedures that were executed by Ero Brasil's internal laboratory, and found them to be sound, having been executed in accordance with industry best practices. Verification procedures, results of verification analysis and detailed comments are addressed in Chapter 12 – Data Verification of this Report.

11.1 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

Ero Brasil began to implement routine QA/QC procedures in its activities in 2007. Thereafter, Ero Brasil has been perfecting these procedures based on continuous improvement initiatives implemented by Ero Brasil personnel and recommendations from external consultants.

The QA/QC program covers each chemical analysis performed on drill core samples with the aim of:

- avoiding the use of poor-quality information during the construction of geological models and the execution of resource estimates; and
- promoting procedures for controlling and guaranteeing the quality and reliability of the samples that are prepared and of the chemical analytical result that are obtained in the laboratory.

GE21 conducted the validation of QA/QC data generated in the period from July 4, 2020 to current Effective Date and data presented in the 2021 Technical Report (including data generated between August 18, 2018 and July 4, 2020), separately. Prior QA/QC data was validated by GE21, as detailed in prior technical studies including in the 2017 Technical Report and 2018 Technical Report. A QA/QC *post-mortem* analysis for Project Honeypot in the Pilar UG Mine was performed partly in 2019 and completed in 2022 for inclusion in this Report.

For other target's samples pre-dating the 2007 implementation of QA/QC procedures, a post-mortem analysis was conducted that involved re-analyzing a minimum of 10% of the total number of samples with no corresponding QA/QC data that would be used in the resource and reserve grade estimation to validate the historic assays (before 2007). Details of the post-mortem processes are included in the 2017 Technical Report.

The current validation, corresponding 2018-2022 campaigns, included:

- Blanks
- Standards
- Pulverized Duplicates
- Coarse Tailings Duplicates
- Secondary Laboratory
- Post-mortem Duplicates (for HP target)

11.1.1 2018-2020 QAQC Validation

11.1.1.1 Blank Samples

Mafic gneiss samples that are pulverized to minus 150 mesh at Ero Brasil's laboratory are used as blank control samples. These samples are included with the aim of verifying the quantitative analysis undertaken by the laboratory. The blank samples are sent at an interval of one blank sample for every 10 samples within each batch (a rate of 10%). The figure below presents the statistics and results associated with the blank control samples for period between August 1, 2018, to the July 4, 2020. Results from samples that underwent these quality control procedures and are within the quality control limits, were considered acceptable (Figure 11-3).

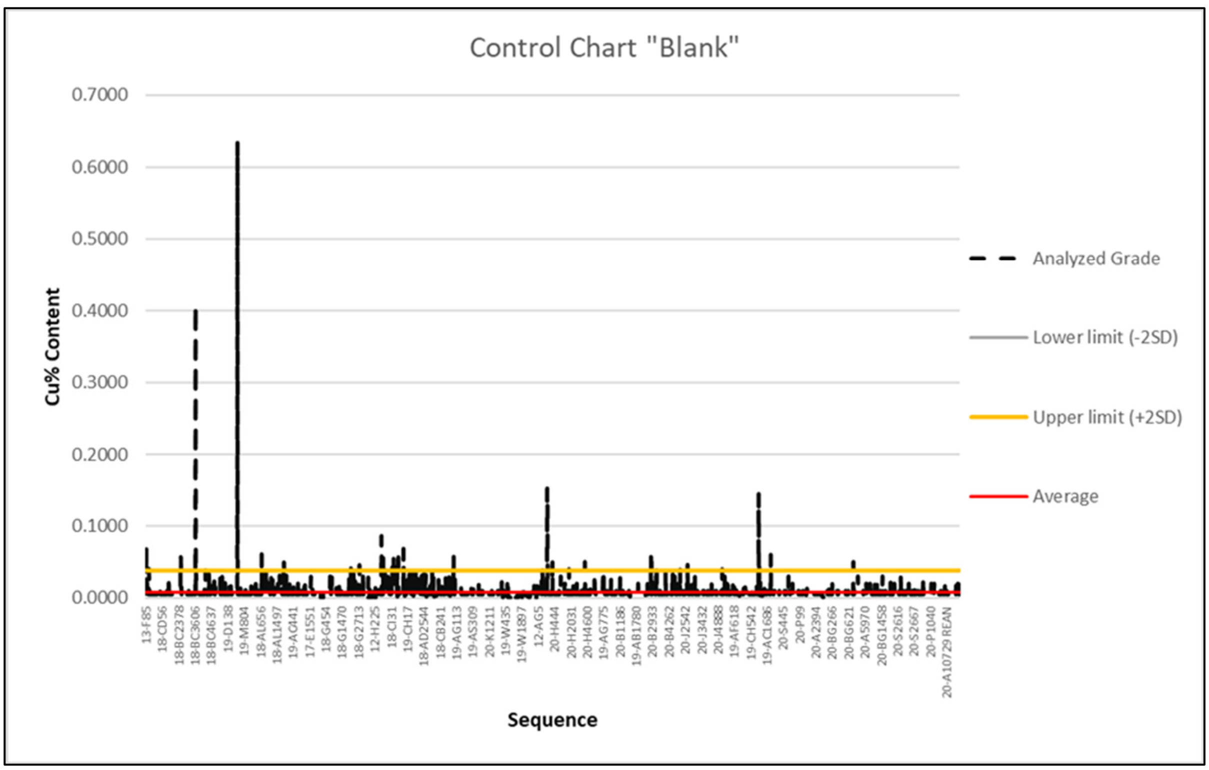


Figure 11-3: Result of the Analysis of Blank Samples, August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

11.1.1.2 Standard Samples

Ero Brasil uses standard samples to verify the laboratory's accuracy. One CRM control sample is inserted at every 10 samples (a rate of 10%), within the batch of duplicates. The CRM samples used, ranged from low to high copper grades. Ero Brasil contracted ITAK to prepare and certify the CRM standards produced from the Curaçá Valley.

Based on internal controls, Ero Brasil has established that 90% of the tested samples should be within the minimum and maximum limits, defined as within two standard deviations of the CRM certified value (or 95% confidence limits). The values of these limits are presented in the table below.

Figure 11-4 to Figure 11-20 shows the results of the QA/QC analysis of the CRM over the period from August 1, 2018, to July 4, 2020.

Table 11-1: Ero Brasil – Caraíba CRM Evaluation Criteria (August 1, 2018, to July 4, 2020)

CRM ID	Certified value (%)	Lower Limit (%)	Upper Limit (%)
		95% Confidence	
ITAK-809	0.36	0.34	0.38
ITAK-814	0.45	0.43	0.47
ITAK-821	0.36	0.35	0.38
ITAK-823	0.87	0.82	0.92
ITAK-824	2.68	2.54	2.81
ITAK-825	5.76	5.54	5.98
ITAK-833	1.57	1.50	1.65
ITAK-842	1.56	1.51	1.62
ITAK-843	0.80	0.76	0.83
ITAK-844	0.32	0.30	0.35
ITAK-847	0.42	0.41	0.44
ITAK-848	0.64	0.62	0.65
ITAK-849	1.06	1.03	1.09
ITAK-850	3.55	3.43	3.68
ITAK-851	6.98	6.40	7.56
GBM-306-14	1.67	1.55	1.79
GBM-907-14	0.82	0.75	0.89

Type of Control	Standard
Reference	ITAK809
Variable	Cu%
Number of analysis	4

Code	Cu%
Reference Value	**0.359**
Standard desviation	**0.010**
Upper limit (+2SD)	0.380
Lower limit (-2SD)	0.340

Minimum	0.34
Maximum	0.37
Average	0.35
Median	0.35
Bias	-1.79%

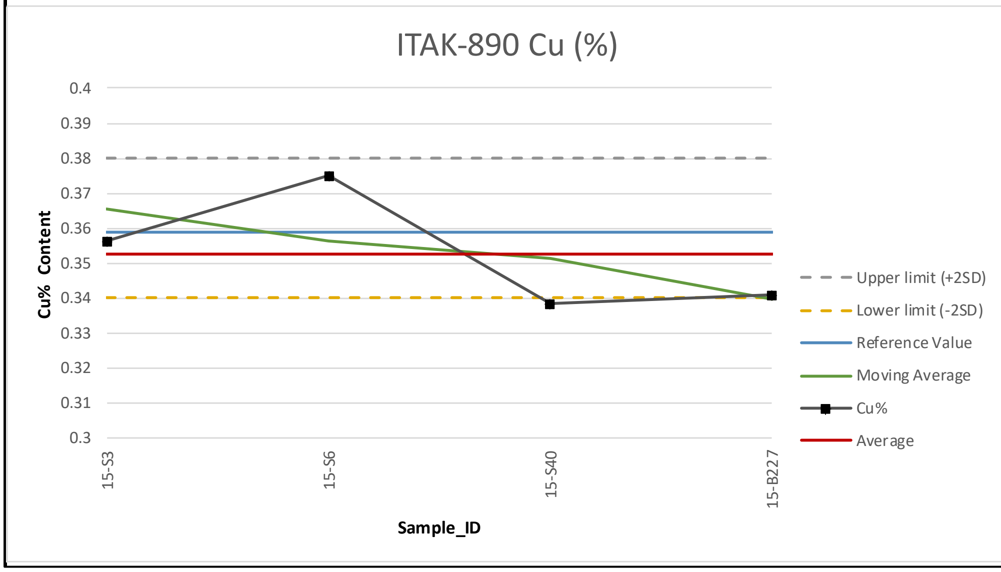


Figure 11-4: Result of the QA/QC Analysis of CRM ITAK 809 August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK814
Variable	Cu%
Number of analysis	90

Code	Cu%
Reference Value	0.451
Standard desviation	0.010
Upper limit (+2SD)	0.470
Lower limit (-2SD)	0.430

Minimum	0.42
Maximum	0.51
Average	0.46
Médian	0.46
Bias	1.81%

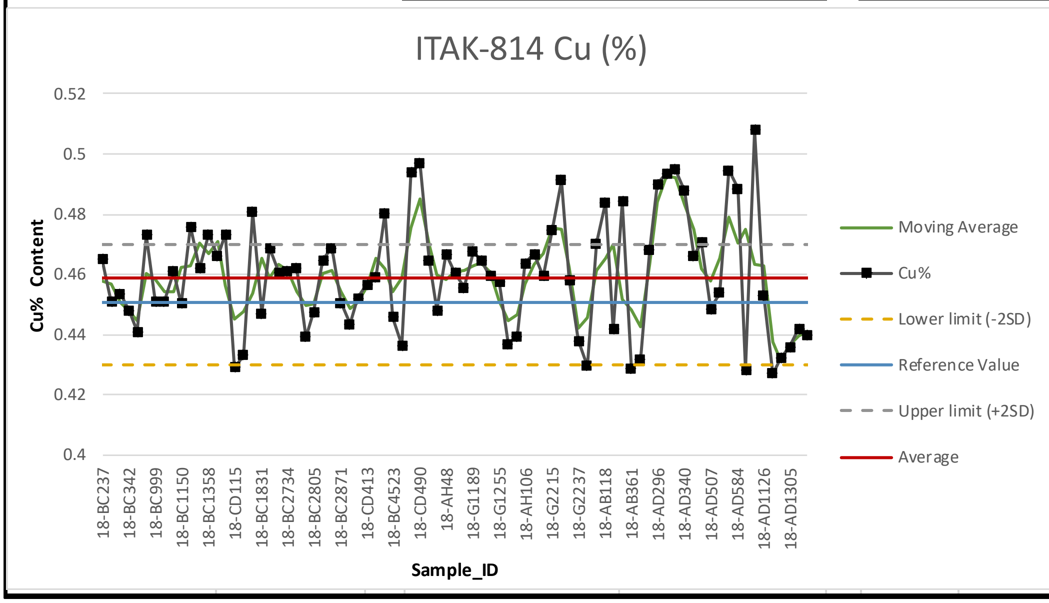


Figure 11-5: Result of the QA/QC Analysis of CRM ITAK 814 August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK821
Variable	Cu%
Number of analysis	116

Code	Cu%
Reference Value	0.362
Standard desviation	0.009
Upper limit (+2SD)	0.380
Lower limit (-2SD)	0.350

Minimum	0.32
Maximum	0.42
Average	0.37
Médian	0.36
Bias	0.96%

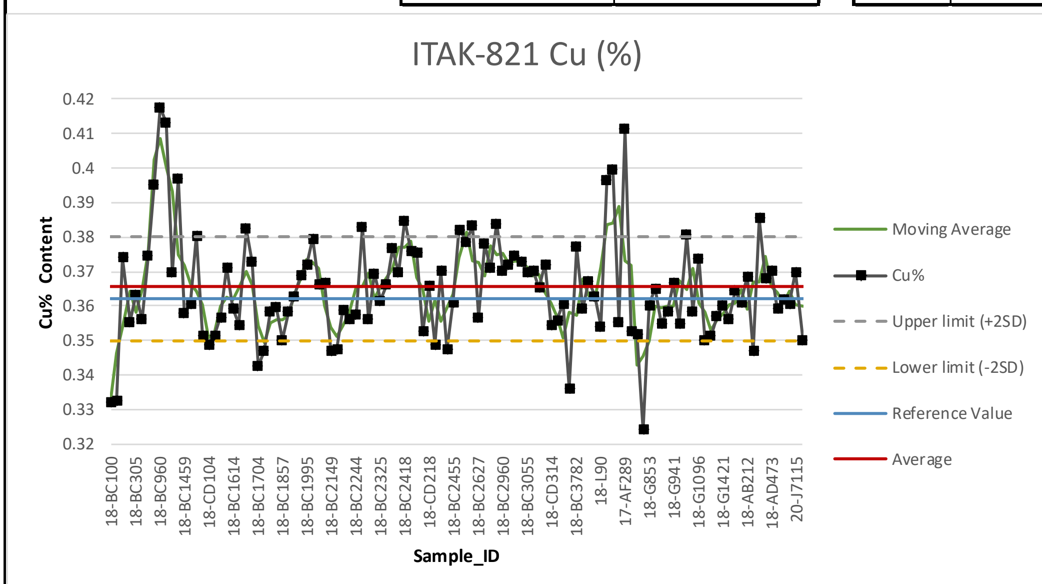


Figure 11-6: Result of the QA/QC Analysis of CRM ITAK 821 August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK823
Variable	Cu%
Number of analysis	134

Code	Cu%
Reference Value	**0.874**
Standard desviation	**0.020**
Upper limit (+2SD)	0.920
Lower limit (-2SD)	0.820

Minimum	0.74
Maximum	0.97
Average	0.86
Médian	0.86
Bias	-1.41%

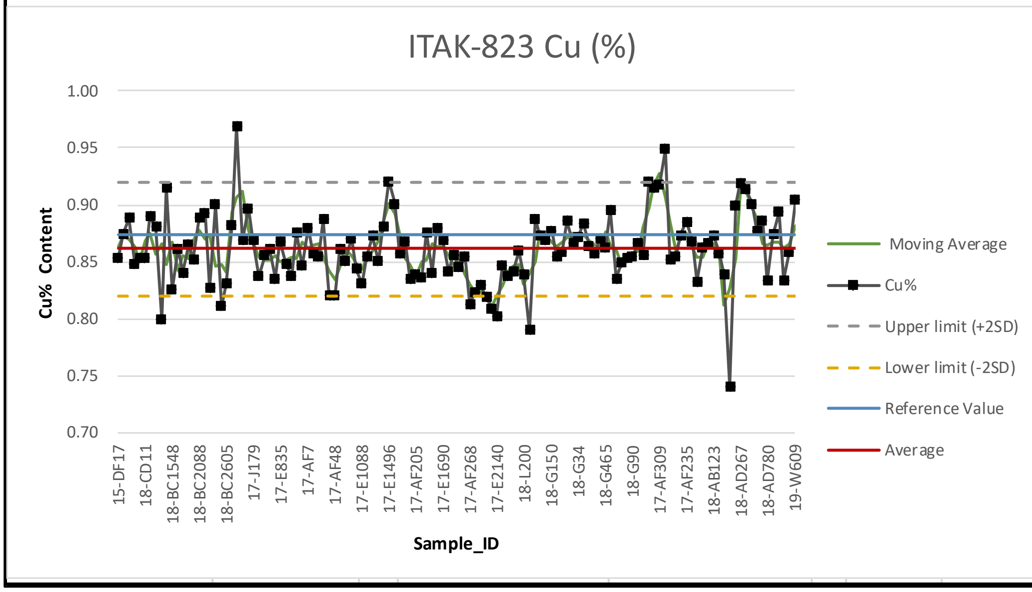


Figure 11-7: Result of the QA/QC Analysis of CRM ITAK 823 August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK824
Variable	Cu%
Number of analysis	94

Code	Cu%
Reference Value	**2.678**
Standard desviation	**0.066**
Upper limit (+2SD)	2.810
Lower limit (-2SD)	2.540

Minimum	2.31
Maximum	2.79
Average	2.62
Médian	2.62
Bias	-2.32%

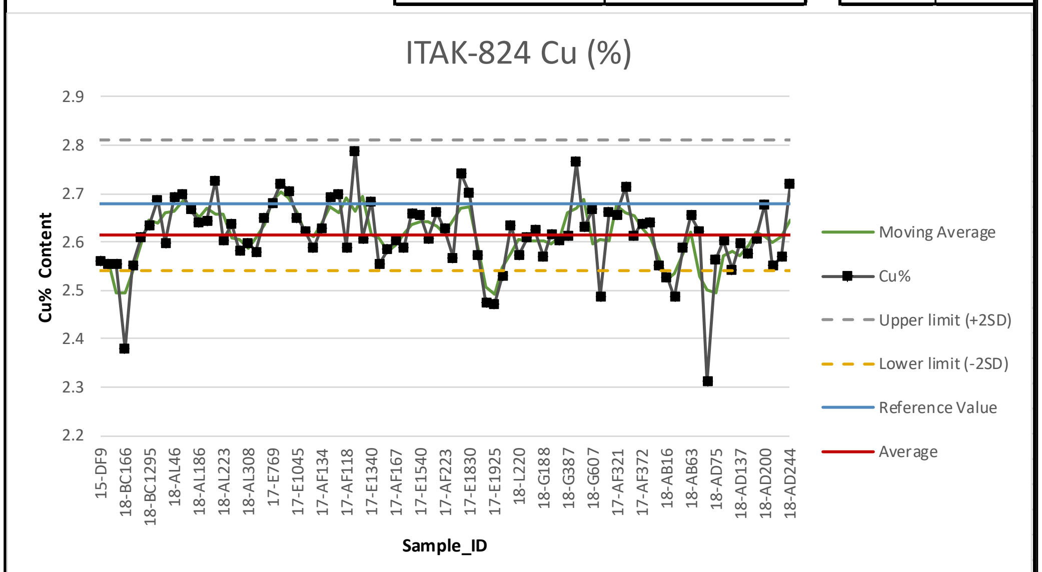


Figure 11-8: Result of the QA/QC Analysis of CRM ITAK 824 August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Type of Control	Standard	Code	Cu%	Minimum	5.05
Reference	ITAK825	Reference Value	5.760	Maximum	6.33
Variable	Cu%	Standard desviation	0.110	Average	5.51
Number of analysis	63	Upper limit (+2SD)	5.980	Médian	5.50
		Lower limit (-2SD)	5.540	Bias	-4.31%

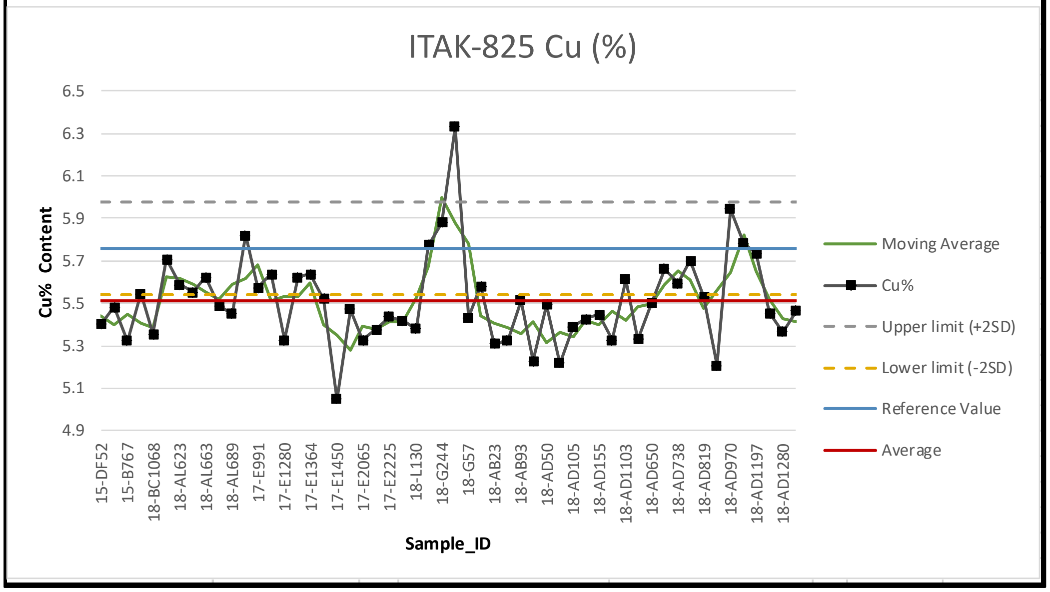


Figure 11-9: Result of the QA/QC Analysis of CRM ITAK 825 August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Type of Control	Standard	Code	Cu%	Minimum	1.44
Reference	ITAK833	Reference Value	1.571	Maximum	1.67
Variable	Cu%	Standard desviation	0.004	Average	1.54
Number of analysis	83	Upper limit (+2SD)	1.650	Médian	1.54
		Lower limit (-2SD)	1.500	Bias	-2.19%

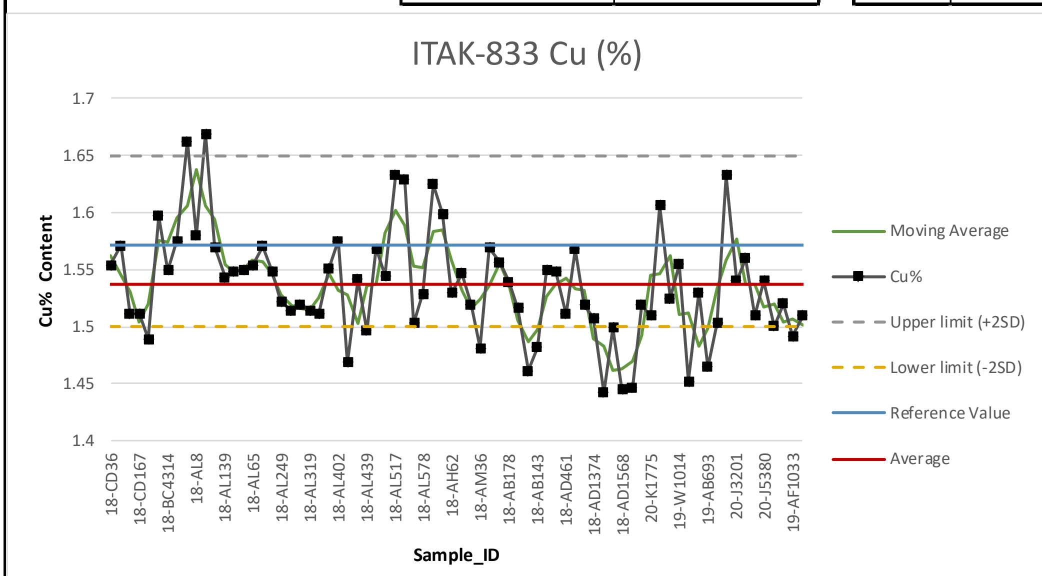


Figure 11-10: Result of the QA/QC Analysis of CRM ITAK 833 August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK842
Variable	Cu%
Number of analysis	221

Code	Cu%
Reference Value	1.562
Standard desviation	0.030
Upper limit (+2SD)	1.620
Lower limit (-2SD)	1.510

Minimum	1.37
Maximum	1.68
Average	1.56
Médian	1.56
Bias	0.05%

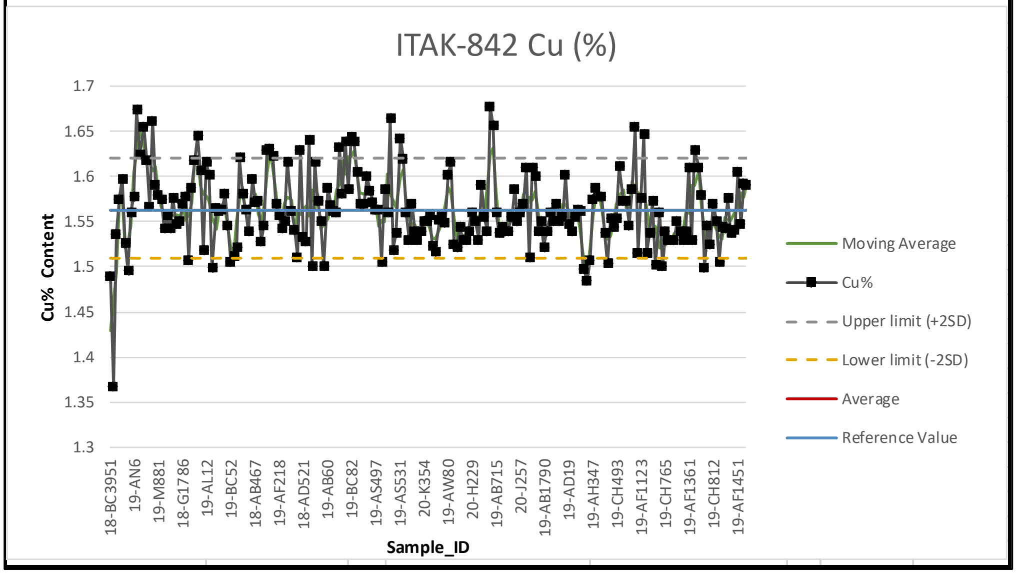


Figure 11-11: Result of the QA/QC Analysis of CRM ITAK 842 August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK843
Variable	Cu%
Number of analysis	384

Code	Cu%
Reference Value	0.796
Standard desviation	0.030
Upper limit (+2SD)	0.860
Lower limit (-2SD)	0.730

Minimum	0.64
Maximum	1.05
Average	0.81
Médian	0.81
Bias	1.39%

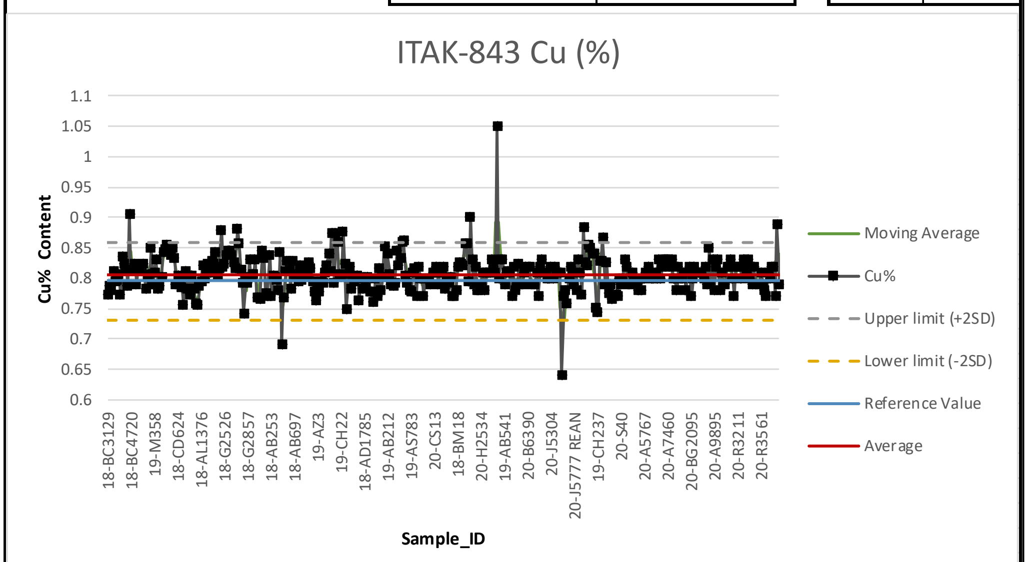


Figure 11-12: Result of the QA/QC Analysis of CRM ITAK 843 August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK844
Variable	Cu%
Number of analysis	590

Code	Cu%
Reference Value	**0.323**
Standard desviation	**0.015**
Upper limit (+2SD)	0.350
Lower limit (-2SD)	0.300

Minimum	0.26
Maximum	0.42
Average	0.33
Médian	0.33
Bias	1.22%

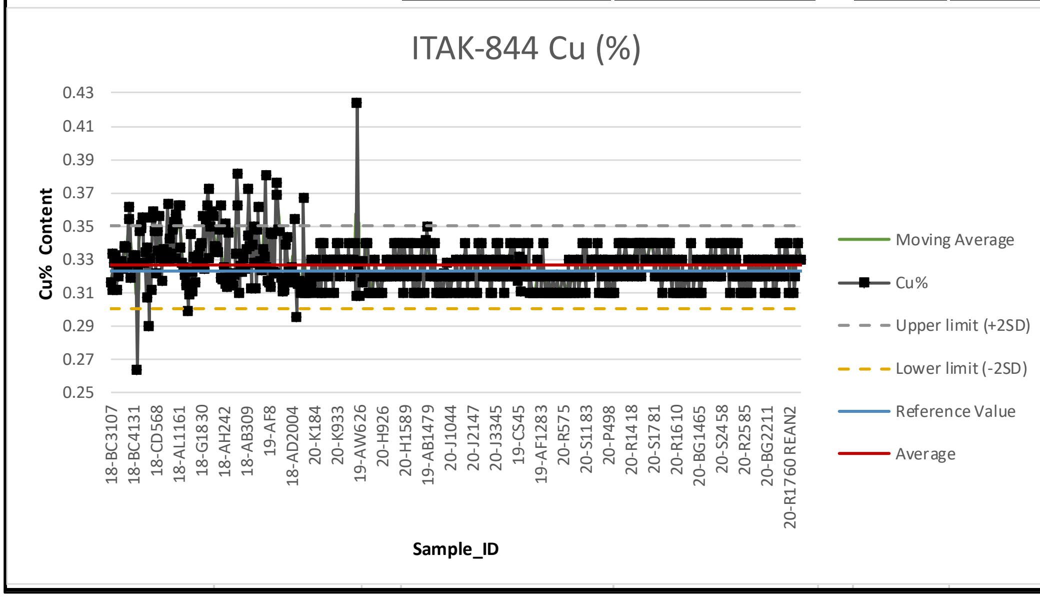


Figure 11-13: Result of the QA/QC Analysis of CRM ITAK 844 August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK847
Variable	Cu%
Number of analysis	413

Code	Cu%
Reference Value	**0.422**
Standard desviation	**0.010**
Upper limit (+2SD)	0.440
Lower limit (-2SD)	0.410

Minimum	0.20
Maximum	1.08
Average	0.42
Médian	0.42
Bias	0.38%

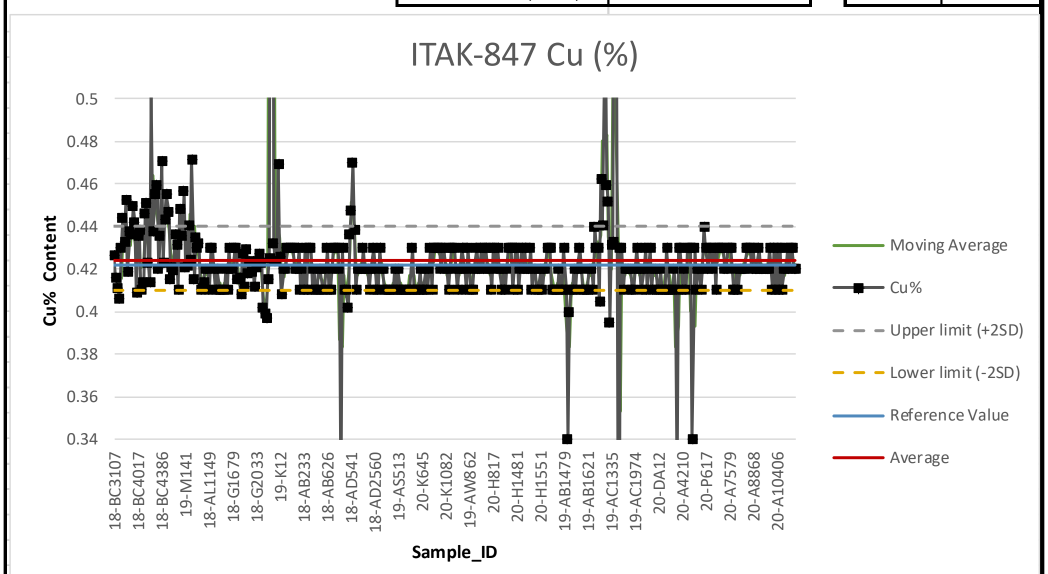


Figure 11-14: Result of the QA/QC Analysis of CRM ITAK 847 August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK848
Variable	Cu%
Number of analysis	262

Code	Cu%
Reference Value	0.636
Standard desviation	0.007
Upper limit (+2SD)	0.650
Lower limit (-2SD)	0.620

Minimum	0.59
Maximum	0.74
Average	0.64
Médian	0.64
Bias	0.59%

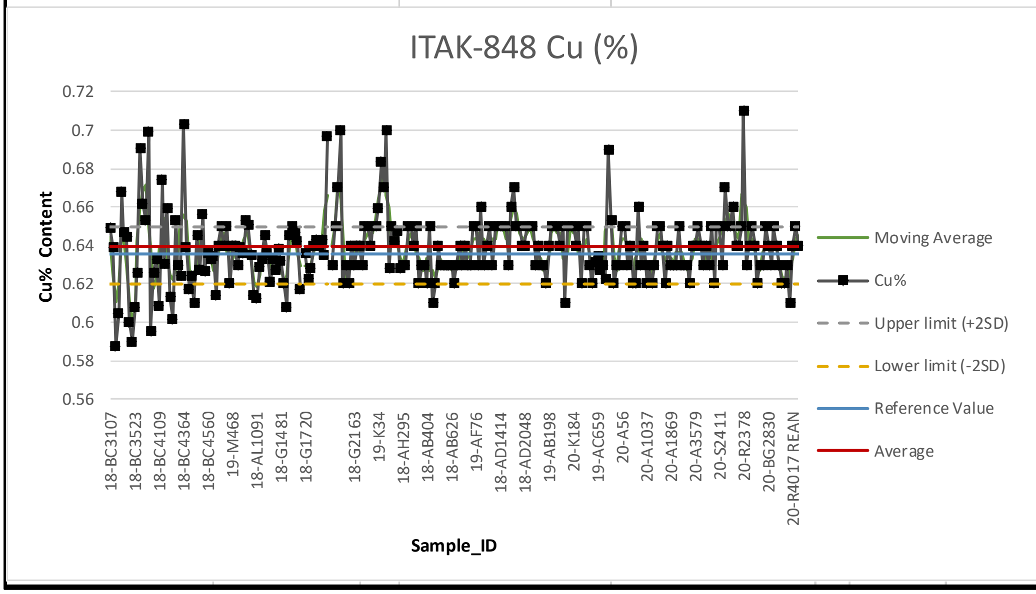


Figure 11-15: Result of the QA/QC Analysis of CRM ITAK 848 August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK849
Variable	Cu%
Number of analysis	444

Code	Cu%
Reference Value	1.062
Standard desviation	0.014
Upper limit (+2SD)	1.090
Lower limit (-2SD)	1.030

Minimum	0.95
Maximum	1.16
Average	1.06
Médian	1.06
Bias	-0.38%

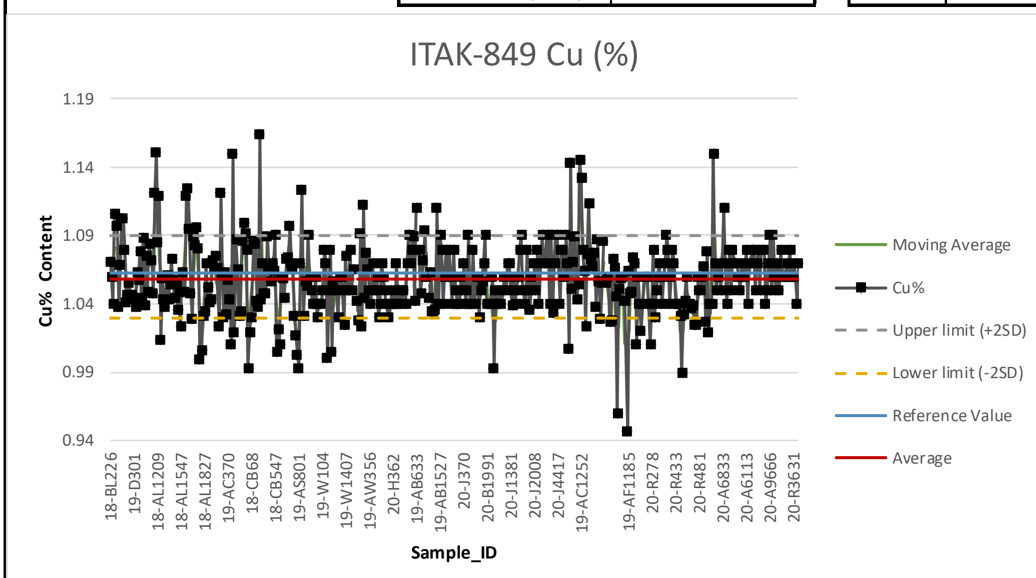


Figure 11-16: Result of the QA/QC Analysis of CRM ITAK 849 August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK850
Variable	Cu%
Number of analysis	370

Code	Cu%
Reference Value	3.554
Standard desviation	0.064
Upper limit (+2SD)	3.680
Lower limit (-2SD)	3.630

Minimum	3.19
Maximum	3.76
Average	3.53
Médian	3.53
Bias	-0.67%

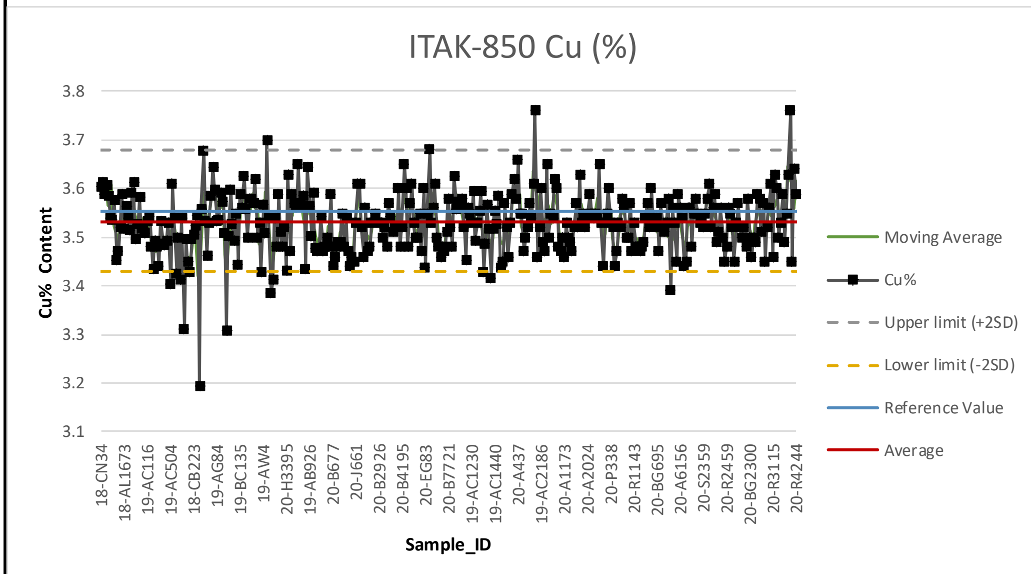


Figure 11-17: Result of the QA/QC Analysis of CRM ITAK 850 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK851
Variable	Cu%
Number of analysis	113

Code	Cu%
Reference Value	6.980
Standard desviation	0.290
Upper limit (+2SD)	7.560
Lower limit (-2SD)	6.400

Minimum	5.97
Maximum	7.48
Average	6.90
Médian	6.91
Bias	-1.21%

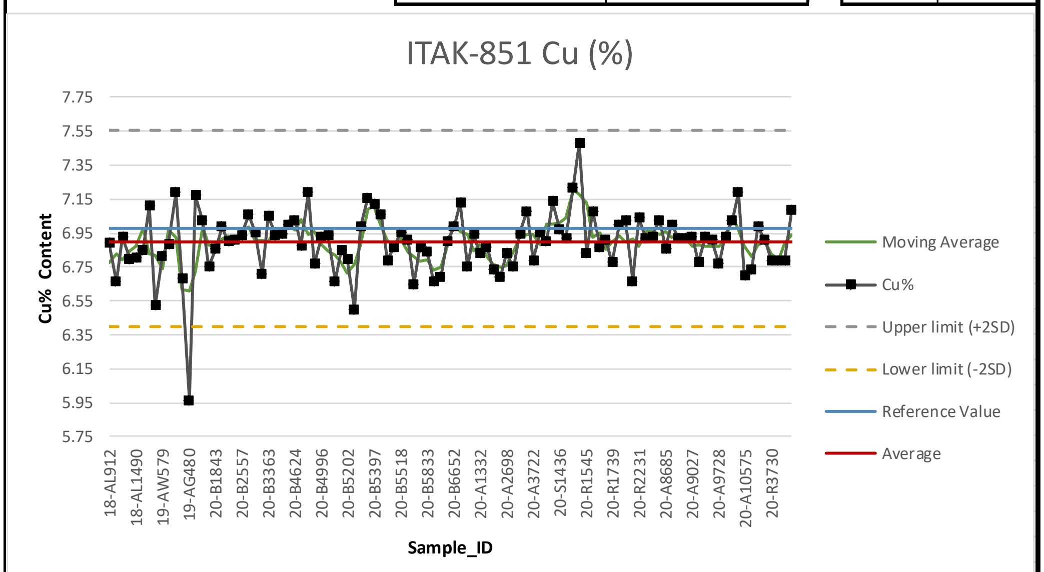


Figure 11-18: Result of the QA/QC Analysis of CRM ITAK 851 August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Type of Control	Standard
Reference	GBM-306-14
Variable	Cu%
Number of analysis	24

Code	Cu%
Reference Value	1.671
Standard desviation	0.060
Upper limit (+2SD)	1.790
Lower limit (-2SD)	1.550

Minimum	1.47
Maximum	1.79
Average	1.62
Median	1.62
Bias	-2.88%

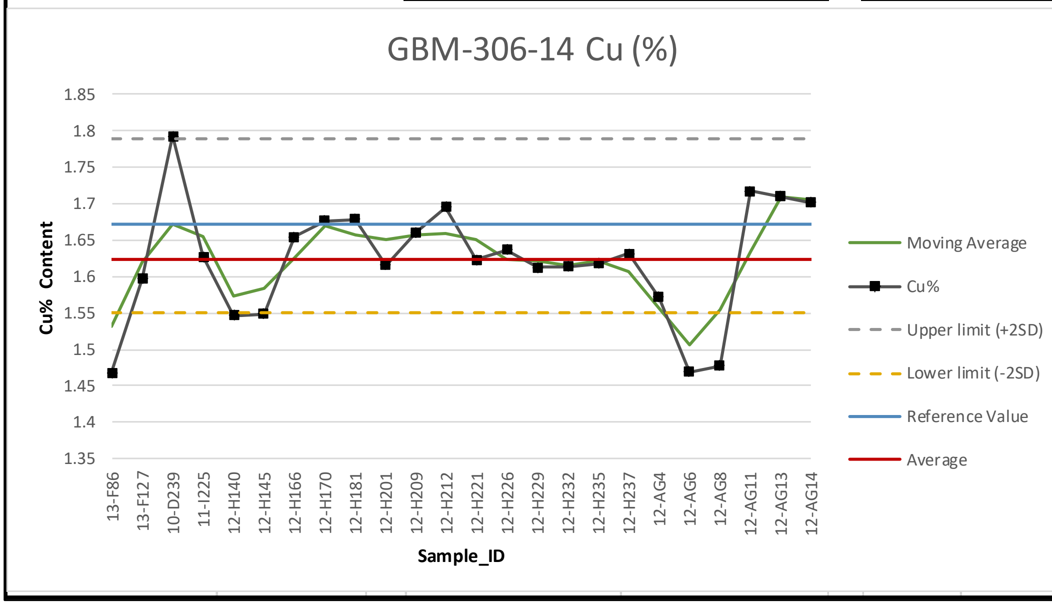


Figure 11-19: Result of the QA/QC Analysis of CRM CBM-306-14 August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Type of Control	Standard
Reference	GBM-907-14
Variable	Cu%
Number of analysis	15

Code	Cu%
Reference Value	0.817
Standard desviation	0.037
Upper limit (+2SD)	0.890
Lower limit (-2SD)	0.750

Minimum	0.75
Maximum	0.89
Average	0.80
Médian	0.81
Bias	-1.63%

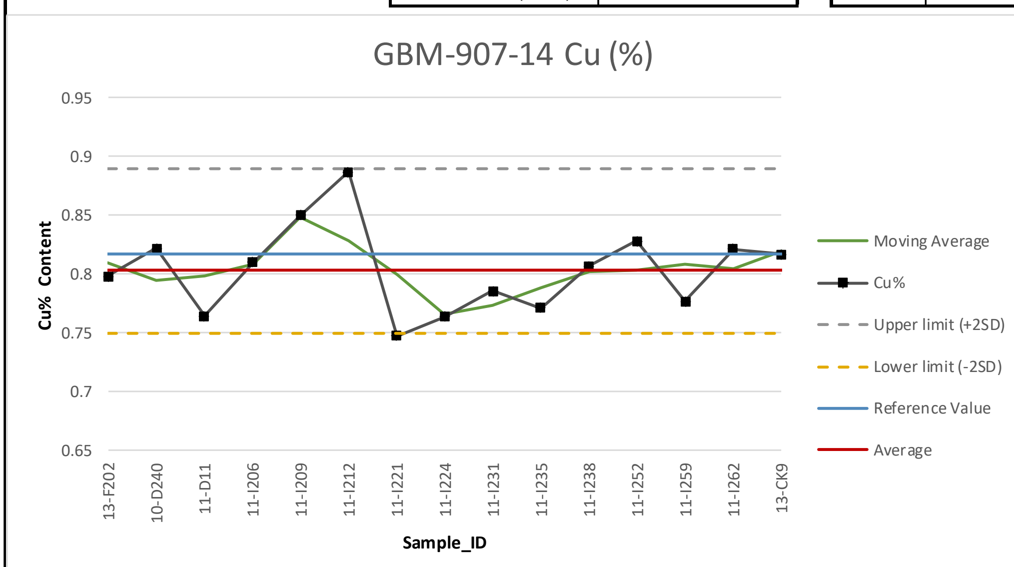


Figure 11-20: Result of the QA/QC Analysis of CRM GBM-907-14 August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Based upon the analysis of the QA/QC results it can be observed that the Ero Brasil laboratory provides good levels of accuracy at lower copper grades. Accuracy, in general, decreases as grades increase in part due to lower sample density. It was observed throughout the course of the GE21 review period, that the Ero Brasil laboratory continues to display a tendency to underestimate the copper values when using CRM ITAK 825; however, the results for CRM ITAK 851, which has similar Cu grade range to that of CRM ITAK 825, demonstrates better reproducibility.

GE21 recommended a validation of the certified grade for CRM ITAK 825 due to the observed inconsistencies with the analysis in the Ero Brasil laboratory, which is in contrast with the consistent results obtained when utilizing CRM ITAK 851, which has a similar Cu grade range.

11.1.1.3 Duplicate Samples

The typical QA/QC program implemented at Ero Brasil involves sending duplicate batches of 2 millimeter ("mm") coarse samples and pulverized 150 mesh samples to the internal laboratory. Samples are chosen to be representative of the sampling data. One sample is selected from the original batch of material at an interval of at least every 20 samples (a rate of 5%).

Analyzing the results of duplicate samples, the authors considered the following limits of acceptability: 20% of the relative difference for coarse reject duplicates and 10% of the relative difference for pulverized duplicates. Overall, the evaluation of Ero Brasil's QA/QC procedures and lab results showed acceptable results for the period from August 1, 2018, to July 4, 2020, as illustrated in the two figures below (Figure 11-21 and Figure 11-22).

Target	All core samples
Reference	Crushed
Variable	Cu_pct
Accuracy limit	20%
Number of pairs	6735

	Sample	Duplicate
Minimum	0.001	0.001
Maximum	29.17	30.15
Average	0.862	0.86
Median	0.28	0.282
HARD median		7.4

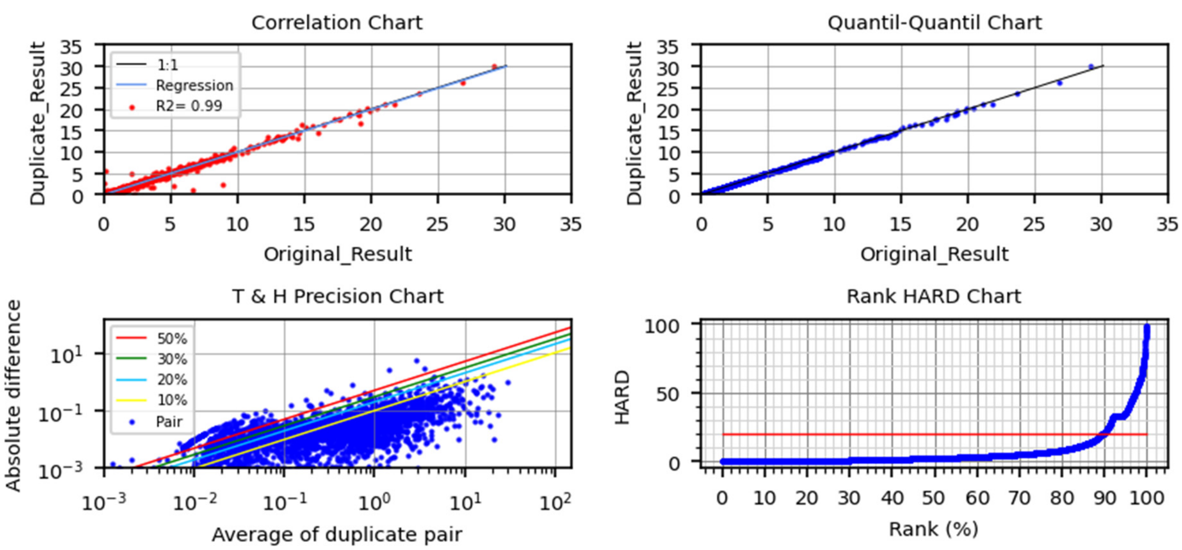


Figure 11-21: Analytical Result of the Crushed Duplicate Samples August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

Target	All core samples
Reference	Pulp
Variable	Cu_pct
Accuracy limit	10%
Number of pairs	8015

	Sample	Duplicate
Minimum	0.001	0.0
Maximum	37.38	37.43
Average	0.898	0.895
Median	0.29	0.286
HARD median		6.5

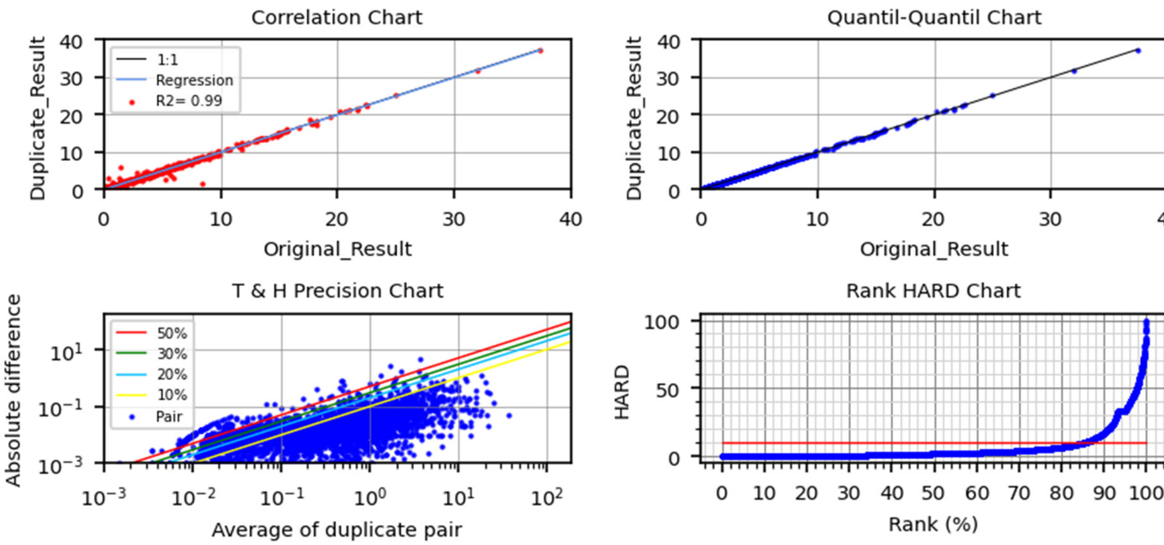


Figure 11-22: Analytical Result of the Pulverized Duplicate Samples August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

11.1.1.4 Check-Assay / Third-Party Laboratory

Check-assay analysis of copper grades by a third-party laboratory was implemented as part of Ero Brasil's QA/QC program. This control involves sending duplicate batches of pulverized samples to ALS Brasil Ltda.'s facility located in Vespasiano, Minas Gerais, Brazil. ALS Brasil Ltda. is a subsidiary of ALS Limited and is independent of the Company as such term is defined under NI 43-101. At a minimum, one sample is selected from the original batch of material at an interval of at least every 40 samples (a rate of 2.5%), with a target rate of approximately 5.0% under the program. In analyzing the results of duplicate check-assay samples, the authors considered 15% of the relative difference as within acceptable limits.

Overall, the evaluation of Ero Brasil's QA/QC procedures and lab results showed acceptable results as illustrated in Figure 11-22, analyzing data generated between September 18, 2019, and July 4, 2020. While it should be noted that only 70% of the samples during this period exhibited a relative difference within the acceptable limit, the authors note (as evidenced in the T&H precision graph) that the largest relative differences occur within the lowest grade ranges. GE21 recommended continuing this control and implementation of a continuous assessment program to reduce relative differences in the future.

Target	All core samples
Reference	Secondary Lab
Variable	Cu_pct
Accuracy limit	15%
Number of pairs	1111

	Sample	Duplicate
Minimum	0.0	0.001
Maximum	13.91	13.455
Average	0.326	0.318
Median	0.023	0.023
HARD median		15.9

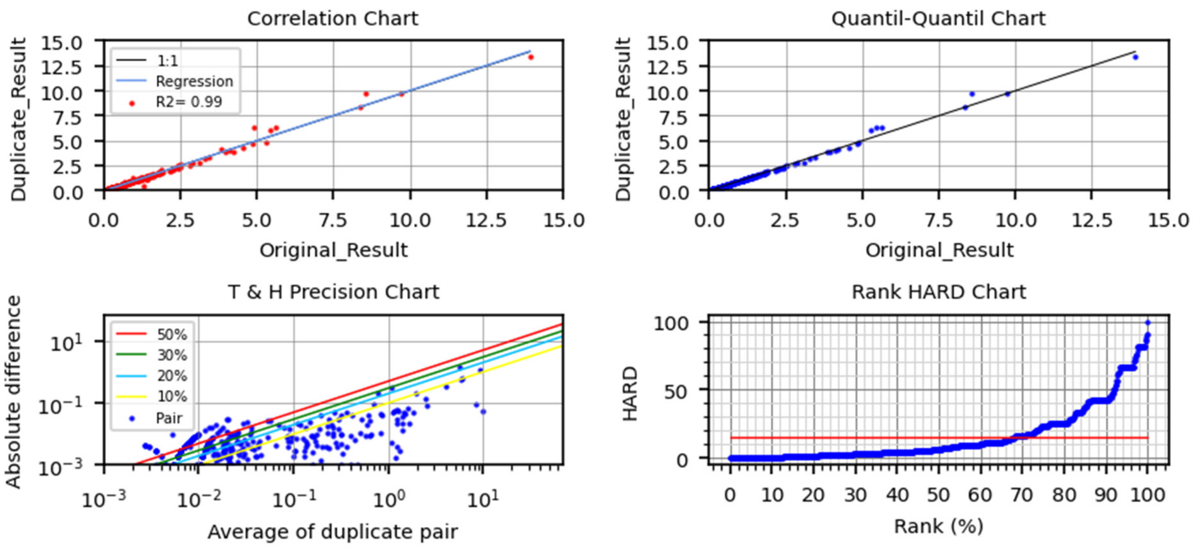


Figure 11-23: Analytical Result of the secondary laboratory August 1, 2018, to July 4, 2020 (Ero Brasil, 2022)

11.1.2 **2020-2022 QAQC Validation**

GE21 conducted the validation of QA/QC data generated for the following Ero Brasil deposits (Table 11-2), from July 4, 2020, to the Effective Date of this report:

Table 11-2: Deposit / Zones within the QAQC 2022 validation by GE21

Deposit / Zone
MSCSUL (Baraúna), Pilar UG Mine
P1P2N, Pilar UG Mine
S10, Pilar District Open Pit
C4, Surubim District Open Pit
S3, Pilar District Open Pit
N7, Vermelhos UG Mine
N8, Vermelhos District Open Pit
N10, Vermelhos District Open Pit
LM, Surubim District Open Pit
MCASUR, Pilar District Open Pit
APF, Pilar UG Mine (Deepening)
HP, Pilar UG Mine (Project Honeypot)

11.1.2.1 Blank Samples

The blank samples are sent at an interval of one blank sample for every 10 samples within each batch (a rate of 10%). Figure 11-24 presents the statistics and results associated with the blank control samples for period between July 4, 2020, to the Effective Date. Results from samples that underwent these quality control procedures, and are within the quality control limits, are considered acceptable. 12 samples were removed from the analysis because they were considered outliers, presenting mostly copper high grades (Table 11-3).

Type of control	Blank
Reference	Blank
Variable	Cu%
Number of analysis	1 940

Pattern's code	Blank
Certificate Value	0.0000
Standard desviation	0.00
Upper limit (5*DL)	0.0050

Minimum	0.00
Maximum	0.08
Average	0.01
Median	0.01
Outside upper limit	266

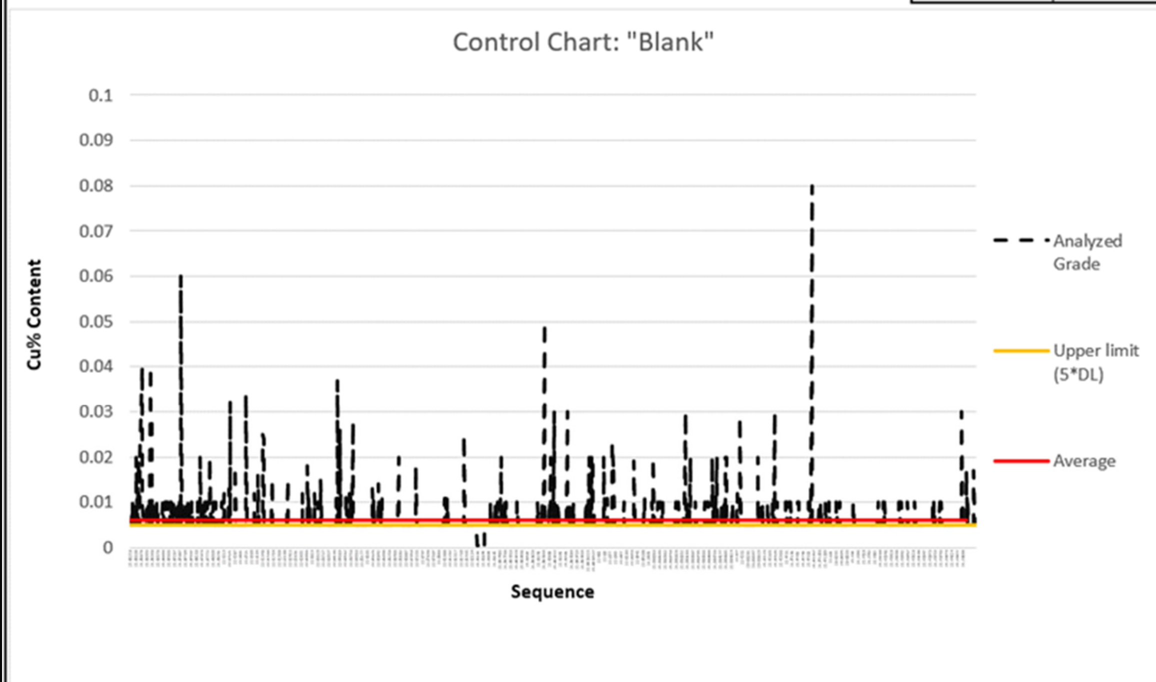


Figure 11-24: Result of the Analysis of Blank Samples (Ero Brasil, 2022)

Table 11-3: Outliers named as blank samples removed from the analysis

Target	Sample	Date	Batch	Lab	Cu (%)
HP	08-H01116	25-jun-08	08-H29-2	Mineração Caraíba	1.236
HP	08-H01117	25-jun-08	08-H29-2	Mineração Caraíba	1.246
HP	08-H01119	25-jun-08	08-H29-2	Mineração Caraíba	1.229
HP	08-H01122	25-jun-08	08-H29-2	Mineração Caraíba	1.217
HP	08-H01123	25-jun-08	08-H29-2	Mineração Caraíba	1.232
HP	08-H01127	25-jun-08	08-H29-2	Mineração Caraíba	1.250
HP	08-H01129	25-jun-08	08-H29-2	Mineração Caraíba	1.249
HP	08-H01130	25-jun-08	08-H29-2	Mineração Caraíba	1.266
HP	08-H01136	25-jun-08	08-H29-2	Mineração Caraíba	1.261
HP	08-H01138	25-jun-08	08-H29-2	Mineração Caraíba	1.252
HP	08-H01326	08-jul-08	08-H34	Mineração Caraíba	0.360
HP	08-H01624	18-ago-08	08-H45-3	Mineração Caraíba	0.344

11.1.2.2 Standard Samples

Ero Brasil uses standard samples to verify the laboratory's accuracy. One CRM control sample is inserted at every 10 samples (a rate of 10%), within the batch of duplicates. The CRM samples used ranged from low to high copper grades, as shown in Table 11-4 . Ero Brasil contracted ITAK to prepare and certify the CRM standards produced from the Curaçá Valley.

Based on internal controls, Ero Brasil has established that 90% of the tested samples should be within the minimum and maximum limits, defined as within two standard deviations of the CRM certified value (or 95% confidence limits). The values of these limits are presented in the table below.

Figure 11-25 to Figure 11-42 shows the results of the QA/QC analysis of the CRM over the period from to July 4, 2020, to the Effective Date.

Table 11-4: Ero Brasil 2020-2022 CRM Evaluation Criteria

CRM ID	Certified value (%)	Lower Limit (%)	Upper Limit (%)
		95% Confidence	
ITAK-809	0.36	0.34	0.38
ITAK-814	0.45	0.43	0.47
ITAK-821	0.36	0.35	0.38
ITAK-823	0.87	0.82	0.92
ITAK-824	2.68	2.54	2.81
ITAK-828	0.353	0.347	0.359
ITAK-833	1.57	1.50	1.65
ITAK-842	1.56	1.51	1.62
ITAK-843	0.80	0.76	0.83
ITAK-844	0.32	0.30	0.35
ITAK-847	0.42	0.41	0.44
ITAK-848	0.64	0.62	0.65
ITAK-849	1.06	1.03	1.09
ITAK-850	3.55	3.43	3.68
ITAK-851	6.98	6.40	7.56
ITAK-877	0.562	0.53	0.59
ITAK-878	0.36	0.33	0.40
ITAK-879	1.03	0.98	1.08

Type of Control	Standard
Reference	ITAK809
Variable	Cu%
Number of analysis	59

Code	Cu%
Reference Value	0.359
Standard desviation	0.010
Upper limit (+2SD)	0.379
Lower limit (-2SD)	0.339

Minimum	0.34
Maximum	0.38
Average	0.36
Médian	0.36
Bias	-0.55%

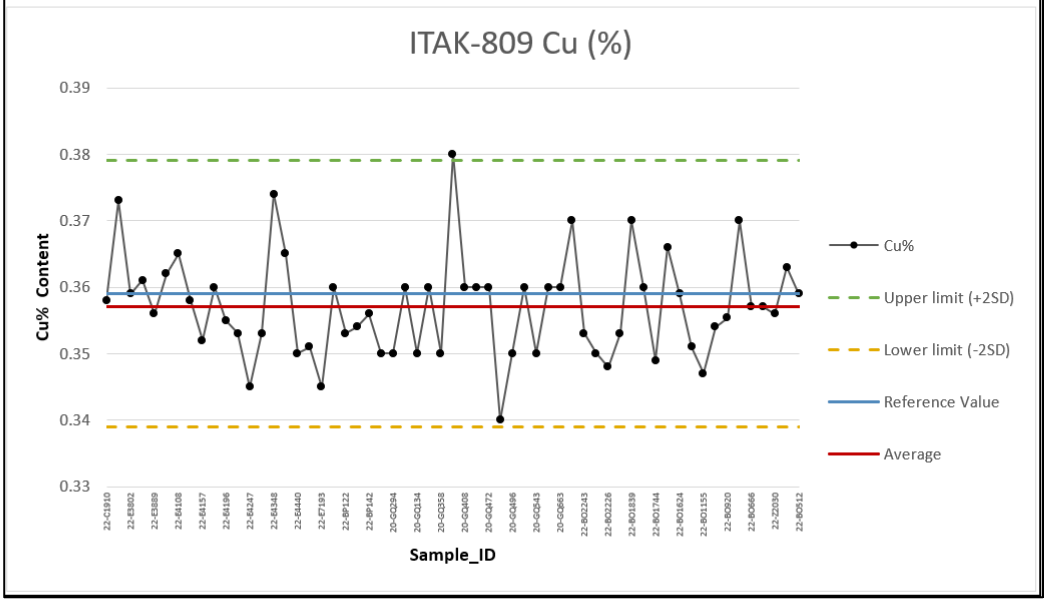


Figure 11-25: Result of the QA/QC Analysis of CRM ITAK 809 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK814
Variable	Cu%
Number of analysis	102

Code	Cu%
Reference Value	0.4507
Standard desviation	0.0095
Upper limit (+2SD)	0.470
Lower limit (-2SD)	0.432

Minimum	0.43
Maximum	0.48
Average	0.45
Médian	0.45
Bias	-0.59%

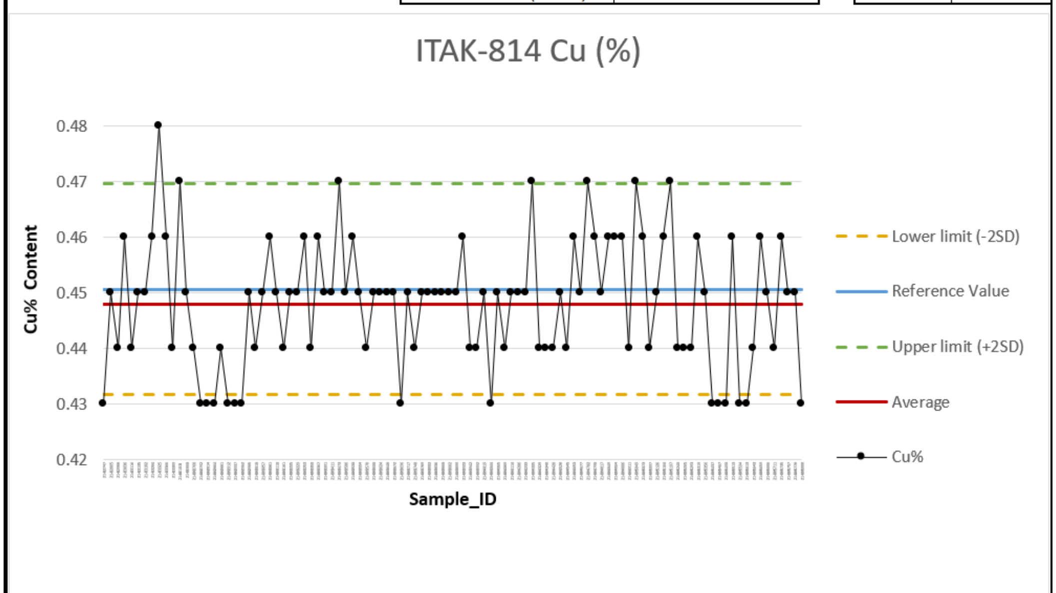


Figure 11-26: Result of the QA/QC Analysis of CRM ITAK 814 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK821
Variable	Cu%
Number of analysis	79

Code	Cu%
Reference Value	0.3622
Standard desviation	0.0064
Upper limit (+2SD)	0.375
Lower limit (-2SD)	0.349

Minimum	0.35
Maximum	0.38
Average	0.36
Médian	0.36
Bias	0.23%

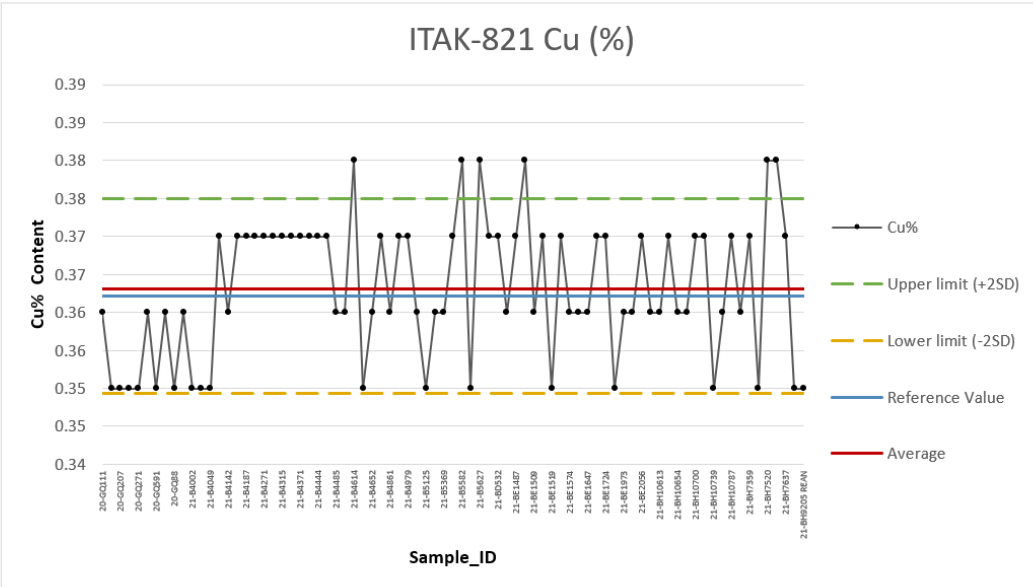


Figure 11-27: Result of the QA/QC Analysis of CRM ITAK 821 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK823
Variable	Cu%
Number of analysis	588

Code	Cu%
Reference Value	0.874
Standard desviation	0.025
Upper limit (+2SD)	0.924
Lower limit (-2SD)	0.824

Minimum	0.77
Maximum	0.95
Average	0.88
Médian	0.88
Bias	0.59%

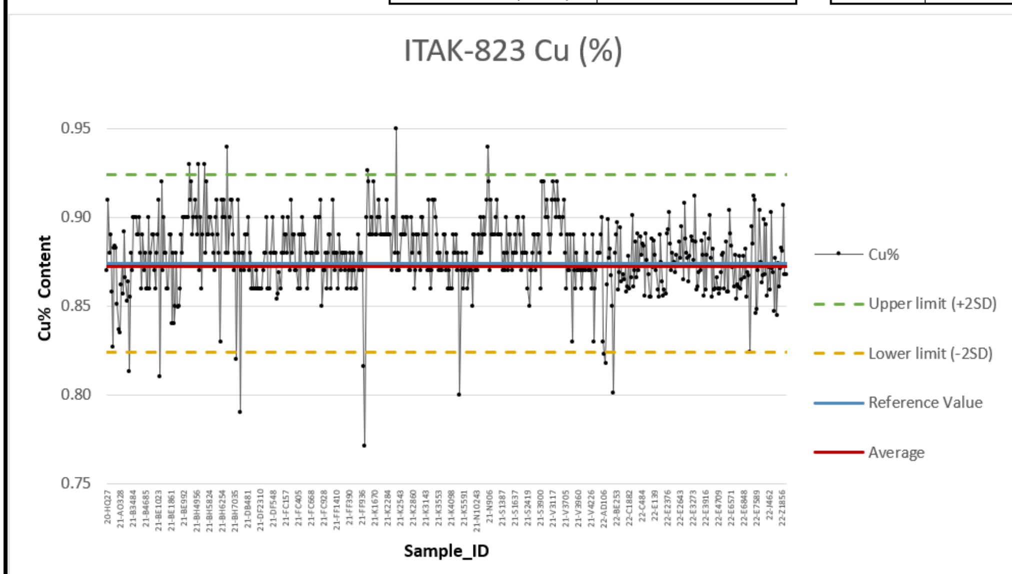


Figure 11-28: Result of the QA/QC Analysis of CRM ITAK 823 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK824
Variable	Cu%
Number of analysis	85

Code	Cu%
Reference Value	**2.678**
Standard desviation	**0.067**
Upper limit (+2SD)	2.812
Lower limit (-2SD)	2.544

Minimum	2.51
Maximum	2.81
Average	2.63
Médian	2.62
Bias	-1.85%

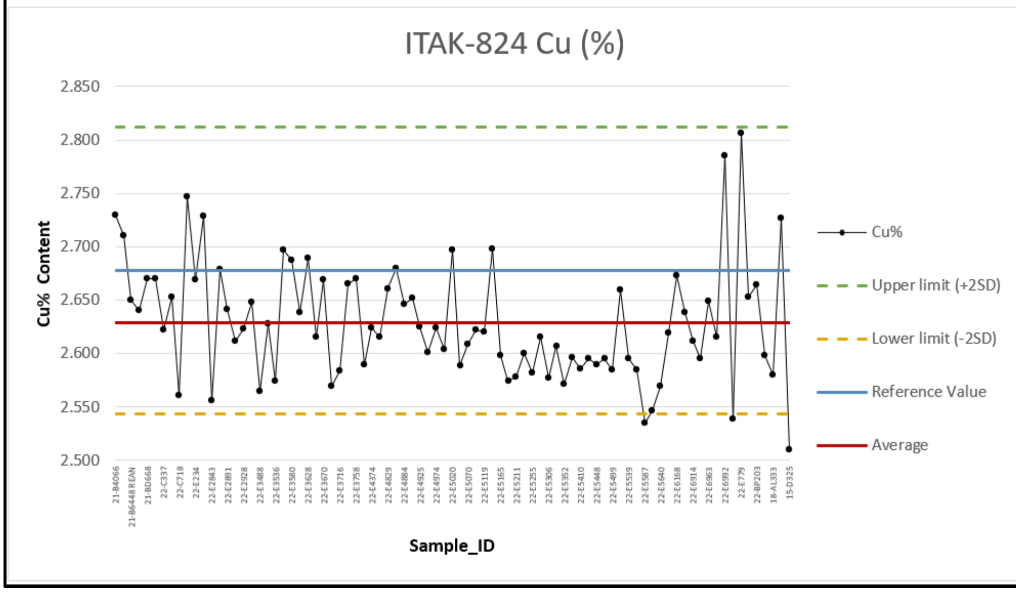


Figure 11-29: Result of the QA/QC Analysis of CRM ITAK 824 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK828
Variable	Cu%
Number of analysis	160

Code	Cu%
Reference Value	**0.353**
Standard desviation	**0.003**
Upper limit (+2SD)	0.359
Lower limit (-2SD)	0.347

Minimum	0.34
Maximum	0.37
Average	0.36
Médian	0.36
Bias	1.10%

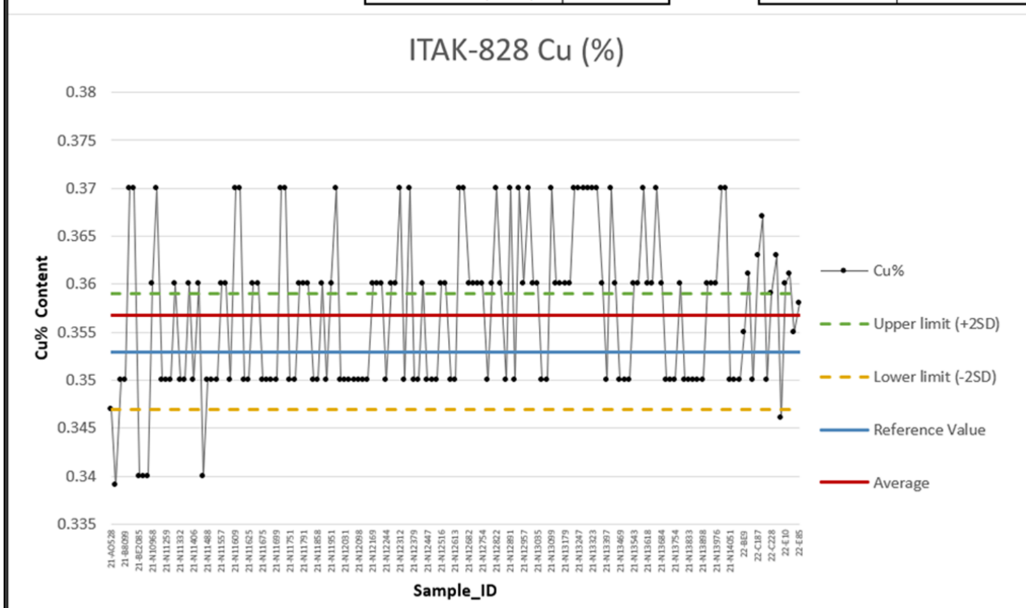


Figure 11-30: Result of the QA/QC Analysis of CRM ITAK 828 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK833
Variable	Cu%
Number of analysis	48

Code	Cu%
Reference Value	1.571
Standard desviation	0.038
Upper limit (+2SD)	1.647
Lower limit (-2SD)	1.495

Minimum	1.48
Maximum	1.62
Average	1.56
Médian	1.56
Bias	-0.68%

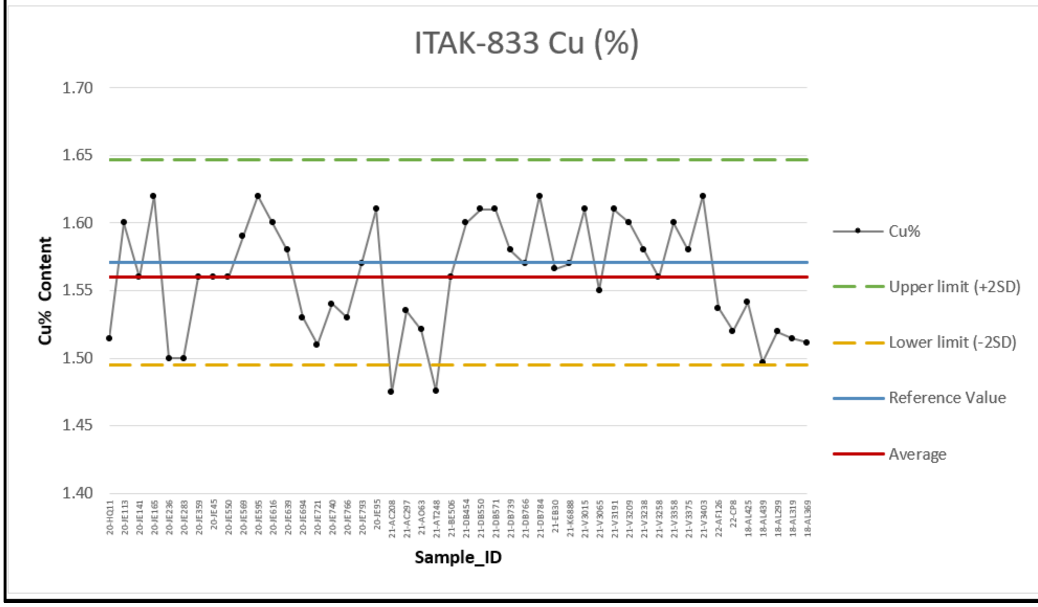


Figure 11-31: Result of the QA/QC Analysis of CRM ITAK 833 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK842
Variable	Cu%
Number of analysis	204

Code	Cu%
Reference Value	1.562
Standard desviation	0.028
Upper limit (+2SD)	1.618
Lower limit (-2SD)	1.506

Minimum	1.46
Maximum	1.69
Average	1.58
Médian	1.58
Bias	1.01%

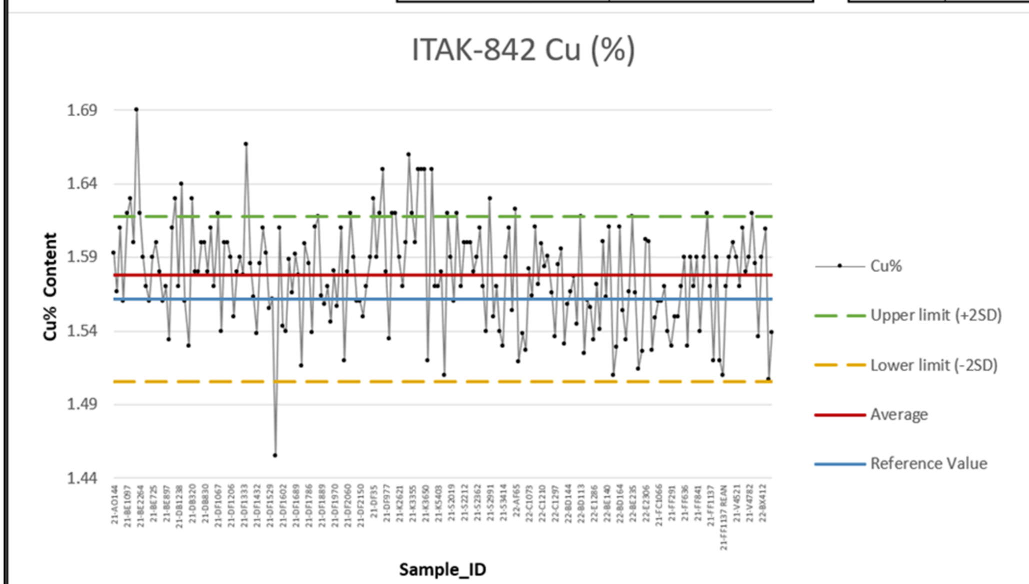


Figure 11-32: Result of the QA/QC Analysis of CRM ITAK 842 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK843
Variable	Cu%
Number of analysis	115

Code	Cu%
Reference Value	0.796
Standard desviation	0.019
Upper limit (+2SD)	0.834
Lower limit (-2SD)	0.758

Minimum	0.76
Maximum	0.89
Average	0.81
Médian	0.81
Bias	1.62%

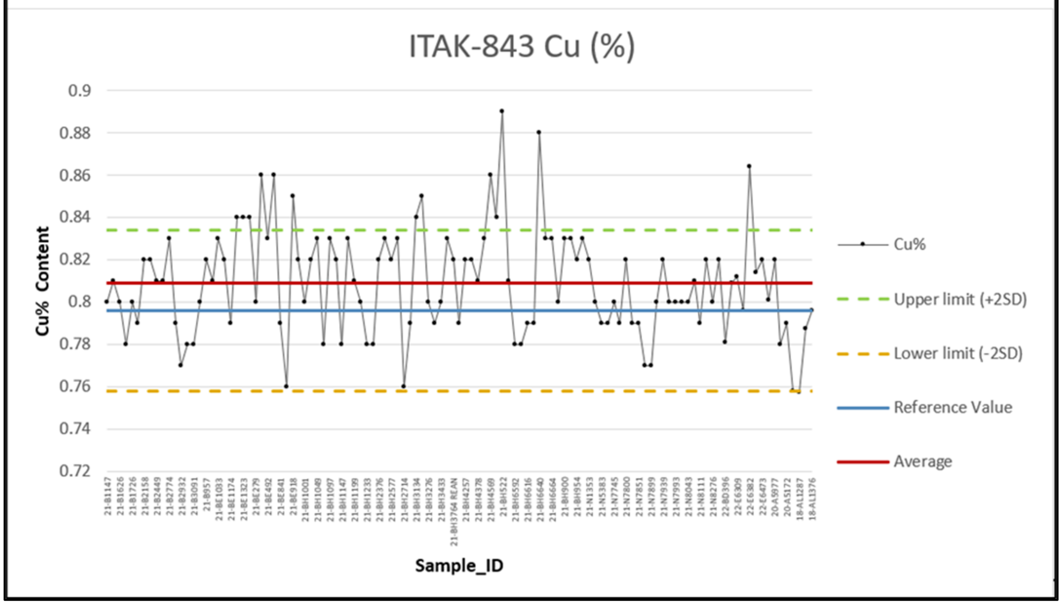


Figure 11-33: Result of the QA/QC Analysis of CRM ITAK 843 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK844
Variable	Cu%
Number of analysis	29

Code	Cu%
Reference Value	0.323
Standard desviation	0.012
Upper limit (+2SD)	0.347
Lower limit (-2SD)	0.299

Minimum	0.31
Maximum	0.37
Average	0.33
Médian	0.33
Bias	3.44%

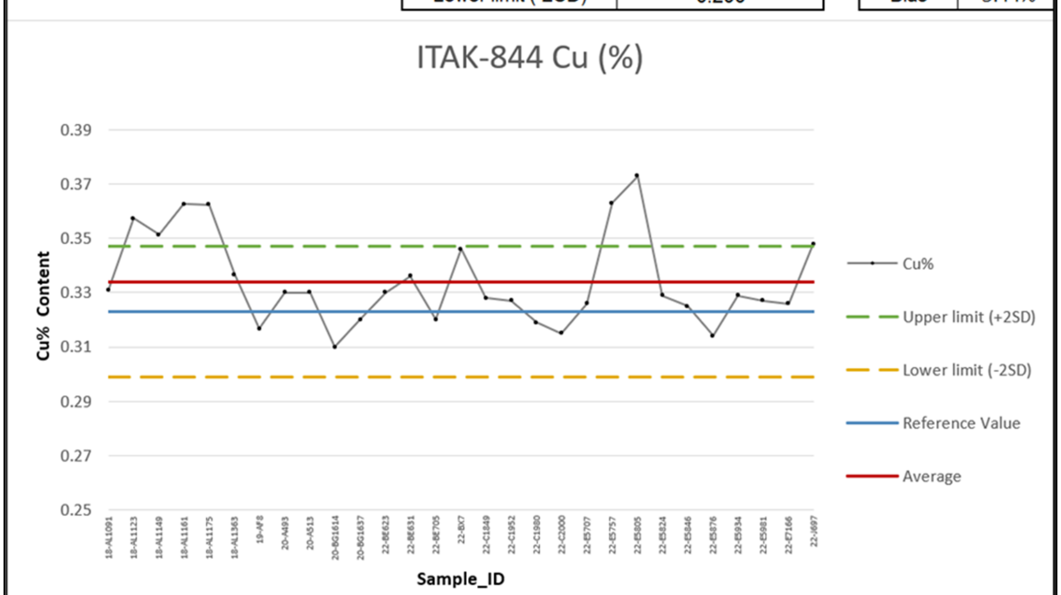


Figure 11-34: Result of the QA/QC Analysis of CRM ITAK 844 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK847
Variable	Cu%
Number of analysis	878

Code	Cu%
Reference Value	0.422
Standard desviation	0.007
Upper limit (+2SD)	0.437
Lower limit (-2SD)	0.407

Minimum	0.39
Maximum	0.47
Average	0.42
Médian	0.42
Bias	-0.59%

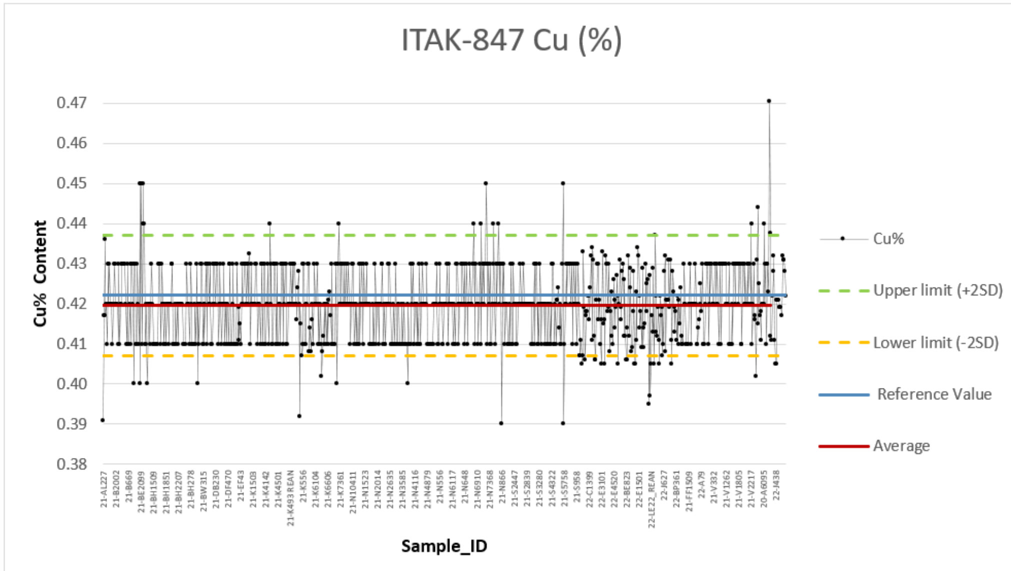


Figure 11-35: Result of the QA/QC Analysis of CRM ITAK 847 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK848
Variable	Cu%
Number of analysis	403

Code	Cu%
Reference Value	0.636
Standard desviation	0.008
Upper limit (+2SD)	0.651
Lower limit (-2SD)	0.620

Minimum	0.59
Maximum	0.68
Average	0.63
Médian	0.63
Bias	-0.39%

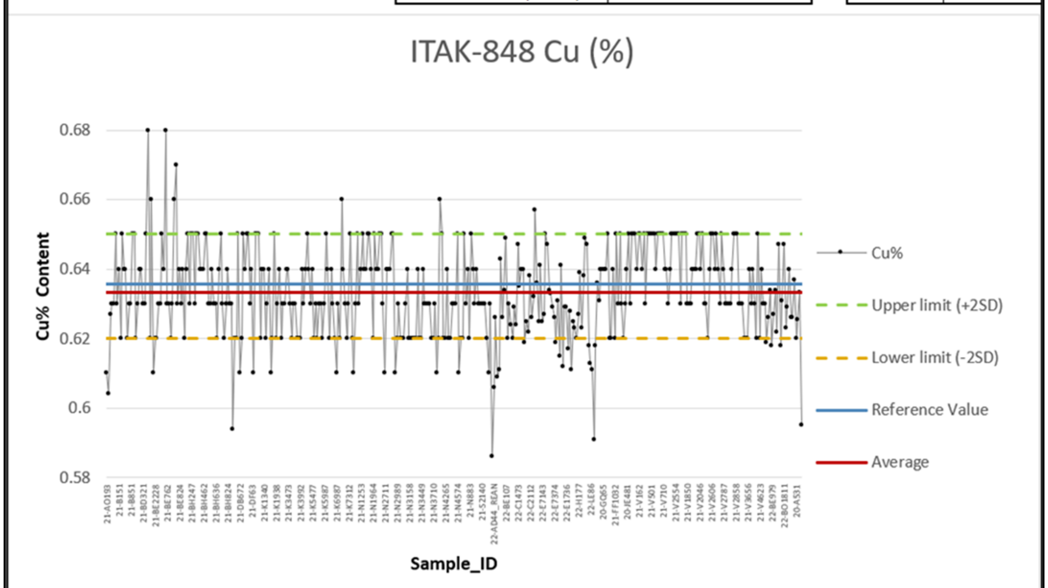


Figure 11-36: Result of the QA/QC Analysis of CRM ITAK 848 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK849
Variable	Cu%
Number of analysis	159

Code	Cu%
Reference Value	1.062
Standard desviation	0.016
Upper limit (+2SD)	1.094
Lower limit (-2SD)	1.030

Minimum	1.01
Maximum	1.15
Average	1.06
Médian	1.06
Bias	0.06%

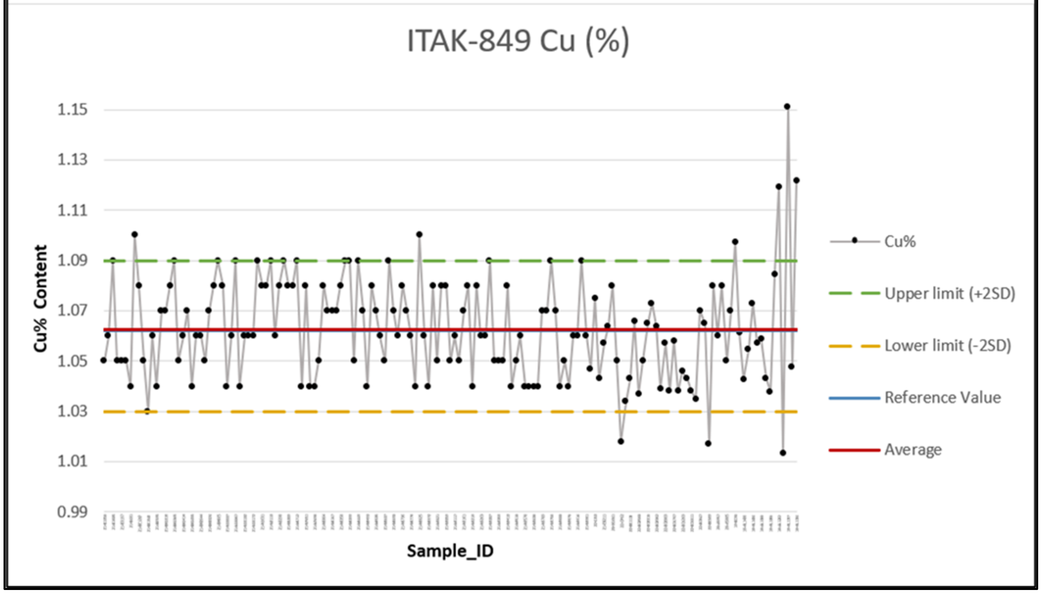


Figure 11-37: Result of the QA/QC Analysis of CRM ITAK 849 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK850
Variable	Cu%
Number of analysis	181

Code	Cu%
Reference Value	3.554
Standard desviation	0.063
Upper limit (+2SD)	3.680
Lower limit (-2SD)	3.428

Minimum	3.29
Maximum	3.74
Average	3.55
Médian	3.55
Bias	-0.09%

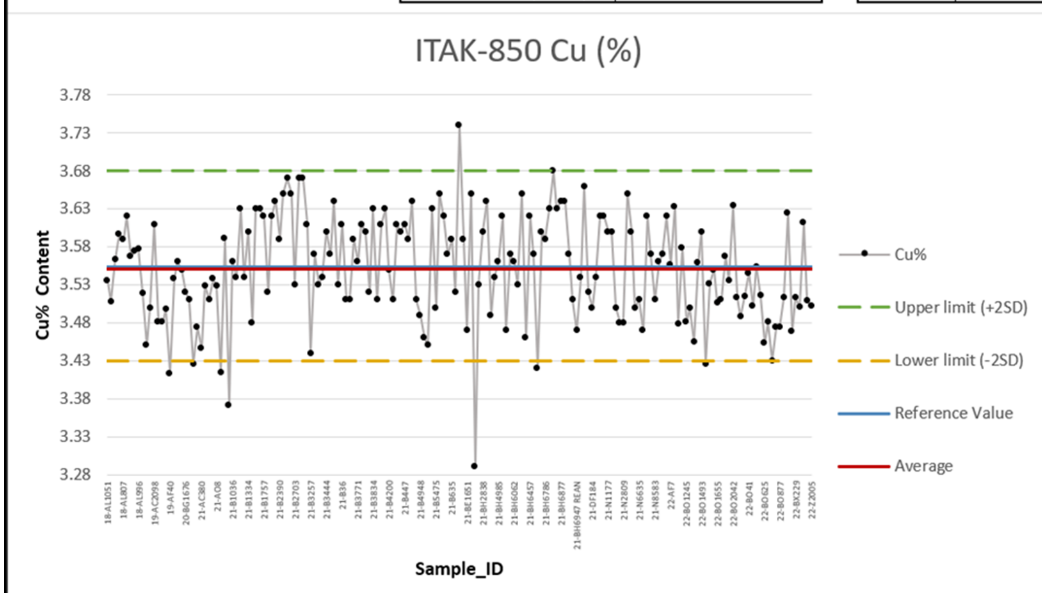


Figure 11-38: Result of the QA/QC Analysis of CRM ITAK 850 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK851
Variable	Cu%
Number of analysis	84

Code	Cu%
Reference Value	6.980
Standard desviation	0.290
Upper limit (+2SD)	7.560
Lower limit (-2SD)	6.400

Minimum	6.28
Maximum	7.50
Average	6.98
Médian	6.99
Bias	-0.05%

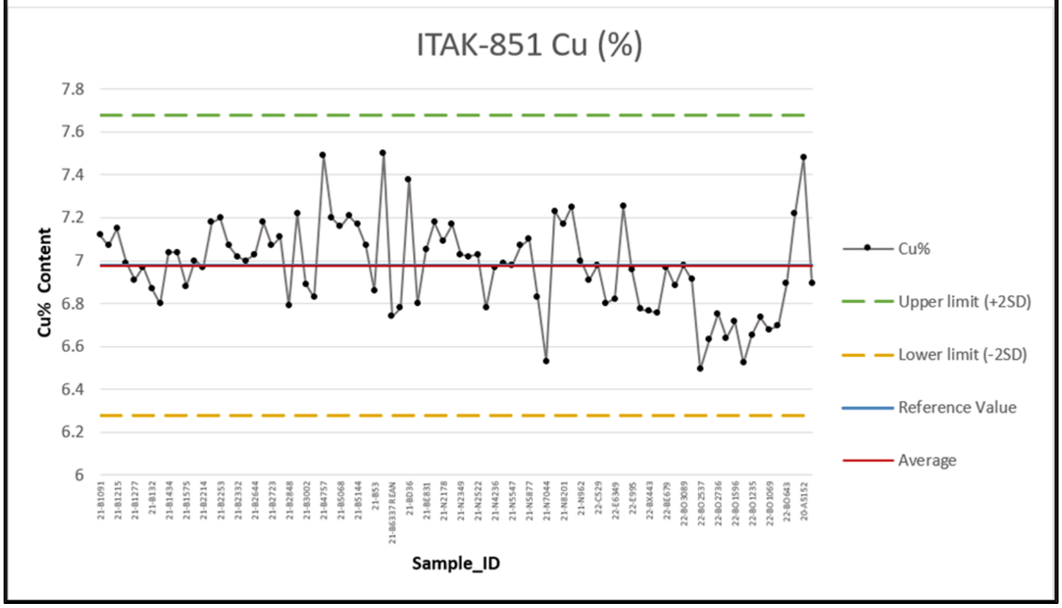


Figure 11-39: Result of the QA/QC Analysis of CRM ITAK 851 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK877
Variable	Cu%
Number of analysis	16

Code	Cu%
Reference Value	0.562
Standard desviation	0.016
Upper limit (+2SD)	0.594
Lower limit (-2SD)	0.530

Minimum	0.58
Maximum	0.58
Average	0.58
Médian	0.58
Bias	3.74%

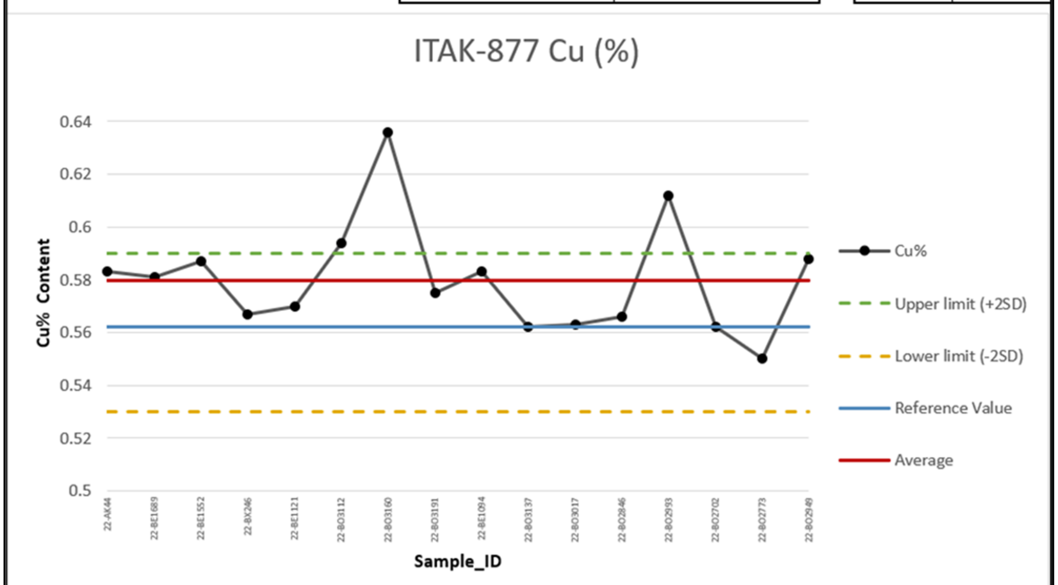


Figure 11-40: Result of the QA/QC Analysis of CRM ITAK-877 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK878
Variable	Cu%
Number of analysis	48

Code	Cu%
Reference Value	0.365
Standard desviation	0.018
Upper limit (+2SD)	0.401
Lower limit (-2SD)	0.329

Minimum	0.35
Maximum	0.43
Average	0.37
Médian	0.37
Bias	2.34%

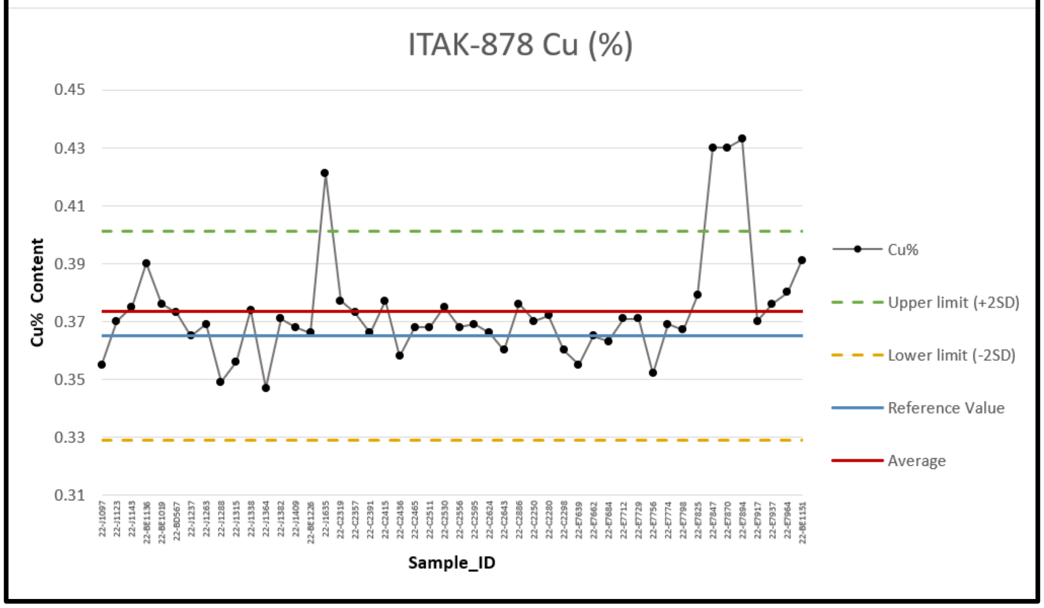


Figure 11-41: Result of the QA/QC Analysis of CRM ITAK-878 (Ero Brasil, 2022)

Type of Control	Standard
Reference	ITAK879
Variable	Cu%
Number of analysis	13

Code	Cu%
Reference Value	1.033
Standard desviation	0.025
Upper limit (+2SD)	1.083
Lower limit (-2SD)	0.983

Minimum	1.01
Maximum	1.08
Average	1.04
Médian	1.03
Bias	0.44%

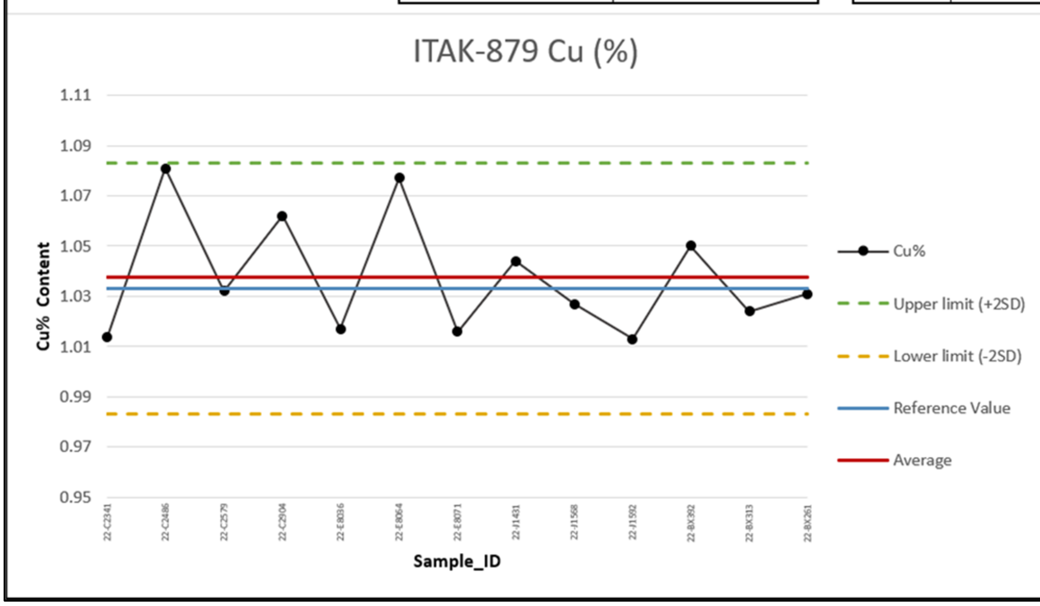


Figure 11-42: Result of the QA/QC Analysis of CRM ITAK-879 (Ero Brasil, 2022)

It is worth noting that the CRM ITAK 828 presented 51% of the analyzed samples above the upper limit (+2SD). however, the results for CRM ITAK 878, which has similar Cu grade range, demonstrates acceptable reproducibility.

11.1.2.3 Duplicate Samples

The typical QA/QC program implemented at the Caraíba Operations involves sending duplicate batches of 2 millimeter (“mm”) coarse samples and pulverized 150 mesh samples to the laboratory. Samples are chosen to be representative of the sampling data. One sample is selected from the original batch of material at an interval of at least every 20 samples (a rate of 5%).

In analyzing the results of duplicate samples, the authors considered the following limits of acceptability: 20% of the relative difference for the coarse reject duplicates and 10% of the relative difference for the pulverized duplicates. Overall, the evaluation of Caraíba Operations’ QA/QC procedures and lab results show acceptable results (above 90%) for the period from July 4, 2020 to Effective Date, as illustrated in Figure 11-43 and Figure 11-44.

Type of control	DUP 2MM
Reference	Global - 2021
Variable	Cu (%)
Accuracy limit	20%
Number of pairs	3058

	SMP	DUP
Minimum	0.00	0.00
Maximum	36.27	34.33
Average	0.58	0.58
Median	0.04	0.04
Within the acceptable limit (%)	90.32%	

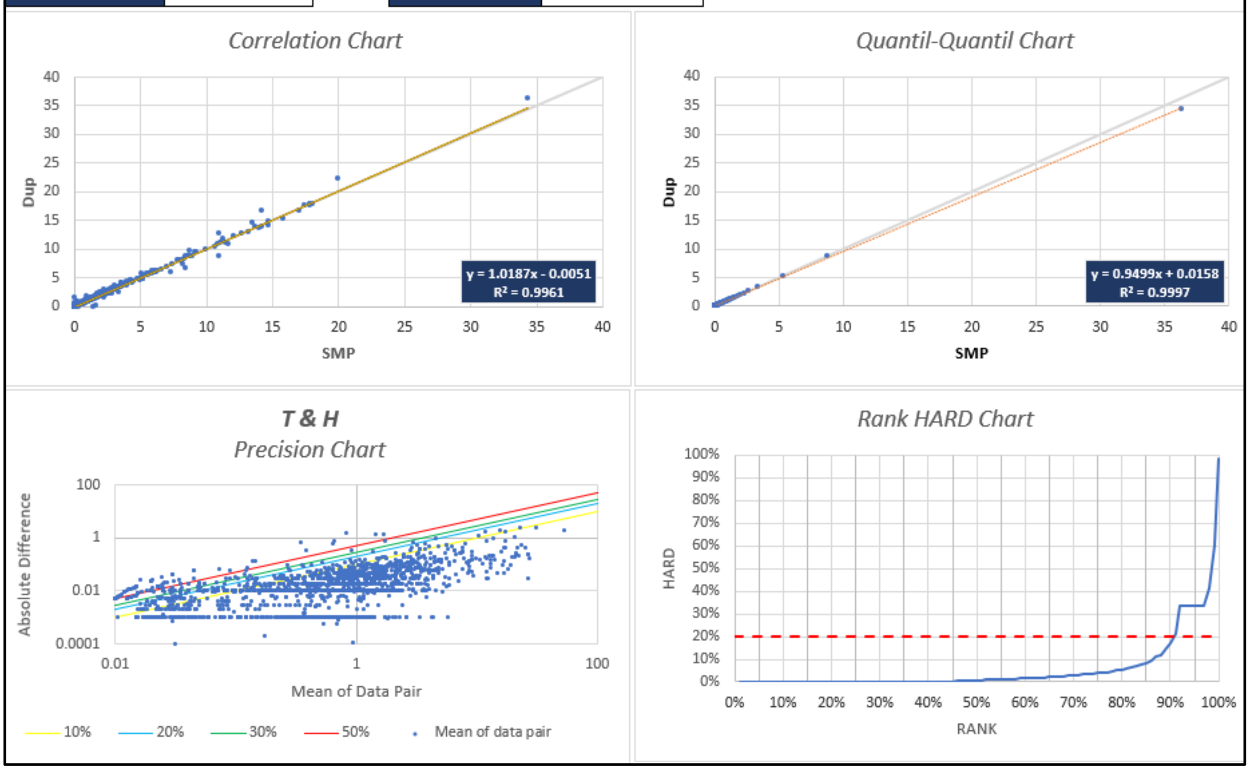


Figure 11-43: Analytical Result of the Crushed Duplicate Samples (Ero Brasil, 2022)

Type of control	DUP Pulverized
Reference	Global - 2022
Variable	Cu (%)
Accuracy limit	10%
Number of pairs	5313

	SMP	DUP
Minimum	0.00	0.00
Maximum	25.73	25.73
Average	0.96	0.96
Median	0.12	0.12
Within the acceptable limit (%)	90.55%	

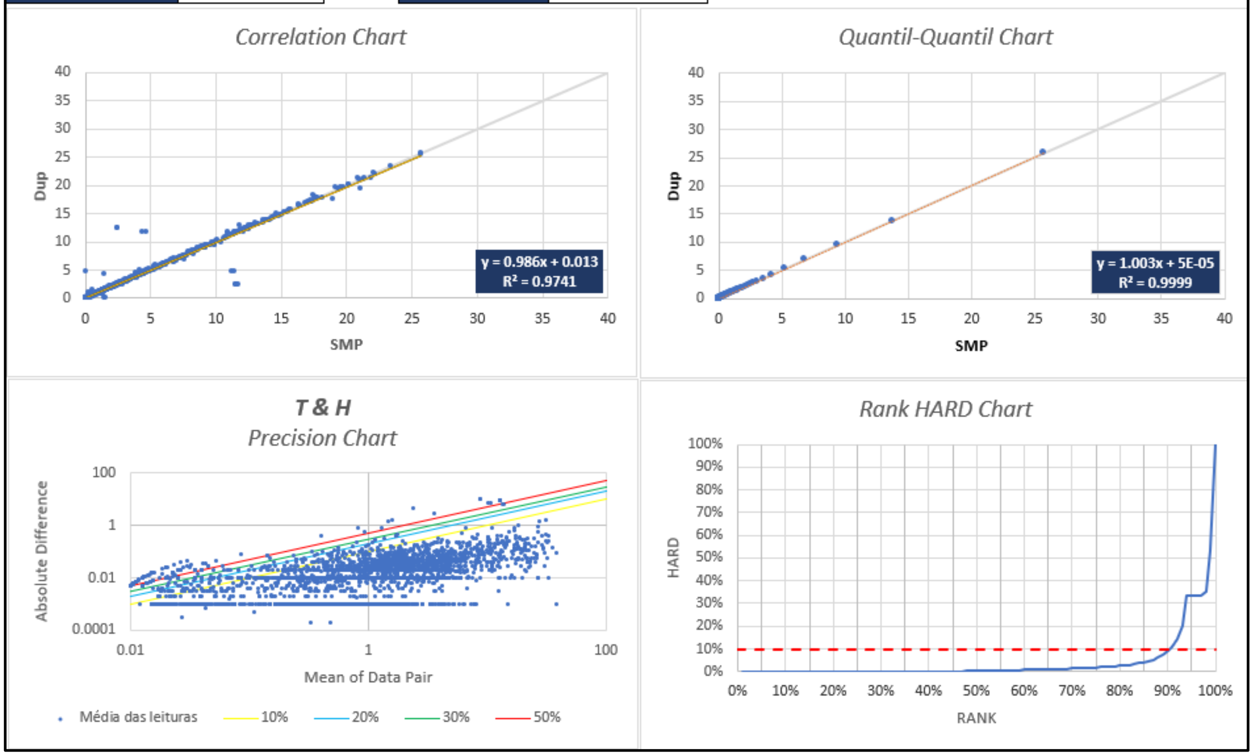


Figure 11-44: Analytical Result of the Pulverized Duplicate Samples (Ero Brasil, 2022)

11.1.2.4 Check-Assay / Third-Party Laboratory

The check assay analysis was performed by ALS for the 2022 validation. The authors considered 15% of the relative difference as within acceptable limits.

Overall, the evaluation of Ero Brasil's QA/QC procedures and lab results show acceptable results, as illustrated in Figure 11-45 analyzing the data generated between 2020 and the Effective Date. While it should be noted that only 71% of the samples during this period exhibited a relative difference within the acceptable limit, the authors observed (as evidenced in the T&H precision graph) that the largest relative differences still occur within the lowest grade ranges. GE21 recommends continuing this control and implementation of a continuous assessment program to reduce relative differences in the future.

Type of control	Secondary Lab
Reference	Global - 2022
Variable	Cu
Accuracy limit	15%
Number of pairs	2731

	SMP	SEC
Minimum	0.01	0.00
Maximum	22.31	20.42
Average	0.50	0.48
Median	0.03	0.03
Within the acceptable limit (%)	70.82%	

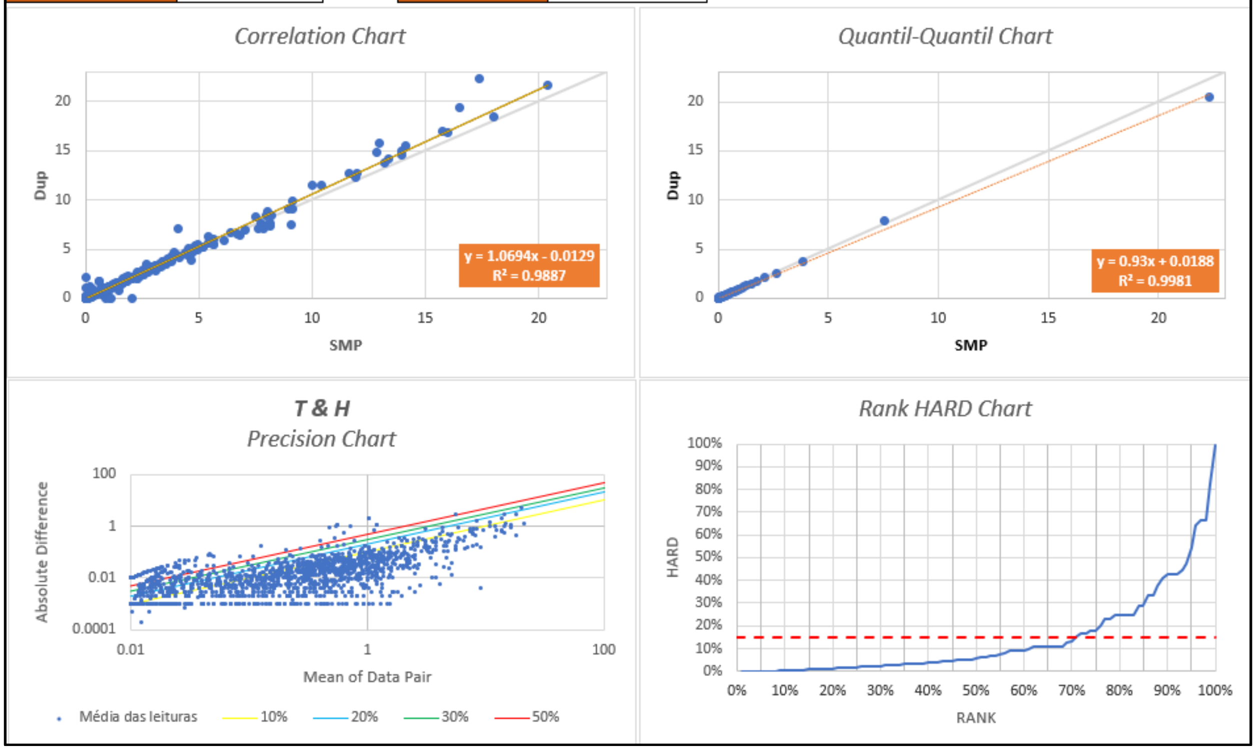


Figure 11-45: Analytical Result of the secondary laboratory (Ero Brasil, 2022)

11.1.3 *Project Honeypot - Post-mortem* QA/QC Analysis

During 2022, Ero Brasil conducted a post-mortem analysis of the Project Honeypot region within the Pilar UG Mine. This region has 600 drillholes that were drilled before the implementation of the QA/QC program and was not previously included in the postmortem QA/QC program carried out in 2017 by GE21.

Approximately 5% of the 109 drillholes available for sampling were selected for resampling. The resampled intervals were selected using criteria of lithological proportion, grades, spatial representativeness, and the condition of the drill core. The resampling campaign started with the collection of 1/4 of the drill core, then was modified to 1/2 drill core at the end, constituting about 40% and 60% of the total samples, respectively. The samples generated in the Project Honeypot validation campaign were sent to the laboratory in batches and under the standardized QA/QC process, as more fully described previously (including control, blank and duplicate samples).

The analysis results are shown in Figure 11-46 and demonstrate accuracy greater than 25% in 90% of the sample pairs. The results from the Project Honeypot post-mortem analysis are consistent with the results achieved in prior post-mortem analyses performed throughout the Caraíba Operations. As a result of the work performed and the results of the post-mortem analysis, GE21 considered the historical database valid for use in the current mineral resource estimate.

Type of control	DUP Post Mortem (HP)
Reference	Global - 2021
Variable	Cu (%)
Accuracy limit	25%
Number of pairs	370

	SMP	DUP
Minimum	0.13	0.02
Maximum	17.18	16.50
Average	1.84	1.73
Median	0.92	0.94
Within the acceptable limit (%)	93.51%	

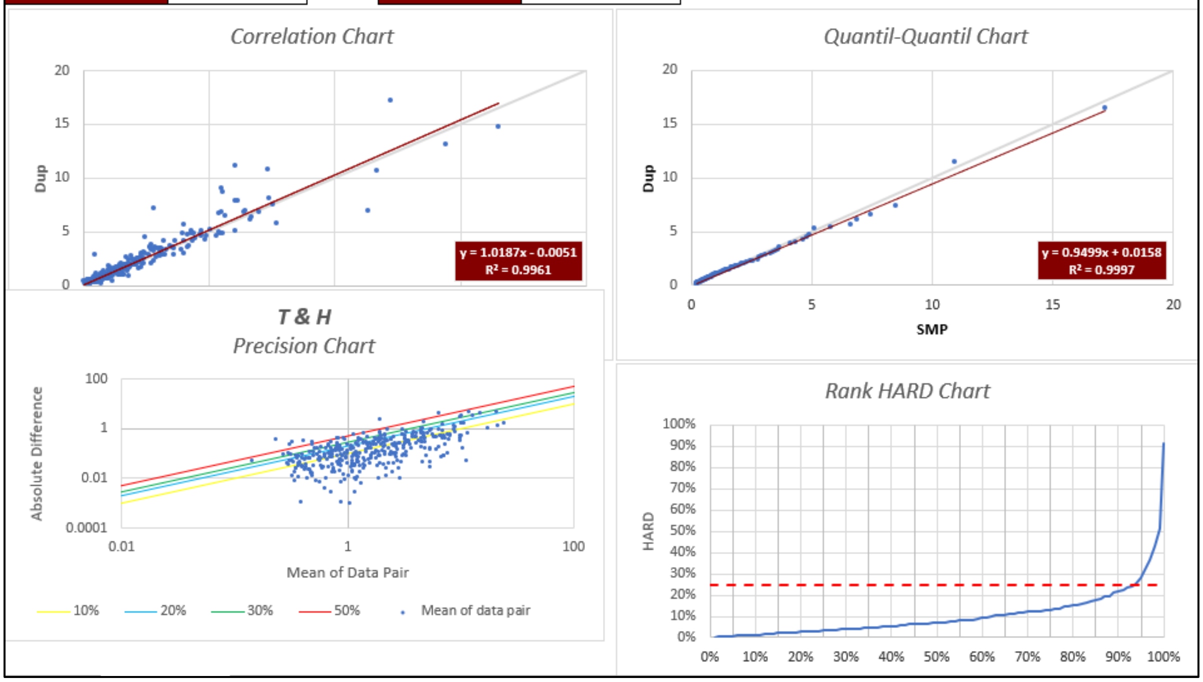


Figure 11-46: Analysis of the Duplicates Produced During the Post Mortem QA/QC, Project Honeypot

11.2 OPINION OF THE QUALIFIED PERSONS

GE21 performed the evaluation of control data and concludes that the QA/QC procedures undertaken by Ero Brasil, and its use in support of the current mineral resource estimate are being followed according to industry best practices. GE21 considers the QA/QC procedures to be in accordance with mining industry norms and valid for use in the current mineral resource estimate.

GE21 recommends the following work program to improve Ero Brasil's QA/QC program:

- While 71% of the samples, generated between July 4, 2020, and the Effective Date of this report, exhibited a relative difference within the acceptable limit compared to the second laboratory analysis, the authors noted (as evidenced in the T&H precision graph) that the largest relative differences occur in the lowest grades. GE21 recommends continuing this control and implementation of a continuous assessment program to reduce relative differences in the future.

- It is worth pointing out that the CRM ITAK 828 presented 51% of the analyzed samples above the upper limit (+2SD). Although this tendency (bias of 1.1%) will not affect the resource estimation, but GE21 recommends a validation of the certified grade for CRM ITAK 828 due to the observed inconsistencies with the analysis in the Caraíba Operations laboratory, which is in contrast with the consistent results obtained when utilizing CRM ITAK 878, which has a similar Cu grade range.

- GE21 concluded that the result of the *post-mortem* QA/QC Analysis for the Project Honeypot zone was satisfactory, and considered the samples that pre-dated the implementation of the standard QA/QC program at Ero Brasil being acceptable for use in the current mineral resource estimate.

12 DATA VERIFICATION

Professionals from GE21, including the majority of the authors of this Report, have conducted periodic field visits to the Caraíba Operations in the Curaçá Valley, since 2017, to personally inspect the site infrastructure, the procedures used in data collection and resource estimation and the results that are obtained from the activities carried out by Ero Brasil personnel.

Eng. Porfirio Rodriguez of GE21 has conducted field visits since 2006. Since then, Mr. Rodriguez has been involved with Ero Brasil and Ero Copper in the development of the resource estimation procedures that have been implemented by Ero Brasil's staff that continue to be in use.

For the 2022 updated mineral resource, site visits were conducted by Porfirio Rodriguez (September 27 to 30, 2021) Fábio Xavier (September 27 to 30, 2021 and February 10 to 12, 2022), Bernardo Viana (September 27 to 30, 2021) and Ednie Carvalho (February 10 to 12, 2022).

GE21 is of the opinion that the exploration data is adequate for use in the mineral resource and mineral reserve estimate. What follows below are some observations that were recorded by GE21 personnel during the course of visits as it relates to the generation, collection, control and storage of exploration data on site at the Company's Caraíba Operations:

- Drill hole logging: this task is considered to be best industry practice. The Company implemented electronic core logging, which has been standardized at the Caraíba Operations since 2018. GE21 performed a review of logging procedures for randomly selected drill core and verified the completeness of the logs. Of the samples reviewed, not all drill holes recorded standard lithological codes and some geologic features were omitted from the logs; however, considering the small number of omissions among the data set reviewed, Ero Brasil has demonstrated that it understands the geology and these omissions are not considered to be material.

- Laboratory and chemical analyses: standardized QA/QC procedures were found to be complete and in-line with standard industry practice as more fully described in Chapter 11 – Sample Preparation, Analyses, and Security. Information collected before the current QA/QC procedures were put in place, including for Project Honeypot, has been verified via a post-mortem validation. Data from drill holes that could not be validated were omitted from the mineral resource estimate.

- Database: recent data is stored in a standard commercial database. Historical records are well managed and, where applicable, have been migrated to the database. Data storage procedures at Ero Brasil are considered standard industry practice. As part of the validation process, GE21 verified 377 holes totaling 96,417m of drilling. Database validation was conducted with the help of Ero Brasil staff according to standard validation procedures including review of collar locations, drill hole deviations and database check-assay review. No inconsistencies were found in the database.

- Density: There is considerable density information available for the Curaçá Valley due to the operating history of the mine(s). The process for determining density is considered in-line with standard industry practice. The table below shows the density determined for each lithological unit.

Table 12-1: Summary of Density Estimates by Lithology

Lithology	Density (g/cm³)			Deviation	Number of Samples
	Max	Min	Mean		
Amphibolite	3.06	2.96	3.01	0.1	55
Biotite Gneiss	3.2	2.88	2.7	0.14	2,894
Biotite	3.85	3.20	3.38	0.11	141
Calcium-silicate	4.14	3.00	3.39	0.15	117
Phlogopite	3.28	3.21	3.25	0.13	102
Gabbro	3.07	2.96	3.01	0.06	140
Gabbronorite	3.05	2.99	3.02	0.04	226
Gneiss Q-F	2.76	2.71	2.74	0.1	247
Tonalitic Gneiss	2.74	2.69	2.72	0.04	577
Granite	2.69		2.69	0.05	49
Gneissic granite	2.81	2.75	2.78	0.02	51
Melanorite	3.5	3.14	3.32	0.18	1,204
Metasomatite	2.91	2.76	2.82	0.13	877
Migmatite	2.91	2.75	2.83	0.12	181
Mylonite	3.38	2.92	3.1	0.19	26
Norite	3.32	2.99	3.15	0.15	1,054
Pegmatite	3.08	2.7	2.86	0.12	126
Pyroxenite	3.7	3.33	3.52	0.24	758
Serpentinite	3.6	3.03	3.3	0.18	322
Tonalite	2.7	2.48	2.6	0.03	8
Quartz vein	2.76		2.76	-	1
TOTAL					**9,153**

13 MINERAL PROCESSING AND METALLURGICAL TESTING

13.1 INTRODUCTION

Since operations were restarted by the Company in February of 2017, a notable increase in metallurgical recoveries has been observed as a result of both ongoing plant improvement initiatives and increased contribution from the Vermelhos UG Mine into the Caraíba Mill fed. The results of initiatives over the years have resulted in metallurgical recoveries improving from approximately 86% in 2017 and 2018 to in excess of 90% by 2019. Optimization work remains ongoing as part of the current mill expansion, expected to be completed by the end of 2023.

Table 13-1: Mill Performance

	2017	2018	2019	2020	2021	2022 (Jan-Sep)
Ore Processed (kt)	1,771.2	2,257.9	2,424.6	1,778.2	2,370.6	2,118.4
Copper Grade (%)	1.31	1.56	1.93	2.03	2.08	1.73
Met Recovery (%)	86.8	86.3	90.5	90.2	92.4	91.8

For LOM planning, forecast metallurgical recoveries for zones within the underground mines have been based on grade-recovery regression curves derived from analyses performed in Ero Brasil's laboratory. Open pit operations have assumed the average historical metallurgical recovery of the Curaçá Valley open pit operations of 86.0%. A 3.0% increase in metallurgical recoveries has been included in the forecast to reflect the observed improvement resulting from the installation of the HIG Mill circuit, which was commissioned during the third quarter of 2020. A description of the test-work related to the HIG Mill recovery improvement is included in Section 13.2 – HIG Mill Recovery Improvement, and the underlying grade-recovery curve data for the underground mines is outlined in greater detail in Section 13.3 – Metallurgical Recovery Curves, below. Where applicable, such laboratory tests were designed to mimic the residence time, grind size and reagent scheme of the processing operations in practice to simulate recoveries in the Caraíba Mill.

Samples used to generate the forecast metallurgical recoveries, and in the HIG Mill analyses are representative of the expected mineral composition of the production plan and consistent with the operating history of the Caraíba Mill.

13.2 HIG MILL RECOVERY IMPROVEMENT

In September 2018, the Company initiated an optimization program aimed at improving metallurgical recoveries. This work included updated mineralogical characterization of the Company's concentrate and final tailing, as well as grind size and liberation analyses performed by SJT MetMin Services (Pty) Ltd. ("SJT MetMin") in South Africa. Upon completion of this initial characterization program, a series of composite samples collected from the oversize fraction of the Company's Derrick screens during plant operations in late 2018 was subjected to particle size characterization and grind vs. recovery test work at Mintek's testing facility in Randburg, South Africa. SJT MetMin and Mintek are independent of the Company as such term is defined under NI 43-101.

Additional verification test work was conducted by Ero Brasil using a composite generated over six fill operating days in March 2019 to validate the expected improvements in recovery at the target grind size of 80% passing 75 microns. The authors of this Report have reviewed the following test work, results and conclusions and found them to be in accordance with industry best practices, and appropriate for use in support of this Report.

13.2.1 Mineralogical Characterization Test work

Characterization test work of a final copper concentrate and final tailings sample from the Caraíba Mill, each weighing 0.5 kg, collected in late 2018 following commissioning of the Vermelhos UG Mine, were performed by SJT MetMin.

Mineralogical characterization work included chemical analysis for total copper and trace elements, XRD, Scanning Electron Microscopic Dispersive Spectrometric ("SEM-DES") analysis and phase quantification of liberation and mineralogical composition.

A complete table highlighting the chemical composition of the final concentrate and tailings samples used in the analysis is shown below.

Table 13-2: Chemical Analysis and Trace Element Composition (%)

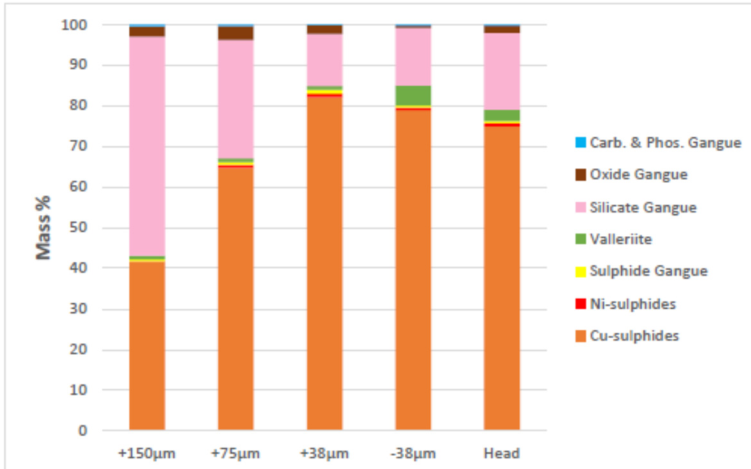
Element	Concentrate			Tailings		
	Analysis A	Analysis B	Avg.	Analysis A	Analysis B	Avg.
SiO_2	10.10	10.20	**10.15**	54.80	54.60	**54.70**
Al_2O_3	2.32	2.20	**2.26**	13.56	13.18	**13.37**
Fe_2O_3	27.26	27.46	**27.36**	12.17	12.13	**12.15**
TiO_2	0.29	0.29	**0.29**	1.06	1.07	**1.06**
CaO	1.17	1.11	**1.14**	4.99	5.01	**5.00**
MgO	3.99	3.79	**3.89**	9.99	9.91	**9.95**
K_2O	0.17	0.15	**0.16**	1.52	1.44	**1.48**
MnO	0.05	0.05	**0.05**	0.14	0.15	**0.14**
P	0.066	0.054	**0.060**	0.122	0.124	**0.123**
Ba	0.005	0.005	**0.005**	0.059	0.059	**0.059**
Co	0.026	0.025	**0.026**	0.007	0.005	**0.006**
Cr	0.114	0.108	**0.111**	0.135	0.126	**0.131**
Cu	37.10	37.60	**37.35**	0.23	0.23	**0.23**
Ni	0.410	0.406	**0.408**	0.044	0.043	**0.044**
Pb	0.056	0.059	**0.058**	bdl	bdl	**bdl**
Sn	0.047	0.037	**0.042**	0.086	0.082	**0.084**
Sr	0.007	0.006	**0.007**	0.039	0.039	**0.039**
V	0.004	0.004	**0.004**	0.025	0.024	**0.025**
Zn	0.033	0.034	**0.034**	0.017	0.016	**0.017**
Moisture	0.02	0.02	**0.02**	0.12	0.08	**0.10**
LOI	7.57	7.46	**7.52**	1.18	1.20	**1.19**

LOI = Loss On Ignition; bdl = blow detection limit

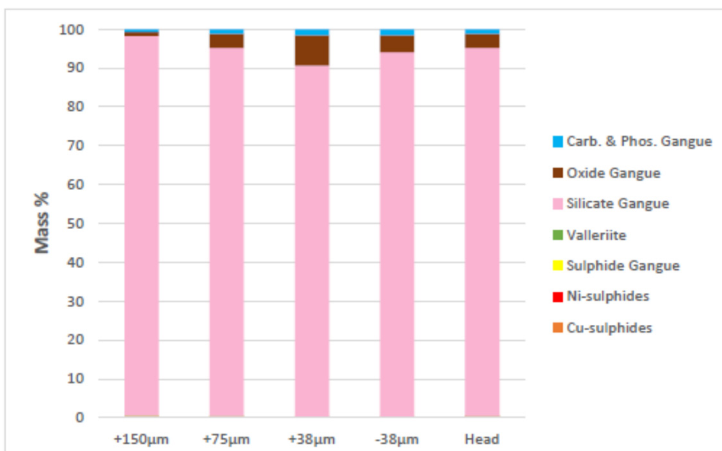
XRD analysis indicated that the main copper-bearing phases in the concentrate sample are chalcopyrite, bornite and cubanite, while that of the tailings sample detected primarily chalcopyrite as the copper-bearing phase, with minor bornite. Gangue minerals in both the concentrate and tailings sample were pyroxene, plagioclase, talc, quartz and mica (biotite/phlogopite). Particle size analysis performed on both samples highlighted the ratio of coarse particles (+150 micrometers ("micron" or "µm")) in the tailings sample as compared to the final concentrate. This coarse size fraction only accounted for approximately 3% of the final concentrate by mass, but approximately 30% of the tailings, indicating a preferential reporting of coarse particles to tailings.

Polished sections of the samples were analyzed to evaluate quantitative mineralogical compositions of both samples. SEM-EDS analysis of both samples confirmed the primary copper-bearing phases of chalcopyrite, cubanite and bornite, with trace amounts of chalcocite, digenite and covellite. The gangue phases in the concentrate sample were predominately present in the -75/+150 micron fractions, indicating insufficient liberation of gangue minerals from the copper-bearing sulphide minerals. The composition, by mass percent, is shown in Figure 13-1.

Calculated copper grades (determined using the mineralogical composition) showed that the highest copper grade of the concentrate sample was in the +38/-75 micron size fraction (containing approximately 43% of total contained copper), while the grade was lower in the +75/-150 micron size fraction (containing approximately 32% of total contained copper) and lowest in the +150 micron size fraction (containing approximately 20% of total contained copper). This distribution, again, demonstrated the presence of un-liberated gangue in the coarser size fractions of the concentrate sample. This relationship was inversely mirrored in the tailings sample, confirming the presence of un-liberated copper-bearing sulphide minerals in the coarser size fractions, as shown in Figure 13-2.



(a)



(b)

Figure 13-1: Mineralogical Composition, by Size Fraction for Concentrate (a) and Tailings (b) Samples (SJT MetMin, 2018)

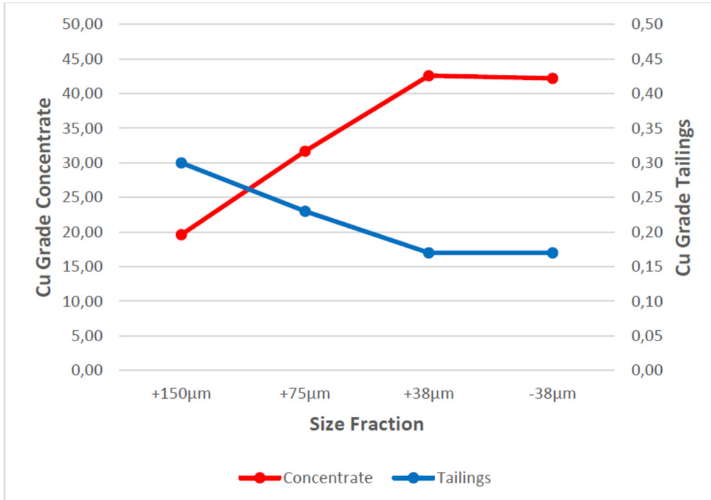


Figure 13-2: Calculated Copper Grades for the Concentrate and Tailings Sample, by Size Fraction (SJT MetMin, 2018)

Liberation analysis of the concentrate sample, which had a grade of 37.35% copper, showed that the copper-bearing sulphide minerals were well liberated; however, additional grinding of the +75 micron particles would further improve liberation. The coarse size fraction represented approximately 29% of the concentrate sample mass and had a calculated grade of 30.34% copper, whereas the -75 micron fraction had a calculated copper grade of 42.35%. It was expected that a regrind of the +75 micron fraction followed by additional cleaning flotation could improve concentrate grade without resulting in a significant copper loss.

In the tailings sample, which had a grade of 0.23% copper, most of the copper-bearing sulphide minerals were within locked or middling particles, except for the occasional fully-liberated copper-sulphide grain in the -38 micron fraction. The +75 micron size fraction represented approximately 62% of the tailing sample mass and had a calculated copper grade of 0.26% compared to the -38 micron size fraction which had a copper grade of only 0.17%. The +150 micron size fraction represented approximately 30% of the tailing sample mass and had a calculated grade of 0.30% copper. Similarly, the liberation analysis of the tailings sample, pointed to a significant potential improvement in overall liberation and recoveries with re-grinding the +75 micron size fraction.

13.2.2 **Grind Size & Rougher Flotation Test work**

Based on the mineralogical characterization work, a review of potential circuit improvements to retrofit and/or replace the Company's existing Vertimill to improve overall grind size was conducted. The Company selected to further evaluate Outotec's HIG Mill based on superior grinding performance characteristics for the ore of the Curaçá Valley. A composite sample of Derrick screen oversize material was prepared for testing during the operating days of September 20th to September 22nd, 2018. The composite slurry sample, consisting of one 200-liter drum, was tested in both Mintek's laboratory and a sub-sample was provided to Outotec for HIG Mill sizing characterization. The table below shows the product particle size distribution as a function of energy input from the HIG Mill test results conducted by Outotec. Outotec is independent of the Company as such term is defined under NI 43-101.

Table 13-3: HIG Mill size characterization test results

Size *micron*	**Feed**	**6.4** kWh/t	**12.8** kWh/t	**19.6** kWh/t	**26.3** kWh/t	**33** kWh/t
600	100	100	100	100	100	100
425	98	100	100	100	100	100
300	86	99	100	100	100	100
212		99	99	100	100	100
150	32	96	97	99	99	100
106	21	89	94	97	99	99
75	16	80	89	94	97	98
45	11	61	74	83	90	93
20	8	41	51	59	71	74
D80	**284**	**75**	**56**	**41**	**30**	**26**

A sub-sample of the composite was milled using a laboratory batch stirred test mill to achieve target grind size for rougher flotation test work. Rougher flotation tests were conducted in a 10-litre Denver flotation cell operating at 1,200 revolutions per minute ("rpm") with an air rate of 60 l/min. The mass of solids used in each test was 2.0kg at a target slurry density of 30% to 33% solids. Concentrates were collected and sampled at 1, 3, 7 and 15 minutes. Flotation concentrates and final tail samples were assayed using ICP-OES. Reagents and dosages included lime (360g/t), Aero4377 (35gpt), PAX (5pgt), MIBC (0.02g + 1 drop), plus 2 drops of MIBC and a second 5g/t dose of Aero3477 after 3 minutes. A second 5g/t dose of PAX was added after 7 minutes in each test.

Rougher flotation testing was conducted at varying grind sizes and, as a base-line, with no regrinding. The size fractions tested were as follows:

- 80% passing 280 microns (baseline with no regrind)
- 80% passing 150 microns
- 80% passing 125 microns
- 80% passing 106 microns
- 80% passing 75 microns
- 90% passing 53 microns

The results, shown in the figure below, highlighted that any degree of regrinding does improve rougher performance and showed improved rougher recovery as compared to the baseline no regrind sample. Grinds of 80% passing 150 microns to 106 microns resulted in similar recoveries of approximately 78% to 80%, while grinding to 80% passing 75 microns improved the overall recovery to around 84%, a 6% to 8% improvement. Regrinding to 53 microns improved rougher recovery further to approximately 86%, but rougher concentrate grades were lower as compared to the 80% passing 75 micron grind sample.

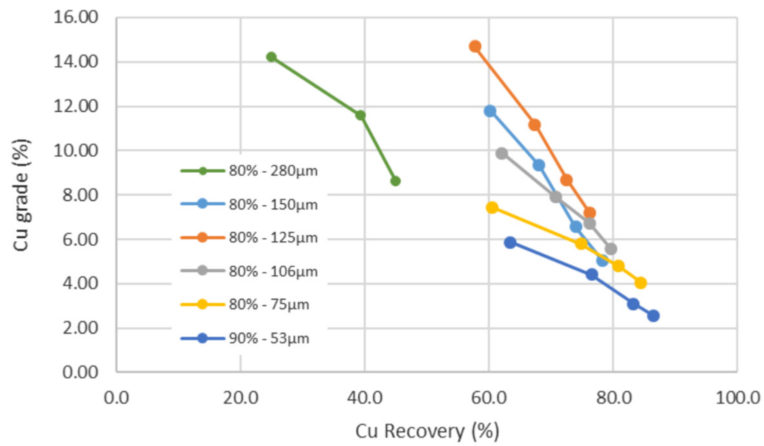


Figure 13-3: Rougher Concentrate Grade vs. Recovery Curves at Various Grind Sizes

13.2.3 Ero Brasil Validation Test work

Additional test work, undertaken by Ero Brasil in March of 2019, sought to validate and further quantify the expected improvement in recovery with a finer grind of the Derrick oversize material, which constitutes feed for the regrind circuit. Over the period of 6 operating days with the Caraíba Mill operating at close to its current installed capacity (of approximately 9,600 t/d), representative samples of mill feed, Derrick screen oversize and Derrick screen undersize were collected for additional testing. The samples, which ranged in copper head-grade from 1.45% copper to 2.38% copper, were tested for rougher flotation recoveries before and after regrinding the oversize fraction to 80% passing 74 microns.

The laboratory rougher flotation test work sought to simulate the residence time, reagent types and dosages of the rougher flotation cells currently in use in the Caraíba Mill. The results, shown in Table 13-4 below, highlight an average 16.1% increase in rougher recovery for the Derrick oversize fraction, resulting in a total increase in metallurgical recovery of between 3.7% and 4.9% copper. A 3.0% increase in metallurgical recoveries has been forecast for the purposes of this Report commensurate with commissioning and integration of the HIG Mill.

Table 13-4: Results of Ero Brasil Validation Test work

	Copper Grade (Cu%)			Cu Recovery Without Regrind			Cu Recovery with Regrind of O/S				Improvement
Sample	Feed	Oversize	Undersize	Oversize	Undersize	Total	Oversize	Undersize	Total		Total Rec.
Mar 22, 2019	1.45%	1.05%	1.64%	72.3%	95.0%	89.6%	92.7%	95.0%	94.5%		**4.9%**
Mar 25, 2019	1.89%	2.34%	1.68%	82.0%	94.6%	89.5%	92.7%	94.6%	93.9%		**4.3%**
Mar 26, 2019	2.10%	2.25%	2.03%	90.4%	95.0%	90.4%	92.4%	95.0%	94.1%		**3.6%**
Mar 27, 2019	2.38%	1.85%	2.65%	78.0%	94.2%	90.0%	92.7%	94.2%	93.8%		**3.7%**
Mar 28, 2019	2.31%	0.91%	2.99%	64.6%	93.8%	90.0%	92.8%	93.8%	93.7%		**3.7%**
Mar 29, 2019	1.49%	0.93%	1.77%	72.0%	94.0%	89.4%	92.6%	94.0%	93.7%		**4.2%**

13.2.4 Operating HIG Mill Results

Installation of the HIG Mill was completed at the end of the third quarter of 2020 with commissioning and feed system integration work continuing into the fourth quarter of 2020. Operational performance data from 2017 to 2022 is shown in the figure below. The sequential increase of Cu recovery is shown from 2021 to 2022 due to the liberation improvement attributed to the HIG Mill.

Figure 13-4 shows the feed grade recovery dataset from 2017 to 2022. The scatter plots demonstrate an increase in recovery in the different feed grade brackets. The recovery performance of the plant in the 0.90%-1.50% copper head grade range increased significantly since 2018. An average increase in plant recoveries of approximately 4.5% has been observed when the HIG Mill is in operation, across a wide range of copper grades and serve to support the metallurgical recovery assumptions used in the Report and in ongoing LOM planning efforts.

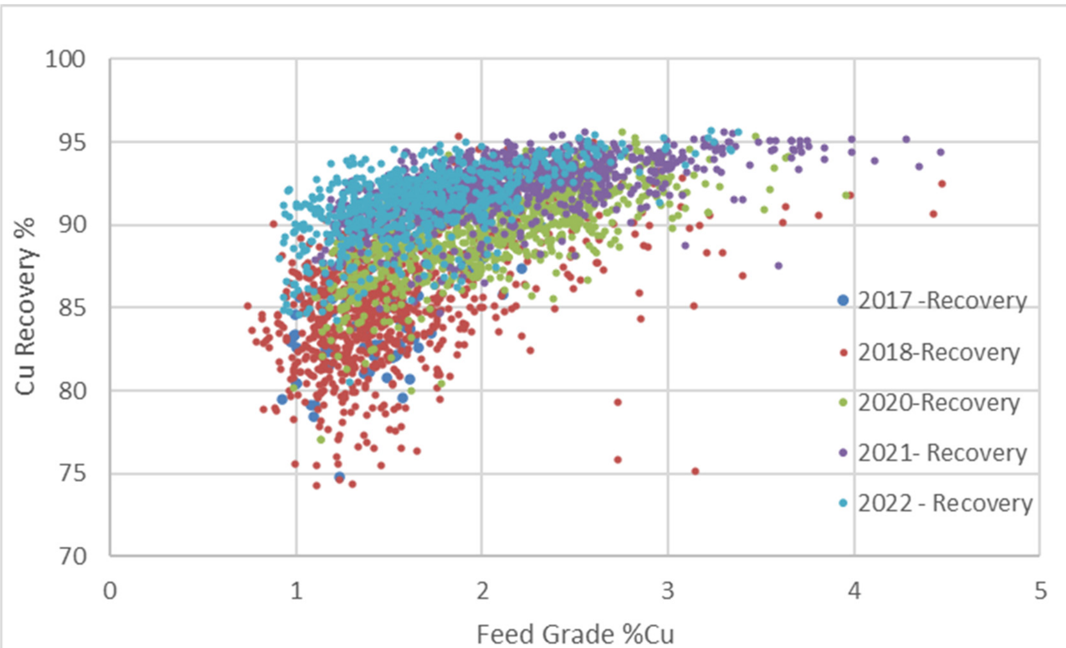


Figure 13-4: Grade Recovery comparison from 2017 to 2022 (Ero Brasil, 2022)

13.3 PILAR UG MINE METALLURGICAL RECOVERY

Drill hole composites from each area within Pilar UG Mine and Vermelhos UG Mine are routinely tested for metallurgical performance and characterization by Ero Brasil's process engineering team and laboratory personnel. The test work consists of sample preparation, mineralogical characterization, grind studies, rougher and cleaner flotation tests. The objective of this work is to predict the recoveries of the ores in the various regions of the underground and open pit mines for planning purposes and to develop optimal process parameters for each ore type. The following sections detail the results of these studies.

13.3.1 Deepening Extension

Flotation tests were carried out with metallurgical composites from 94 drill holes representing 2,078 samples in the composite test work. Recoveries as a function of copper grade are shown in the figure below.

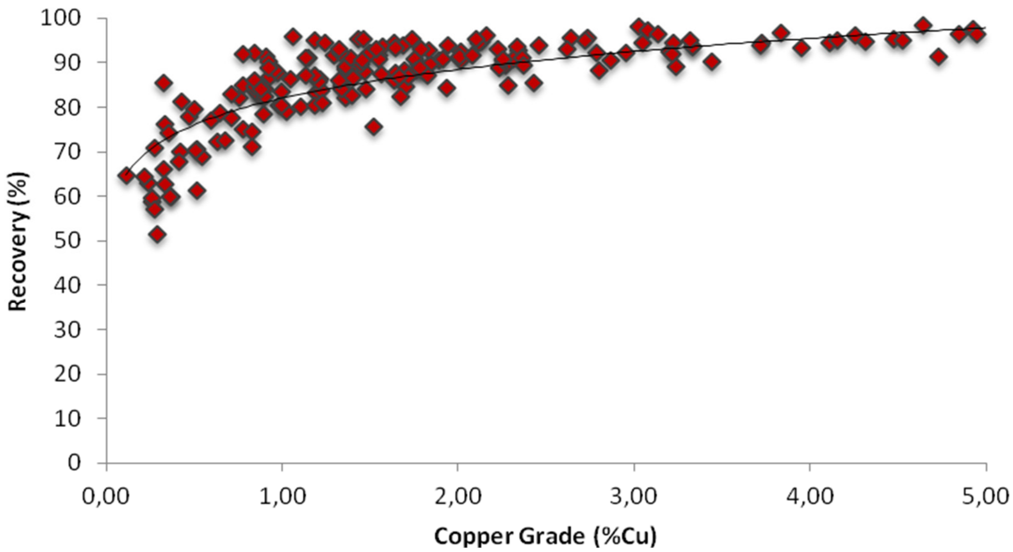


Figure 13-5: Metallurgical Test Work Results for Pilar UG Mine Zone: Deepening (Ero Brasil, 2019)

13.3.2 P1P2NE

Flotation tests were carried out with metallurgical composites from 17 drill holes representing 573 samples in the composite test work. Recoveries as a function of copper grade are shown in the figure below.

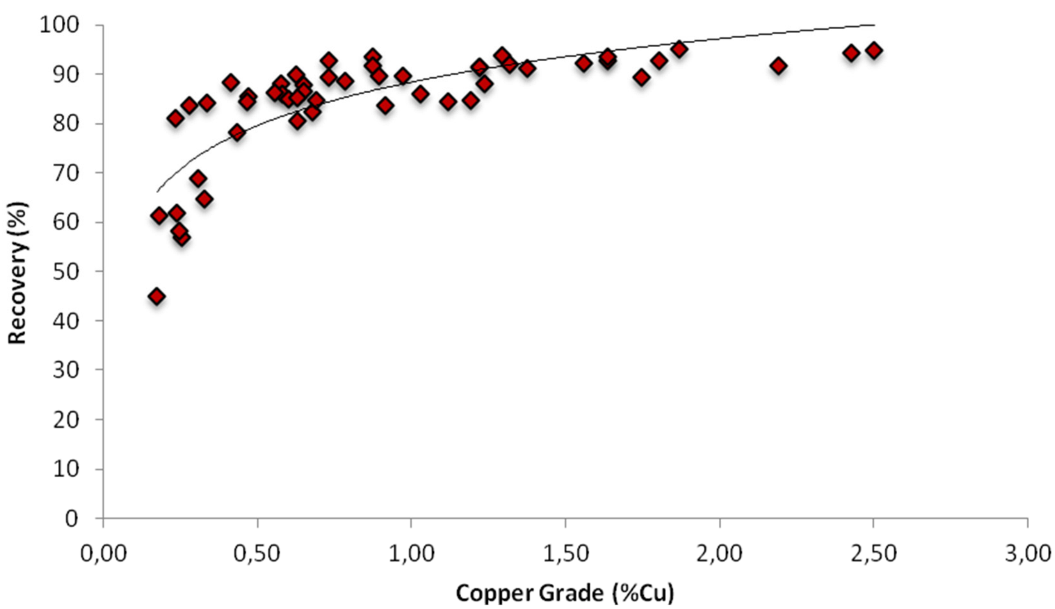


Figure 13-6: Metallurgical Test Work Results for Pilar UG Mine Zone: P1P2NE (Ero Brasil, 2019)

13.3.3 P1P2W (part of the "West Limb")

Flotation tests were carried out with metallurgical composites from 10 holes representing 201 samples in the composite test work. Recoveries as a function of copper grade are shown in the figure below.

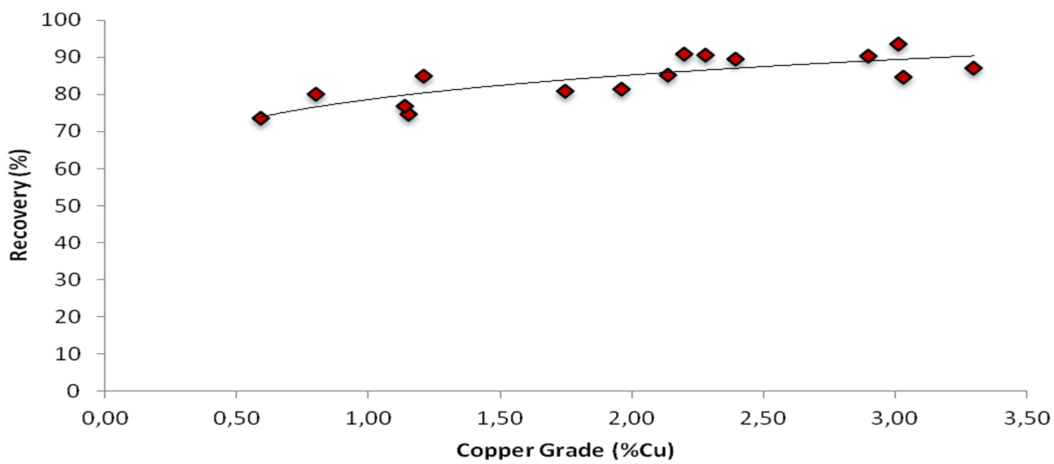


Figure 13-7: Metallurgical Test Work Results for Pilar UG Mine Zone: P1P2W (Ero Brasil, 2019)

13.3.4 MSB South (MSBS)

Ore from MSBS mine area has been processed by the plant. Actual plant performance serves as the guide for forecast metallurgical results. Recoveries as a function of copper grade are shown in the figure below.

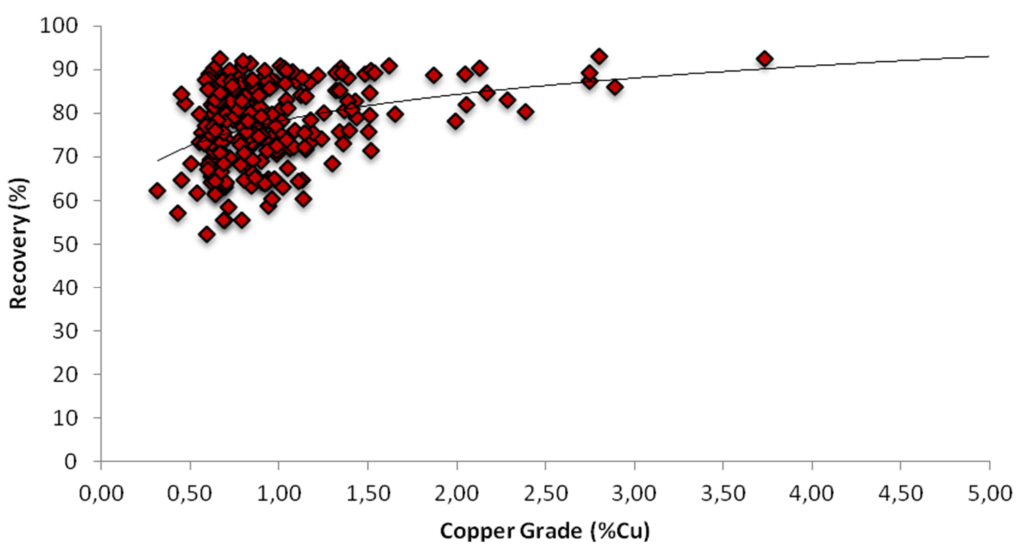


Figure 13-8: Metallurgical Test Work Results for Pilar UG Mine Zone: MSBS (Ero Brasil, 2019)

13.3.5 GO2040 + Piloto 1

Ore from GO20140 & Pilar Upper Level mine areas have been processed by the plant. Actual plant performance serves as the guide for forecast metallurgical results. Recoveries as a function of copper grade are shown in the figure below.

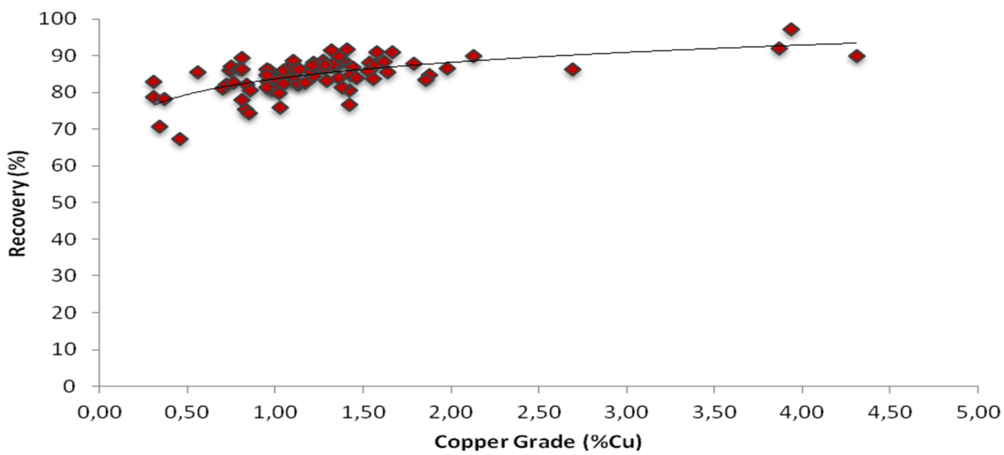


Figure 13-9: Metallurgical Test Work Results for Pilar UG Mine Zone: GO2040 & Pilar Upper Levels (Ero Brasil, 2019)

13.3.6 Sill Pillar

Ore from the Sill Pillar mine area has been processed by the plant. Actual plant performance serves as the guide for forecast metallurgical results. Recoveries as a function of copper grade are shown in the figure below.

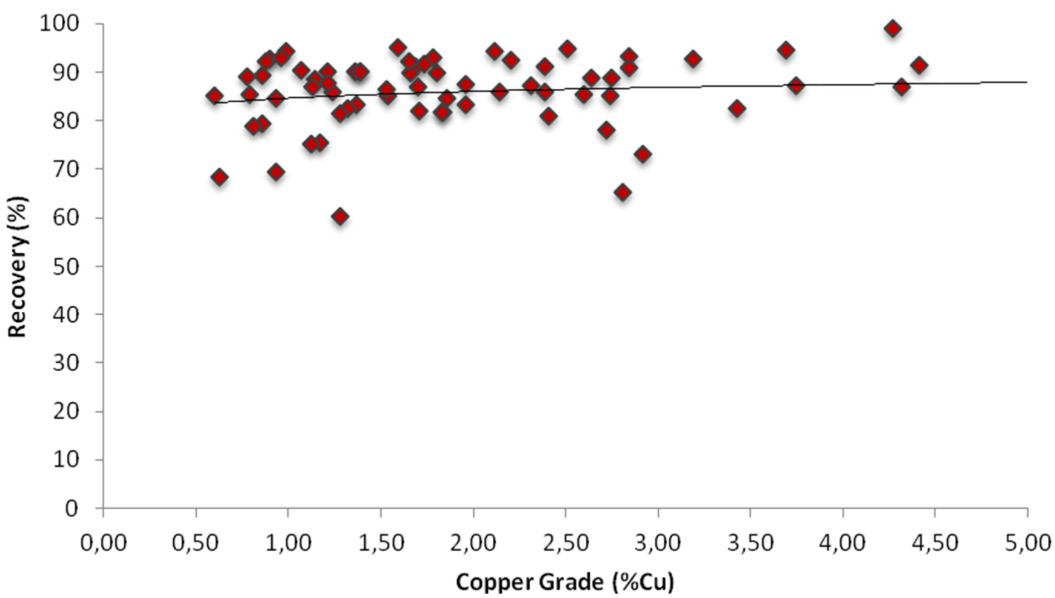


Figure 13-10: Metallurgical Test Work Results for Pilar UG Mine Zone: Sill Pillar (Ero Brasil, 2019)

13.4 VERMELHOS UG MINE METALLURGICAL RECOVERY

Ore from the Vermelhos UG Mine has been processed by the Caraíba Mill since 2018. Actual plant performance serves as the guide for forecast metallurgical results. Recoveries as a function of copper grade are shown in the figure below.

Metallurgical performance within the mine can be further separated into mineralization derived from the main central orebodies of Toboggan and Sombrero and that of the previously mined area of UG1. UG1 was mined in 2018 and early 2019 and is generally characterized as having elevated phlogopite and alteration, which at lower grades, necessitates a decline in recoveries to maintain concentrate grades at 35% when compared to the main orebodies. In late 2019, improvements to the Company's Carboxymethlcellulose ("CMC") dosing unit operations were made resulting in improved metallurgical recoveries for highly altered zones, such as UG1.

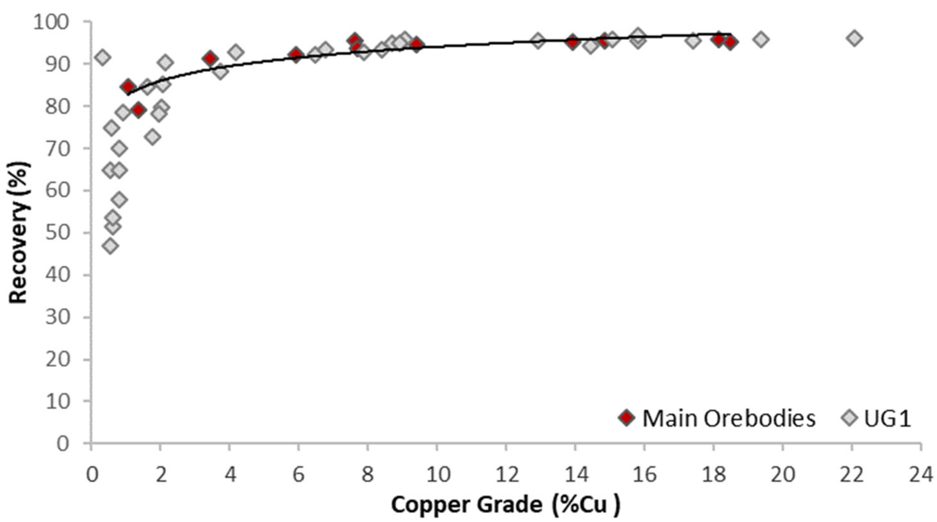


Figure 13-11: Metallurgical Test Work Results for Vermelhos UG Mine (Ero Brasil, 2019)

13.4.1 Vermelhos Geometallurgical Test Program

Geometallurgical test work commenced in 2018 on the main mining areas of Vermelhos UG Mine, as currently defined, to test varying metallurgical responses between the main orebodies and the northern and the southern satellite bodies (namely UG2 and UG1, respectively).

GE21 analyzed the geometallugy data from three main areas, incorporating 77 samples comprised of both drill hole composites from the main orebody and stockpile material from the UG1 deposit. The classification ID and number of samples comprising each sub-group area as follows:

- CNT (Toboggan and Sombrero) = 33 samples
- UG1 = 35 samples
- UG2 = 9 samples

GE21 observed that the UG1 zone exhibited lower recovery, greater recovery dispersion and lower copper enrichment factors when compared to both CNT and UG2, consistent with plant performance in this zone over the period that UG1 was mined and processed. The figure below presents the different sample behavior according to mining area.

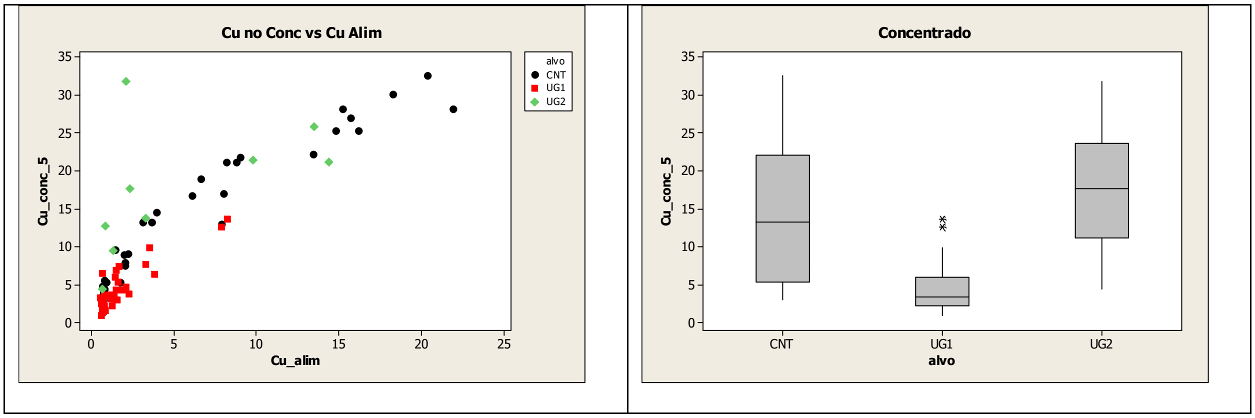


Figure 13-12: Sample behavior According to Feed Source (GE21, 2019)

Based on the geometallurgical analysis performed, it is believed that the sub-optimal recoveries realized in UG1 are predominantly as a result of the presence of MgO bearing minerals such as serpentine (Mg, Fe)$_3$Si$_2$O$_5$(OH)$_4$), and K2O bearing minerals such as phlogopite (KMg $_3$(AlSi$_3$O$_{10}$)(F, OH)$_2$), as shown in the two figures below.

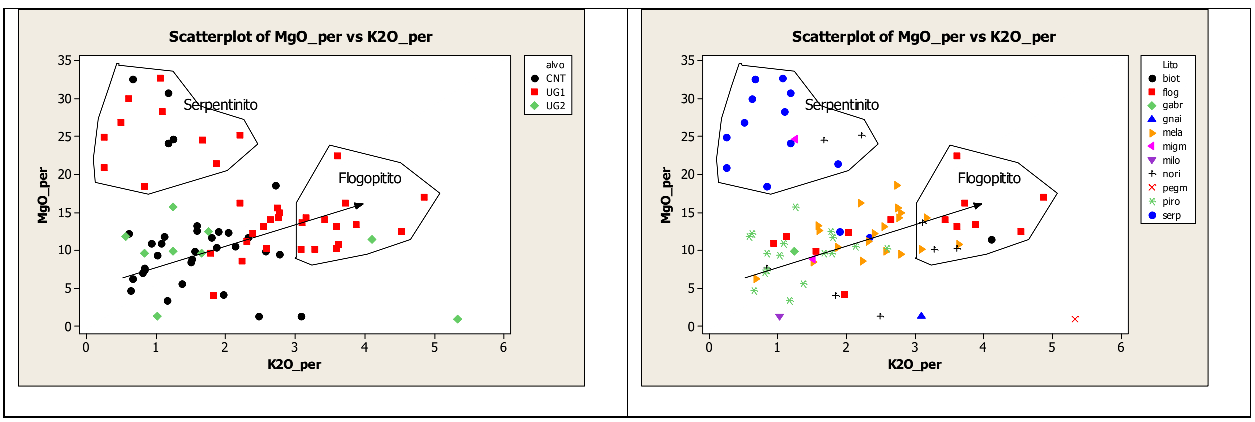


Figure 13-13: Mineral Association on UG1 (GE21, 2019)

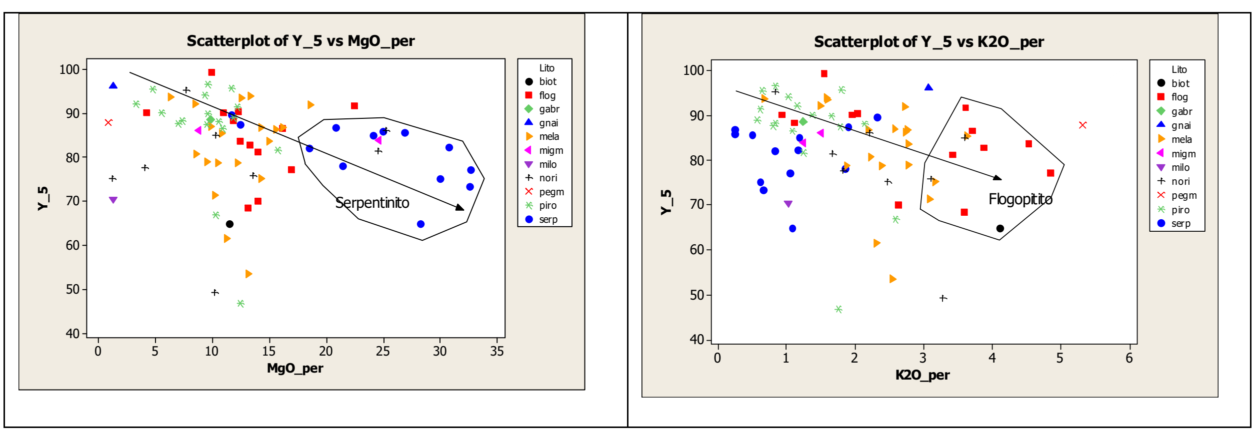


Figure 13-14: Relation Between MgO and K$_2$O Bearing Lithology and Copper Recovery (GE21, 2019)

As evidenced in the above classification, and as observed in actual plant performance, CNT, UG1, and UG2 areas represent different geological domains that influence copper recovery.

Overall, lower recoveries should be expected when copper mineralization is hosted in heavily altered rocks (with strong association of phlogopites and serpentinites), as is the case with UG1. There was no observed recovery difference between the primary host lithologies for copper mineralization (pyroxenite, norites and melanorites) at the Vermelhos UG Mine. The Company's addition of a CMC dosage plant in late 2019 has contributed to improved recoveries when mining and processing heavily altered rocks such as those of UG1 but encountered elsewhere within the Curaça Valley.

13.5 ORE SORTING

As part of ongoing optimization efforts, and in recognition of the heterogeneous nature of the mineralization of the Curaçá Valley, the Company undertook test work in early 2019 to evaluate the potential of XRF ore-sorting to upgrade copper content of mined ores. To evaluate this potential, three bulk samples weighing approximately 300kg each, 900kg in total, were collected from several locations within the Surubim mine. The sampling program sought to create representative high-grade, medium-grade and waste bulk composite sample from exposed ore in a recently mined open pit to form approximately one tonne of material grading approximately one percent copper. These samples were crushed, screened, and delivered to Metanza Mineral Processors (Pty) Ltd. outside of Johannesburg South Africa in six drums. Particle sizes of the bulk samples ranged between 30mm and 75mm. Metanza Mineral Processors (Pty) Ltd. is independent of the Company as such term is defined under NI 43-101.

These samples were passed through a XRF machine in normal operation mode to analyze the particles as they fell past the XRF sensor, which was set to record the relative values of copper, iron, nickel, and calcium. Relative values were normalized to develop optimal sorting conditions based on the normalized values of copper, nickel, and iron. A 24 product factorial approach was then used to evaluate the cumulative performance throughout the selectivity range for each composite sample. Each of the sort products were pulverized and sent to ALS laboratories in Johannesburg to determine copper, nickel, iron, and calcium contents using four-acid digestion and inductively coupled plasma atomic emission spectroscopy ("ICP-AES"). ALS laboratories is independent of the Company.

The results of this test program demonstrated that XRF ore-sorting could be used to upgrade the copper content of these samples with minimal copper loss. The combined result showed that a sample weighing approximately 900kg and grading 1.00% copper could be sorted to approximately one-half of its original mass, while only losing 5% of the contained copper. The results of the test work program are shown below for the XRF selectivity setting that maximized copper recovery.

Table 13-5: XRF Test Results

Sample ID	Sample head-grade (Cu %)	Sort Concentrate Mass (%)	Sort Concentrate Grade (Cu %)	Reject Grade (Cu %)	Copper Recovery (%)
High-grade	1.69%	66.8%	2.41%	0.24%	95.3%
Medium-grade	1.38%	79.0%	1.68%	0.26%	96.2%
Waste	0.04%	3.20%	0.62%	0.02%	49.6%
Total Bulk	**1.00%**	**47.9%**	**1.98%**	**0.10%**	**95.0%**

Total Bulk sample mass of 912.9kg comprised of 292.3kg of high-grade, 292.9kg of medium-grade and 327.7kg of waste sample. Cumulative performance up to the selectivity range for maximum copper recoveries shown.

Following this test work, the Company elected to run a comprehensive trial ore sorting campaign using a XRF machine. An ore sorting pilot plant was constructed at the Pilar Mine consisting of a single XRF sorting machine. Construction of the pilot plant was completed in the fourth quarter of 2019 and test work began in early 2020. From early 2020 through

September 2020, a total of approximately 29,000 tonnes of material from eight different sources of material throughout the Curaçá Valley were run at commercial throughput rates through the ore sorting pilot plant.

For each deposit tested, and for material from the Angicos Mine stockpile, material was crushed and screened to between 30 mm and 90 mm and fed into the XRF sorting unit at a rate of approximately 20 tonnes per hour using a belt feeder to provide a consistent feed rate. Minus 30 mm material and fines generated during the crushing process were screened away from the ore sorting feed and sent directly to the mill. For each source tested, the trial campaign sought to model sorting performance at a variety of selectivity ranges (or 'set points') to determine the unique performance characteristics throughout the selectivity curve. Optimal mass yield, defined as the amount of material that is upgraded in the sort product, is based on maximizing the upgrade ratio, defined as sort product copper grade divided by feed grade, while minimizing copper loss of the sort product. Samples of both the sort product and sort reject were collected at routine intervals and assayed for total copper at the Company's on-site laboratory. Prior to changing selectivity set points and between each of the sources tested, the crushing and XRF sorting unit were cleaned to prevent contamination of results.

Upgrade ratios were determined across a range of mass yields using the selectivity curves generated for each source. Results of the program across a range of mass yields are further detailed in the table below.

Table 13-6: Ore Sorting Trial Campaign Results at Varying Mass Yields

Tested Mine / Source	Sample Tested (Tonnes)	Sample Head Grade (Cu %)	Results at Selected Ore Sorting Mass Yield[1] 20%	40%	60%	80%
Vermelhos HG Sample	**4,569**	**2.71**				
Sort Product Grade (Cu%)			12.22	6.39	4.37	3.34
Upgrade Ratio (Sort Product Grade/Feed Grade)			4.50x	2.35x	1.61x	1.23x
Calculated Copper Loss (%)			9.8%	5.7%	3.2%	1.4%
Vermelhos MG Sample	**4,246**	**1.21**				
Sort Product Grade (Cu %)			5.46	2.85	1.95	1.49
Upgrade Ratio (Sort Product Grade/Feed Grade)			4.52x	2.36x	1.61x	1.23x
Calculated Copper Loss (%)			9.8%	5.7%	3.2%	1.4%
Vermelhos LG Sample	**9,109**	**0.80**				
Sort Product Grade (Cu %)			3.61	1.89	1.29	0.99
Upgrade Ratio (Sort Product Grade/Feed Grade)			4.49x	2.35x	1.61x	1.23x
Calculated Copper Loss (%)			9.8%	5.7%	3.2%	1.4%
Pilar Mine HG (Deepening)	**1,161**	**1.97**				
Sort Product Grade (Cu %)			8.86	4.64	3.17	2.43
Upgrade Ratio (Sort Product Grade/Feed Grade)			4.49x	2.35x	1.61x	1.23x
Calculated Copper Loss (%)			10.0%	5.8%	3.3%	1.5%
Pilar Mine LG Development	**904**	**0.33**				
Sort Product Grade (Cu %)			1.08	0.65	0.48	0.39
Upgrade Ratio (Sort Product Grade/Feed Grade)			3.33x	1.99x	1.48x	1.20x
Calculated Copper Loss (%)			34.4%	21.4%	12.5%	5.7%
Surubim Mine	**940**	**0.30**				
Sort Product Grade (Cu %)			0.97	0.59	0.44	0.35
Upgrade Ratio (Sort Product Grade/Feed Grade)			3.20x	1.93x	1.43x	1.16x
Calculated Copper Loss (%)			35.0%	21.8%	12.8%	5.8%
Suçuarana Mine	**3,753**	**0.27**				
Sort Product Grade (Cu %)			0.69	0.46	0.36	0.31
Upgrade Ratio (Sort Product Grade/Feed Grade)			2.59x	1.73x	1.36x	1.15x
Calculated Copper Loss (%)			48.8%	31.7%	19.2%	8.9%
Angicos Mine Stockpile	**4,216**	**0.38**				
Sort Product Grade (Cu %)			1.04	0.67	0.52	0.44
Upgrade Ratio (Sort Product Grade/Feed Grade)			2.73x	1.77x	1.37x	1.15x
Calculated Copper Loss (%)			45.5%	29.2%	17.5%	8.1%

Based on the success of the trial campaign and economic evaluations, ore sorting has been integrated into the LOM plan update with a focus on implementing the technology within the Vermelhos District because of the excellent response to ore sorting and expected savings in transport costs. As a result of newly integrated sources of mill feed, particularly from the inclusion of Project Honeypot, ore-sorting is assumed to commence in year 2031. The deferral of ore-sorting to later in the LOM as compared to prior LOM initiatives has allowed postponement of capital related to pre-stripping and ore sorting of the Vermelhos District open pit deposits, as well as simplifying the Company's development initiatives over the medium-term.

13.6 HYDROPHOBIC MINERAL SUPPRESSION WITH CMC

Copper concentrate quality as well as metallurgical recoveries are strongly influenced by the natural floatability of hydrophobic minerals. The use of CMC as a flotation reagent is critical to suppress hydrophobic minerals naturally present within the ore of the Caraíba operations. A CMC plant project was initiated in 2020 and the phase 2 upgrade was commissioned in June 2022. A phase 3 upgrade and improvement initiative is planned for first quarter 2023.

A correlation was developed for the operations determine the appropriate CMC dosage rates for known percentages of hydrophobic minerals in the feed. Figure 13-15 shows the actual CMC dosage per month for 2021 to 2022 September. The CMC plant has positively contributed to the copper recovery and concentrate quality since its installation in 2020.

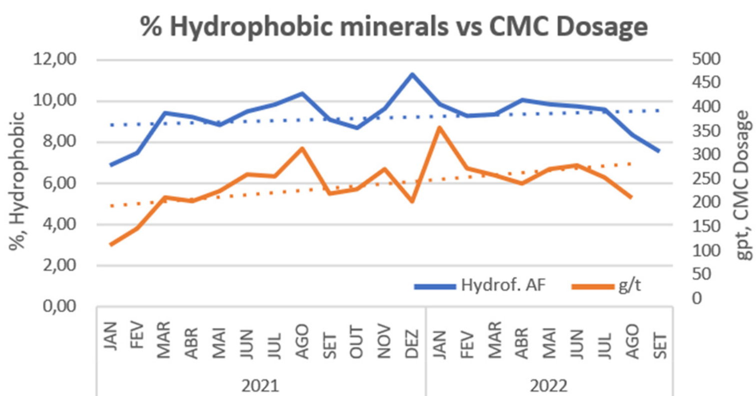


Figure 13-15: Monthly CMC Dosage (grams per tonne) for 2021 and 2022 (Ero Brasil, 2022)

13.7 CARAÍBA ORE COMPETENCY TEST WORK – PLANT EXPANSION

As part of the plant expansion studies undertaken in 2021, samples were collected from within operating stopes within each mine in an effort to obtain comprehensive blends across various ore-type composition. These samples were analyzed by Metso and the main comminution parameters determined for use in the mill expansion design. Key data incorporated into the expansion project design includes the Bond Ball Work Index (BWi), Crusher work index (CWi) and Bond abrasion index. These values directly affect the selection of communication equipment and range of power draw and wear cost planning. The results of the competency test work are included below:

Table 13-7: Sample Blends for Ore Competency Test Work (Ero Brasil 2022)

Blend	Project	Location	Sample Name	Interval (m)	Weight, (kg)
1	Baraúna (Pilar Mine)	GO2040 Braço 01	GO2040 Braço 01	1 to 10	84.5
		GO2040 Ac. Alternativo	Ac. Alternativo GO2040	1 to 12	96.5
2	MSB-SUL (Pilar Mine)	Nível -174 GAN-174 RE01	GAN-174 RE01	1 to 9	50.0
3		Nível -174 GAN-174 RE03	GAN-174 RE03	1 to 6	46.0
		Nível -174 GAN-174 RE04	GAN-174 RE04	1 to 4	28.0
4	Deepening (Pilar Mine)	Nível -537 TRN-537RE10F3	TRN-537RE10F3	1 to 3	24.5
		Nível -670 TRN-670 RE19	TRN-670 RE19	1 to 4	35.5
5		Nível -800 TRN-800 RE14	TRN-800 RE14	1 to 16	85.6
6		Nível -930 TRN-930 RE09	TRN-930 RE09	1 to 3	31.5
		Nível -965 GVN-965 Norte	GVN-965 Norte	1 to 10	37.5
7	UG3 (Vermelhos Mine)	PONTO 01 GAN+135_01	UG3	1 to 8	62.0
8	Vermelhos Mine (prco1 e PTBB01)	PONTO 02 GAN+285_13	PRC01	9 to 13	71.0
		PONTO 02 GAN+162_06_01	PTBB01	14 to 18	
		PONTO 03 GAN+185_11	PTBC02	942 to 961	117.0
9	N8 Open Pit	PONTO 04 N8 Cava Experimental	MCA_N08	1 to 11	65

Table 13-8: Results of Ore Competency Test Work (Ero Brasil 2022)

Test work	Unit	Blend 1	Blend 2	Blend 3	Blend 4	Blend 5	Blend 6	Blend 7	Blend 8	Blend 9
Bond Abrasion Index, Ai	g	0.351	0.336	0.166	0.311	0.403	0.182	0.579	0.341	0.204
Macron Abrasion Index, Ai	g/t	1592	902	692	1234	1362	992	1446	1546	1166
Macron Crushability, Cr	%	44	41.4	31.5	52.9	37.5	36.8	42.3	48.4	37.9
Crushing Work Index, CWi	kWh/t	18.2	19.5	22.2	15.7	19.3	19.0	18.7	17.2	19.2
Bulk Density	t/m^3	1.95	1.75	1.78	1.86	1.72	1.85	1.69	1.84	1.74
Specific Density	t/m^3	3.02	2.88	2.88	3.08	2.77	3.17	2.79	3.02	2.91
BWi Test										
- Closing Screen	mm	0.149	0.149	0.149	0.149	0.149	0.149	0.149	0.149	0.149
- Grindability	g/rev	1.513	1.341	0.962	1.529	1.462	1.173	1.245	1.477	1.264
- F80	mm	2.558	2.451	2.765	2.707	2.592	2.255	2.592	2.328	2.549
- P80	mm	0.122	0.121	0.114	0.124	0.123	0.126	0.123	0.123	0.125
- Wi	kWh/t	15.66	17.29	21.44	15.52	16.12	20.02	18.35	16.22	18.35
Drop weight Test										
- Dwi	kWh/m^3	5.45	6.46	8.45	4.76	7.34	7.89	5.14	5.35	5.24
- Mia	kWh/t	13.5	17.2	21.3	12.5	19.1	18.2	15.2	13.7	15.1
- Mih	kWh/t	9.6	12.6	16.5	8.7	14.4	13.9	10.7	9.7	10.7
- Mic	kWh/t	5	12.6	8.6	4.5	7.4	7.2	5.5	5	5.5
- A	-	90.1	95.6	100	78.1	100	90.2	87.4	87.7	80.1
- b	-	0.67	0.48	0.35	0.86	0.4	0.46	0.62	0.68	0.68
- sg	-	3.29	2.97	2.97	3.19	2.96	3.29	2.79	3.19	2.85
- ta	-	0.48	0.4	0.31	0.55	0.35	0.33	0.5	0.48	0.49
- SCSE	kWh/t	8.94	9.81	11.22	8.47	10.47	10.75	8.77	8.95	8.85

14 MINERAL RESOURCE ESTIMATES

14.1 INTRODUCTION

This chapter describes the work undertaken by GE21 and key assumptions and parameters used to prepare the mineral resource models for the three districts (or regions) within the Curaçá Valley: Pilar District (South Curaçá Valley), the Vermelhos District (North Curaçá Valley), and the Surubim District (Central Curaçá Valley), together with appropriate commentary regarding the merits and possible limitations of such assumptions. The three main mineral districts were divided into 8 target zones or deposits (or "domains"), which were the object of specific analysis as it relates to the current mineral resource estimate. For the 2022 mineral resource update, there are several domains for which no additional drilling or mining activity took place between the effective date of the 2021 Technical Report and the Effective Date of this Report. These domains include: the East Limb, West Limb, R75 and Suçuarana of the Pilar UG Mine, C12, Cercado Velho and Terra do Sal within the Surubim District, and the N9 (Vermelhos East) Deposit and N5 (Siriema) deposit within the Vermelhos District. In these instances, the authors of this Report reviewed the mineral resource wireframes, drill hole databases and prior mineral resource estimates, which were prepared by GE21 in connection with the 2021 Technical Report for validation and inclusion in the current mineral resource estimate. Additional technical information pertaining to the resource estimation parameters for those domains, which remain unchanged from 2021, are detailed in Section 14.9.

Ero Brasil's technical team prepared the geological models and grade interpolation shells using Datamine and Leapfrog software and performed the statistical and variography analysis, supported by Geovariance team, using Isatis Neo software. GE21 validates the database and estimates by Ero Brasil.

The authors of this Report are not aware of any environmental, permitting, legal, title, taxation, socio-economic, marketing, political or other relevant factors which could materially affect the current mineral resource estimate. GE21 is of the opinion that the current drilling information is sufficiently reliable to interpret with confidence the boundaries of the higher-grade mineralization domains and that the assaying data is sufficiently reliable to support estimating mineral resources.

14.2 MINERAL RESOURCE DATABASE

The Caraíba Operations geological database was provided by Ero Brasil in Datamine formats, including drill hole collar survey, geology, assay results and density estimates. The current drill hole database consists of over 1 million meters of drilling. The current mineral resource model incorporates a total of 420,000 individual assay samples. The table below shows a summary of the drill hole database by mine and domain. The drilling and assay data were loaded on a Geoexplo Database Manager software, and later converted to a Datamine software format, as well as Leapfrog for estimation and validation procedures. The validation procedures include:

- Validation of data that was either duplicated or entered incorrectly;
- Identification of any missing data;
- Verification of the consistency of the "from- to" intervals (elimination of any gaps and overlaps).

Table 14-1: Summary of the Database Used in 2020 Mineral Resource Estimation

District / Domain	Number of Drill Holes	Number of Assay Samples
Pilar District		
Deepening	1,508	38,095
MSB Sul/ Baraúna	764	28,293
P1P2	7,068	114,474
Suçuarana*	204	24,154
R75*	63	3,877
East Limb*	7	42
West Limb*	42	2,041
Honey Pot	3533	114,066
S3	9	1,769
S10	32	2,820
Surubim District		
Surubim	253	15,336
C12*	110	10,645
Lagoa da Mina	104	9,845
Cercado Velho*	50	3,250
Terra do Sal*	61	4,684
C4	38	5,572
Vermelhos District		
N5 (Siriema)*	101	19,076
N7 (Vermelhos UG Mine)	1256	20,222
N8 (Vermelhos West)	2001	158,781
N9 (Vermelhos East)*	36	1,400
N10 (Vermelhos North)	16	1,322
Total	**8,680**	**420,000**

(*) Denotes domains within the Curaçá Valley where no additional drilling or mining was performed since the effective date of the 2021 Technical Report. Please refer to Section 14.9 for additional information.

14.3 2020 GEOLOGICAL MODELLING

14.3.1 Pilar District, 2022 Update

For the preparation of the updated mineral resource estimate in 2022, the Pilar District, containing the Pilar UG Mine, was further sub-divided into 4 discrete geologic domains for which new drilling and mining activities took place after the effective date of 2021 Technical Report. The separation of the domains was based on continuity of mineralization and expected mine production and overall planning purposes, based, in part, on Ero Brasil's knowledge of Curaçá Valley deposits and operational experiences.

A 3D grade shell model was constructed from east-west cross-sections interpreted with the Datamine, using 22.5 m by 22.5 m and 45 m by 45 m drill spacing grids. Contacts of mineralized intervals were adjusted, using drill hole assay data and logged lithology information. The interpolation across adjacent cross-sections was used to create 3D solids for each of the domains. Solids were prepared within a wireframe "linking adjacent" tool, to plot the continuous mineralized solids.

Figure 14-1 details the updated 3D models of the Pilar UG Mine. The model corresponds to the local coordinate grid, used for the Pilar UG Mine and updated domains. Figure 14-2 and Figure 14-3 present, respectively, the grade shell 3D models of S3 and S10 domains using Leapfrog software.

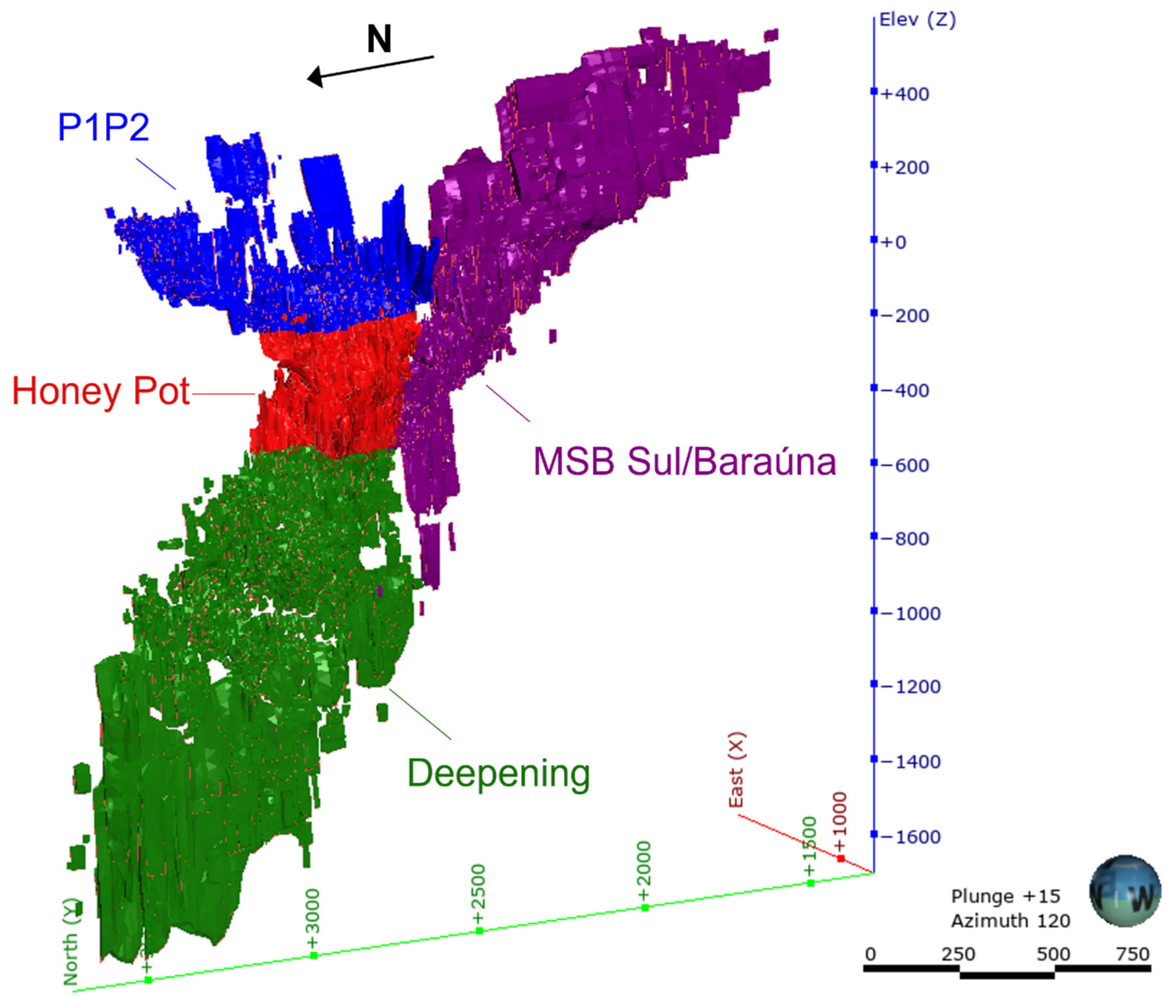


Figure 14-1: 3D high-grade models of the domains of the Pilar UG Mine shown on local coordinate system. Colors denote interpretation zones or domains for visual reference only (Ero Brasil, 2022)

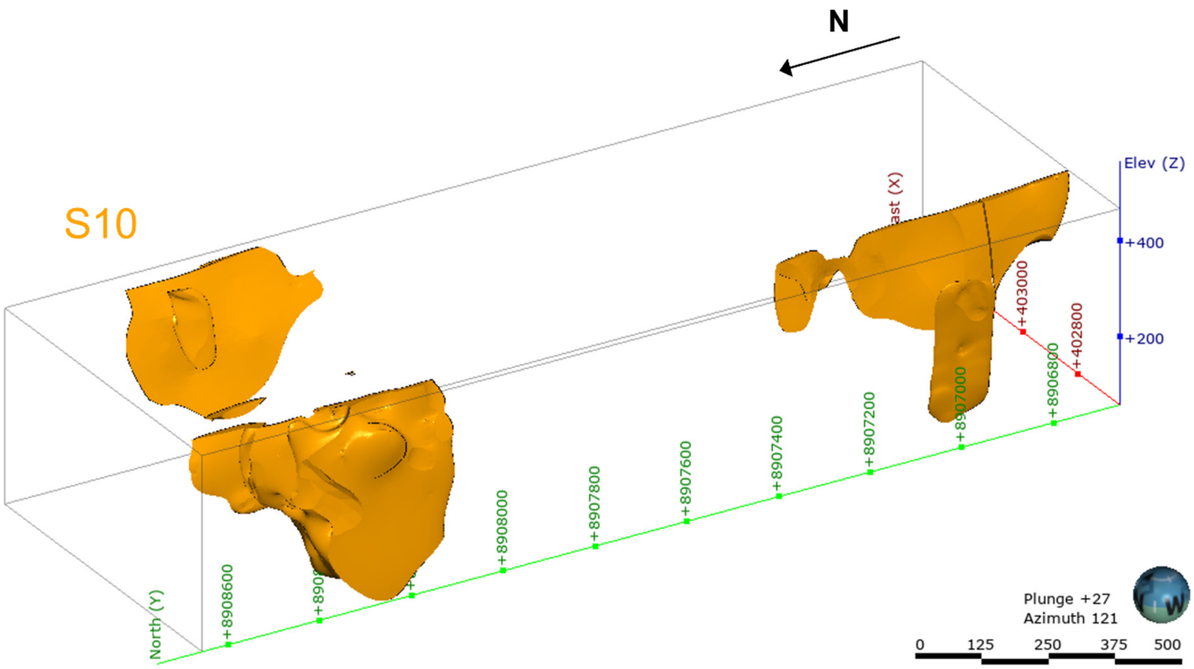


Figure 14-2: 3D model of Suçuarana domain (Sirgas 2000 – UTM coordinate system). Colors denote interpretation zones or domains for visual reference only (Ero Brasil, 2022)

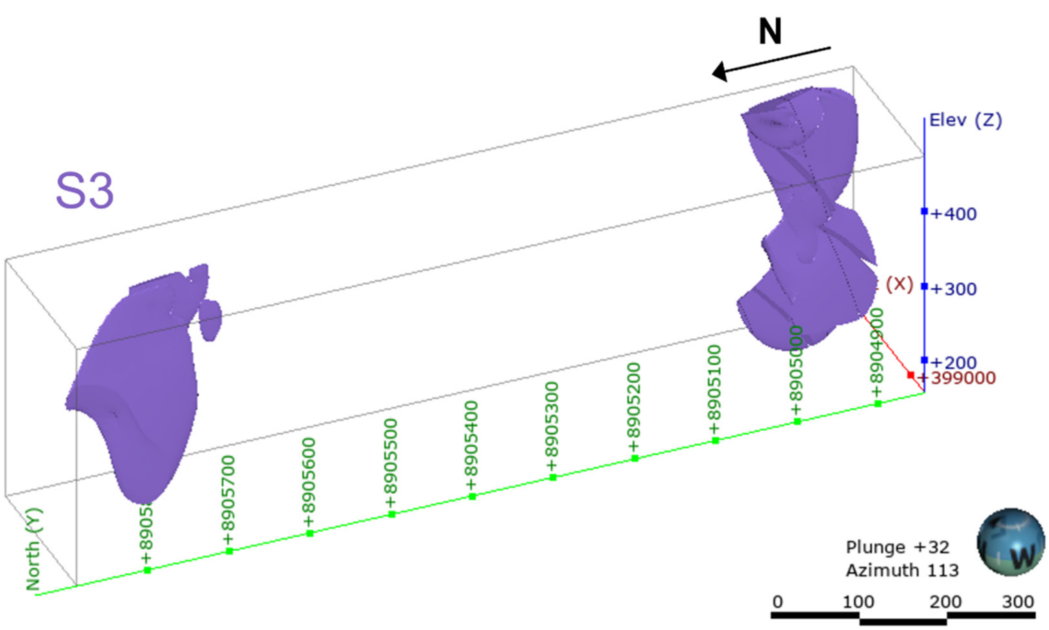


Figure 14-3: 3D model of S3 domain (Sirgas 2000 – UTM coordinate system). Colors denote interpretation zones or domains for visual reference only (Ero Brasil, 2022)

14.3.2 Vermelhos District

Within the Vermelhos District, known occurrences of mineralization occur, most commonly, as flat planar structures and as sub-vertical stacked mineralized lenses, generally trending north-south, dipping to the west and plunging to the north. The 3D model of the Vermelhos District mineralized lenses are based on the geological interpretations, using vertical cross-sections constructed using a 25 m by 25 m and 50 m by 50 m drill spacing grid. The resource estimation model considers sample intervals composited to one meter, a grade-shell value of 0.20% Cu to delineate near-surface low-grade mineralized lenses and a grade-shell value of 0.45% Cu to delineate higher grade lenses for the purposes of generating higher-grade estimation volumes, primarily for consideration of underground designs.

The figure below presents the 3D models of the updated domains located within the Vermelhos District. The geological models of the domains for the Vermelhos UG Mine (Vermelhos South - N7) and Siriema (N5) were prepared by the Ero Brasil geology team, using Datamine under the supervision of GE21. The Vermelhos West (N8) 3D model and grade shell was developed using Leapfrog. The modelling considered different lithologies, including gneisses, mafic and ultra-mafic lithotypes as well as pegmatite dikes.

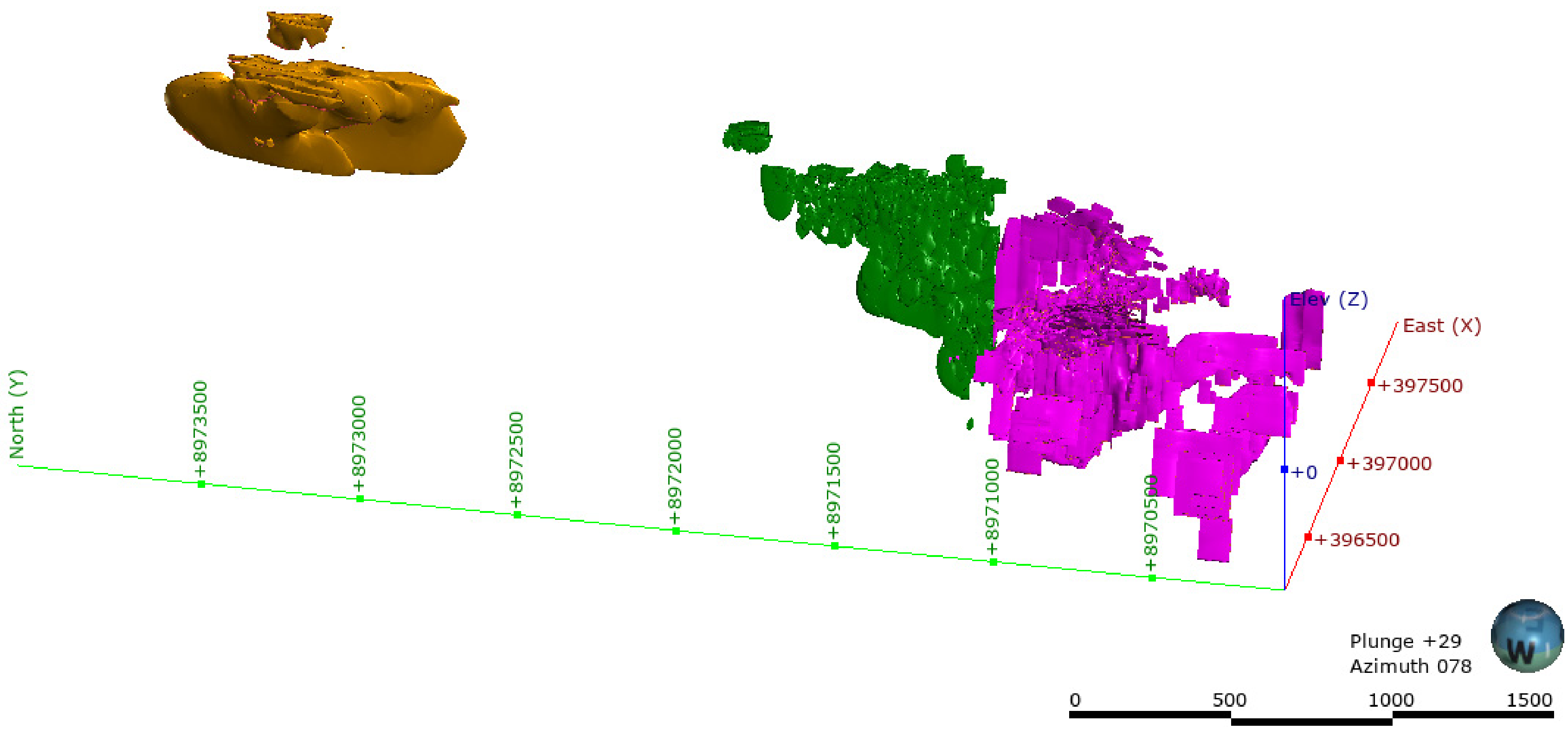


Figure 14-4: 3D grade shell model of North Curaça district (Sirgas 2000 – UTM coordinate system). Colors denote interpretation zones or domains for visual reference only (Ero Brasil, 2022)

14.3.3 Surubim District

Within the central Surubim District, known occurrences of mineralization occur most commonly along an NNE trending corridor of mafic and ultramafic rocks (norites and pyroxenites) that exhibit alteration to phlogopite throughout the district, with localized zones of intense alteration. The geometry and volume of the mineralized lenses of the Surubim, Lagoa da Mina and C4 Domains were estimated using vertical geologic cross-sections and copper grade distributions. The occurrence of waste rock zones, often between 2m to 5m in thickness, within the mineralized envelopes are common in in this region, including in the Terra do Sal Domain. These waste zones were incorporated into the mineralized envelopes to provide appropriate dilution considerations for mine planning and mineral reserve estimation. Continuous stratums (observed between sections) of un-mineralized or low-grade gneiss were classified as waste rock in the models. Figure 14-5, Figure 14-6 and Figure 14-7 show, respectively, the Surubim, Lagoa da Mina and C4 grade shell models, constructed by Ero Brasil technical team, using Leapfrog Geo software.

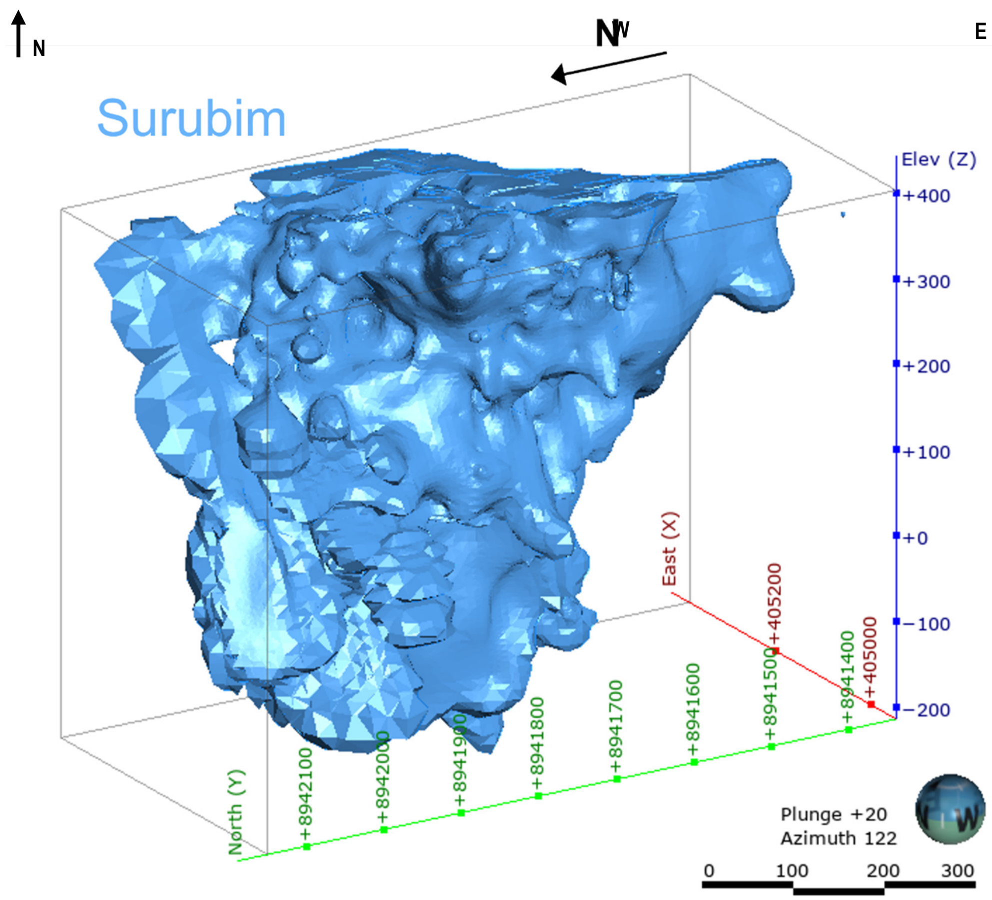


Figure 14-5: 3D grade shell model of the Surubim domain in the Surubim District (Ero Brasil, 2022)

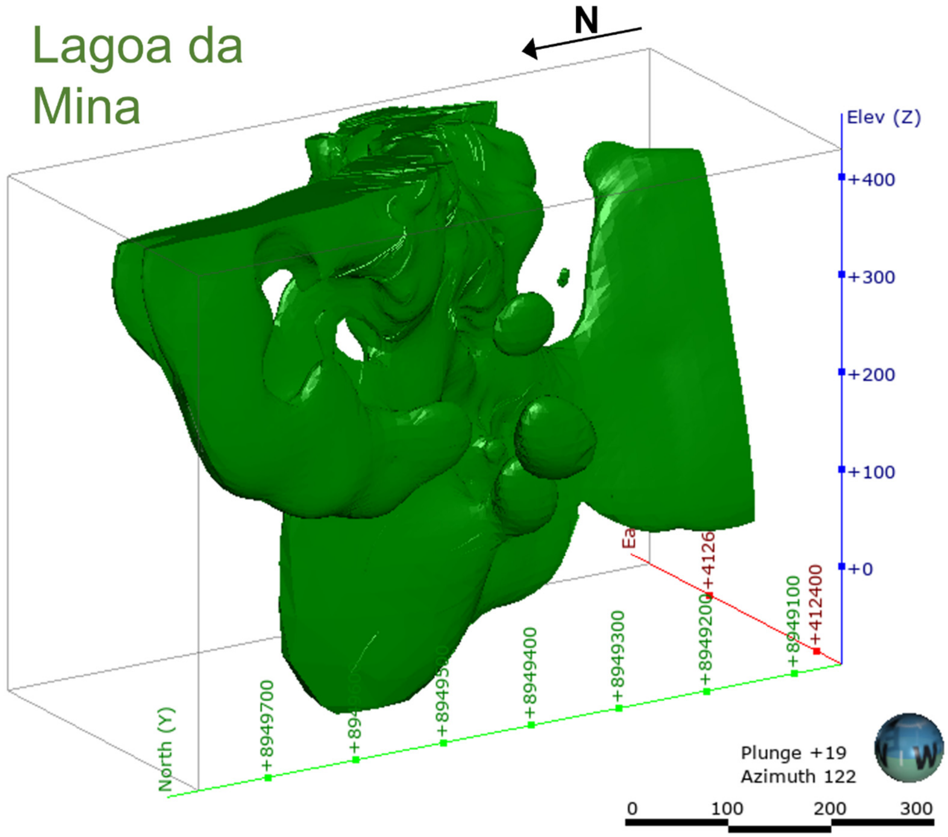


Figure 14-6: 3D grade shell model of Lagoa da Mina domain in the Surubim District (Ero Brasil, 2022)

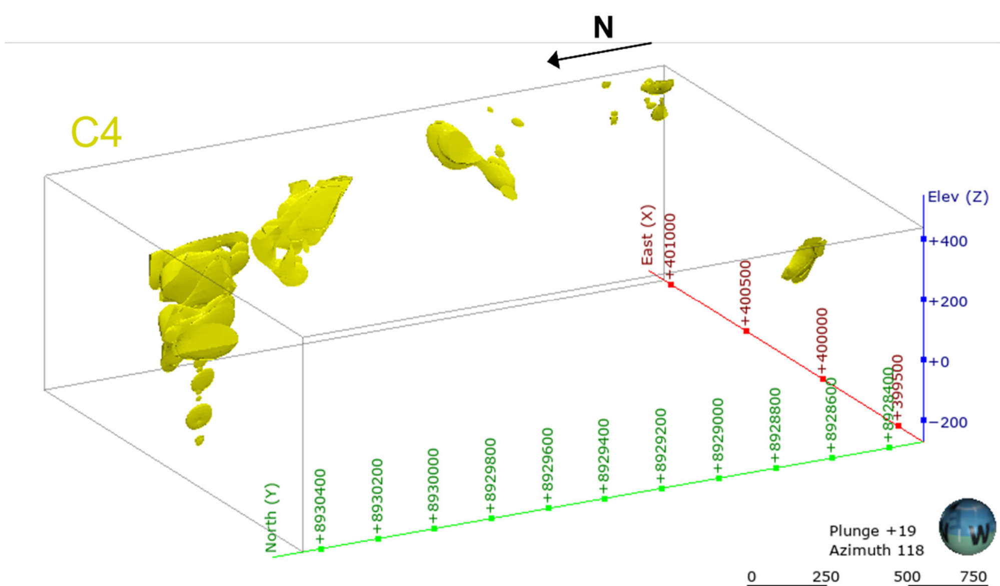


Figure 14-7: 3D grade shell model of the C4 Domain in the Surubim District (Ero Brasil, 2022)

14.4 2022 COMPOSITING

For the 2022 update, sample composites were constructed to standardize sample size and decrease population variance. The procedure was performed starting from the boundaries of modelled domains as previously described. Sample assays were composited to 1.0m in length corresponding to the most frequently sampled core interval of 1.0m. The table below shows a summary of basic statistics of sample size for each domain.

Table 14-2: Basic statistics of sample interval size, 2022 Updated Domains

District	Domain	N Samples	Q25%	Median	Q75%
Pilar District	Deepening	38,095	0.64	1.00	1.00
	MSB Sul / Barauna	28,293	0.80	1.00	1.00
	P1P2	114,474	0.77	1.00	1.00
	Honey Pot	114,066	0.78	1.00	1.00
	S3	1,769	0.68	1.00	1.00
	S10	2,820	0.62	1.00	1.00
Surubim District	Surubim	15,336	0.98	1.00	1.00
	Lagoa da Mina	9,845	0.37	1.00	1.00
	C4	5,572	0.68	1.00	1.00
Vermelhos District	N7 (Vermelhos UG Mine)	20,222	0.65	1.00	1.00
	N8 (Vermelhos West)	26,110	1.00	1.00	1.00
	N10 (Vermelhos North)	1,322	0.85	1.00	1.00

14.5 EXPLORATORY DATA ANALYSIS , 2022 UPDATE

The study included an Exploratory Data Analysis ("EDA") of all mineralized domains within each District. The figure below illustrates the EDA results for N8 Deposit. The table below includes the statistics of all targets and domains, expressed in total copper content ("CuT") in percent.

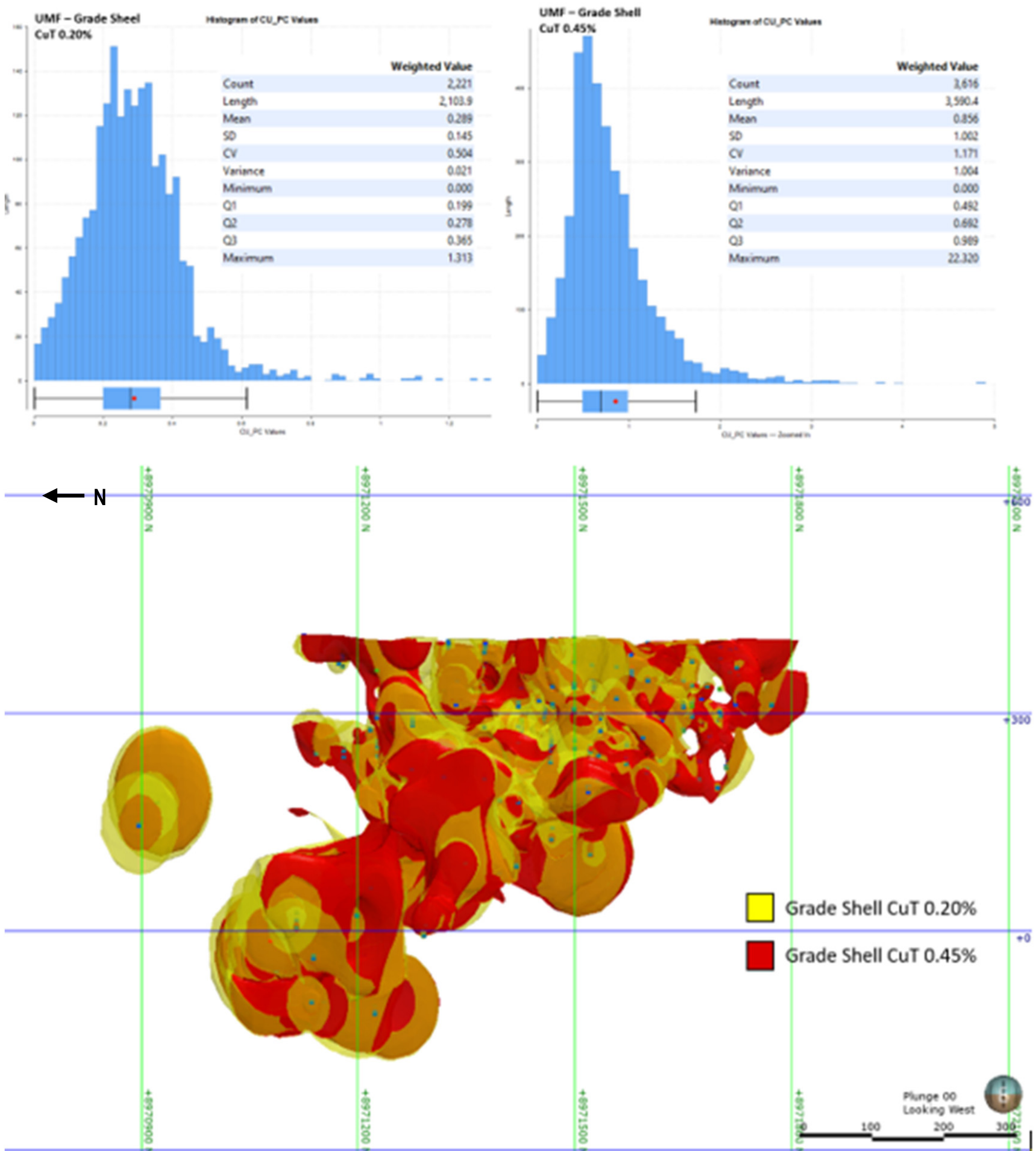


Figure 14-8: EDA – Cu grade composited samples for the N8 Deposit (Ero Brasil, 2022)

Table 14-3 Summary Statistics of Total Cu (CuT, %) by domain, 2020 Updated Domains

Domain	Sub-domain	N° Samples	Minimum	Maximum	Mean	Variance	CV
Pilar District							
Deepening	2004	22252	0.005	38.600	2.974	11.836	1.157
	2005	3594	0.001	19.810	2.194	4.527	0.970
	5005	8151	0.001	27.502	0.891	0.787	0.996
	6006	1235	0.005	30.600	0.992	2.182	1.489
MSB Sul / Barauna	3001	12429	0.005	19.920	1.306	1.357	0.892
	3002	11799	0.003	8.800	0.780	0.276	0.674
	6006	466	0.020	5.000	0.857	0.379	0.719
P1P2	1001	557	0.005	3.167	0.675	0.198	0.659
	1002	2844	0.001	9.781	1.205	0.997	0.829
	1004	364	0.005	2.249	0.697	0.152	0.559
	1005	3974	0.005	8.394	1.187	0.670	0.689
	1006	3019	0.005	12.187	1.662	1.659	0.775
	2005	17544	0.005	30.400	2.362	5.456	0.989
	6006	2829	0.000	30.600	0.997	1.390	1.183
Honey Pot	1001	156	0.005	2.250	0.628	0.174	0.664
	1002	1381	0.005	9.781	1.168	1.254	0.958
	1005	550	0.005	4.840	0.964	0.598	0.803
	1006	98	0.005	10.600	2.117	4.050	0.950
	2003	1019	0.005	19.300	1.352	2.311	1.124
	2004	8607	0.005	37.200	2.760	8.368	1.048
	2005	10566	0.005	30.400	2.619	6.660	0.985
	3001	662	0.033	7.800	1.341	1.006	0.748
	5005	1569	0.005	12.400	0.731	0.410	0.410
	6006	149	0.005	14.000	0.900	2.577	2.577
S3	102	18	0.400	1.300	0.500	0.000	0.301
	103	99	0.100	1.600	0.400	0.100	0.744
	104	353	0.000	0.300	0.100	0.000	1.066
S10	103	19	0.020	0.500	0.341	0.148	0.433
	104	52	0.005	0.320	0.124	0.098	0.732
	203	10	0.120	0.350	0.245	0.080	0.327
	204	13	0.020	0.250	0.160	0.067	0.418
	303	141	0.060	0.560	0.378	0.101	0.266
	304	13	0.005	0.240	0.114	0.096	0.838
	403	30	0.100	0.450	0.100	0.083	0.302
	404	6	0.005	0.150	0.754	0.053	0.526
	501	7	0.150	1.280	0.554	0.420	0.556
	502	197	0.150	0.900	0.336	0.172	0.311
	503	230	0.010	0.630	0.082	0.150	0.447
	504	161	0.005	0.270	0.314	0.073	0.882
Surubim District							
Surubim	101	1027	0.005	10.431	1.316	0.633	0.604
	102	665	0.005	3.352	0.640	0.185	0.671
	103	592	0.002	2.957	0.341	0.098	0.918
	104	2231	0.001	2.987	0.052	0.018	2.555
	201	2191	0.005	9.130	1.319	0.691	0.630
	202	1489	0.005	4.314	0.592	0.168	0.693
	203	1476	0.002	6.578	0.325	0.086	0.903
	204	8465	0.000	3.200	0.045	0.014	2.653
Lagoa da Mina	300	665	0.005	6.615	1.308	0.643	0.613
	400	786	0.001	2.560	0.559	0.104	0.576
	500	1524	0.000	3.654	0.281	0.041	0.721
C4	202	95	0.058	1.269	0.520	0.037	0.367
	203	392	0.022	0.900	0.265	0.023	0.576
	204	768	0.005	1.110	0.121	0.020	1.159
	302	66	0.148	0.610	0.491	0.005	0.145
	303	303	0.005	0.517	0.256	0.014	0.467
	304	801	0.005	0.440	0.081	0.006	0.924
	402	7	0.348	0.902	0.553	0.034	0.334
	403	124	0.023	0.866	0.300	0.033	0.606
	404	398	0.005	0.640	0.035	0.004	1.859
	503	94	0.048	0.590	0.252	0.009	0.376
	504	450	0.005	0.478	0.079	0.006	0.979
	602	34	0.131	2.137	0.782	0.241	0.627
	603	36	0.013	0.620	0.251	0.023	0.606
	604	185	0.005	0.535	0.143	0.004	1.480

Domain	Sub-domain	N° Samples	Minimum	Maximum	Mean	Variance	CV
Vermelhos District							
Vermelhos UG Mine (N7)	100	1136	0.005	8.659	0.667	0.329	0.860
	200	2036	0.001	31.919	1.412	4.122	1.438
	300	7148	0.004	31.814	2.867	17.240	1.448
	400	1923	0.005	29.250	4.388	31.434	1.278
	450	1603	0.001	26.139	1.332	3.331	1.370
	500	2882	0.005	15.590	0.965	1.184	1.128
	6006	345	0.005	15.541	1.306	1.733	1.702
Vermelhos West (N8)	110	973	0.000	2.350	0.290	0.057	0.822
	120	968	0.005	4.652	0.822	0.389	0.759
	210	225	0.005	1.635	0.301	0.072	0.892
	220	284	0.010	4.740	0.774	0.337	0.750
	410	3623	0.000	2.159	0.282	0.037	0.679
	420	6234	0.000	5.525	0.817	0.312	0.683
N10	102	57	0.120	2.178	0.645	0.122	0.349
	103	218	0.002	1.078	0.330	0.062	0.249
	104	950	0.000	2.720	0.067	0.029	0.169
	202	21	0.024	1.109	0.588	0.080	0.283
	203	18	0.018	1.035	0.303	0.059	0.244
	204	58	0.005	0.474	0.042	0.008	0.092

14.6 OUTLIER ANALYSIS, 2022 UPDATE

Block grade estimates may be unduly affected by high-grade assays, which are common within the deposits of the Curaçá Valley, and as a result - all assay data was evaluated to identify high-grade outliers within each domain.

Outlier values were defined by breaks in the distribution probability curves. In order to effectively limit the influence of outlier high-grade values on resource estimation, copper grades were capped at the corresponding value for grade estimation of any given block volume within the corresponding domain. Additionally, a high-grade search ellipse restriction was applied to those values in order improve swath plots resulting from the resource estimation. For the purposes of the 2022 mineral resource estimate, the outlier analysis was performed by the Ero Brasil's technical team for each domain and subsequently reviewed by GE21. The table below presents the results of outlier analysis for each of the updated domains, and the corresponding cap placed on Cu assay values in the estimation process.

Table 14-4 Summary of Outlier Analysis, 2022 Updated Domains

Domain	Sub-domain	Cap – CuT
Pilar District		
Deepening	2004	30.00%
	2005	10.60%
	5005	8.60%
MSB Sul / Barauna	3001	11.30%
	3002	4.19%
	6006	2.33%
P1P2	1001	1.60%
	1002	3.80%
	1003	6.60%
	1004	1.50%
	1005	4.40%
	1006	6.40%
	6006	2.80%
S3	102/103/104	NA
S10	103	0.50%
	104	0.32%
	203/404/501	NA
	204	0.25%
	303	0,56%
	304	0.24%
	403	0.45%
	502	0.90%
	503	0.63%
	504	0.27%

14.7 VARIOGRAPHY, 2022 UPDATE

The Ero Brasil technical team, in collaboration with Geovariance, supervised and reviewed by GE21, conducted a work program to prepare new variograms and models for each of the domains (and sub-domains) for the 2022 Update.

GE21 considers the variograms generated to be of moderate robustness. Similarities between the variographic models are commonly observed between the various deposits and domains throughout the Curaçá Valley. Variations between deposits and domains are mainly observed in the orientation in the anisotropic ellipsoid.

Domain	Sub-Domain	Major Orientation				Structure 1					Structure 2				
		Az	Plunge	Dip	Nugget	Model	Sill	Major	Semi-Major	Minor	Model	Sill	Major	Semi-Major	Minor
Deepening	2004	0	47	80	0.3	Exp	0.5	8	5	8	Sph	0.2	40	30	16

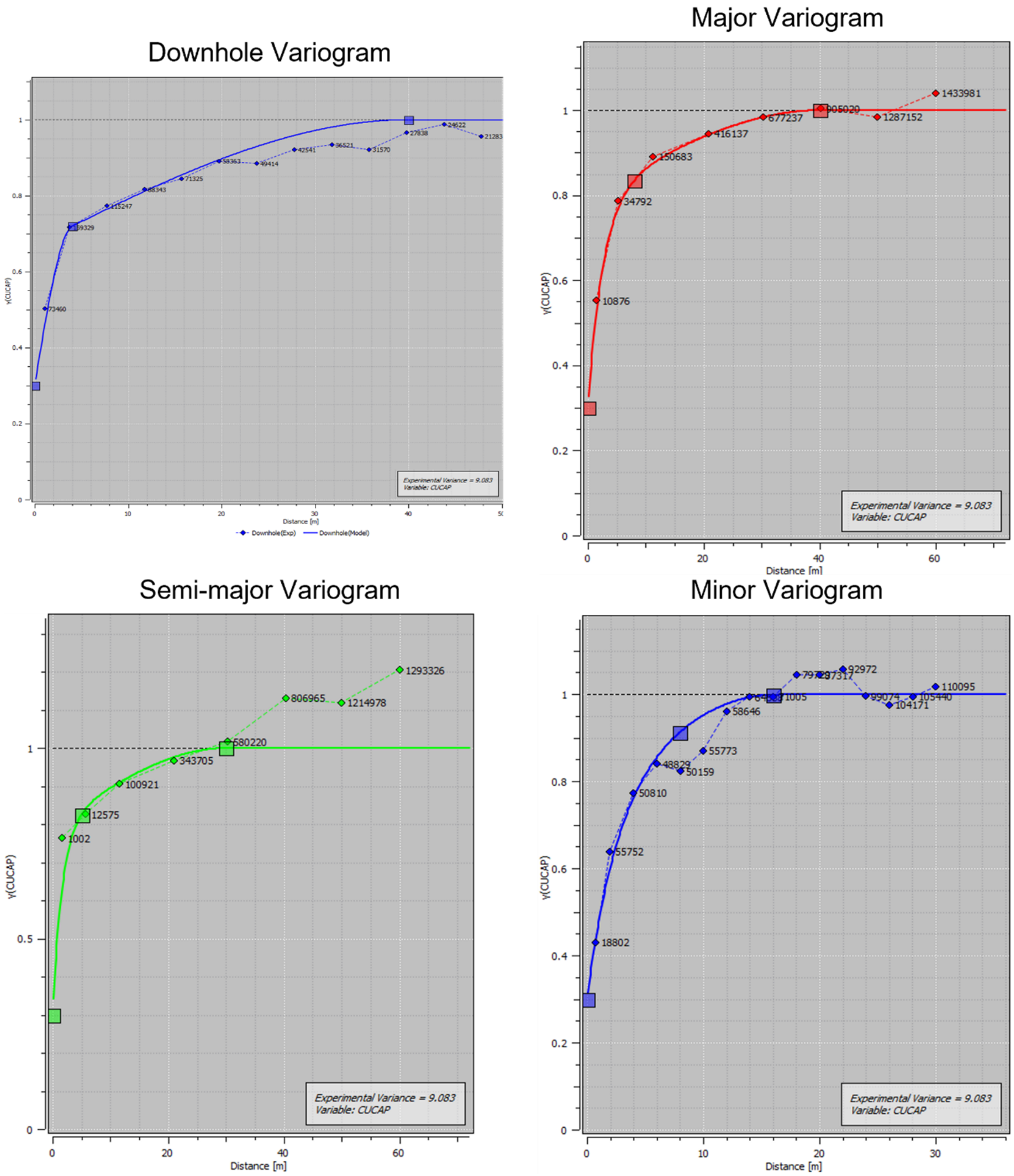


Figure 14-9: Example of Variographic analysis – Deepening Domain, Pilar UG Mine (Ero Brasil, 2022)

Table 14-5: Summary of Variographic Analysis – Structures and Anisotropy, 2022 Update

Domain	Sub-Domain	C0	C1	C2	A1 Major	A1 Semi Major	A1 Minor	A2 Major	A2 Semi Major	A2 Minor
Deepening	2004	0.3	0.5	0.2	8	8	5	40	30	16
	2005	0.25	0.43	0.32	15	12	4	50	50	30
	5005	0.3	0.4	0.3	3	3	3	40	40	11
MSB Sul / Baraúna	3001	0.3	0.5	0.2	8	8	5	40	30	16
	3002	0.2	0.66	0.14	18.62	8.47	2	55	28	10
P1P2	1001/ 1002/ 2005/6006	0.25	0.43	0.32	15	12	4	50	50	30
	1004/ 1005/ 1006	0.2	0.65	0.15	9	9	5	40	40	15
Honey Pot	1001/1002/2005	0.25	0.43	0.32	15	12	4	50	50	30
	1005/1006	0.2	0.65	0.15	9	9	5	40	40	15
	2003/5005	0.4	0.36	0.25	19	8	2	55	28	10
	2004/3001/6006	0.3	0.5	0.2	8	8	5	40	30	16
S3	NA									
S10	101/102/103/104 /203/204/303/304/ 403/404/503/504	0.2	0.4	0.4	140	6	1	200	125	14
Surubim	101/102/103/104	0.25	0.25	0.5	35	45	2	77	65	11
	201/202/203/204	0.25	0.3	0.45	25	20	11	85	45	16
Lagoa da Mina	300/400/500/600	0.2	0.4	0.4	90	30	30	130	55	40
C4	NA									
N7 (Vermelhos UG Mine)	100/ 6006	0.3	0.4	0.3	15	15	3	45	45	10
	200	0.3	0.25	0.45	22	5	3	70	20	12
	300	0.2	0.42	0.38	12	10	5	110	55	40
	400	0.2	0.52	0.28	20	12	10	60	60	30
	450	0.2	0.40	0.2	8	6	2	40	25	10
	500	0.25	0.55	0.3	20	7	5	50	40	17

Table 14-6: Summary of Variographic Analysis – Ellipsoid Orientation, 2022 Update

District	Domain	Sub-Domain	Azimuth	Dip	Pitch
Pilar District	Deepening	2004/ 2005 5005	N0 N0	80 90	47 47
	MSB Sul/ Barauna	3001 3002	N0 N0	80 90	47 47
	P1P2	1001/ 1002/ 2005/ 6006	N0	80	47
		1004/ 1005/ 1006	-50	37	15
	Honey Pot	1001/1002/2004/2005/3001/6006 1005/1006 2003/5005	N0 -50 0	80 37 -90	47 15 47
	S3	102/ 103/ 104	350	70	0
	S10	101/102/103/104/203/204/303/304/403/404/503/504	355	90	0
Surubim District	Surubim	100/ 102/103/104 201/202/103/104	23 0	75 45	0 0
	Lagoa da Mina	300/400/500/600	285	0	70
	C4	104	0	80	0
		202/ 203/ 204	176	80	0
		302/ 303 / 304	190	80	0
		402/ 403/ 404	185	80	0
		503/ 504	182	70	0
		602/ 603/ 604	185	90	0
Vermelhos District	N7 (Vermelhos UG Mine)	100/200/500/6006	-90	0	-110
		300	344	25	20
		400	97	7	36
		450	0	115	0
	N8 (Vermelhos West)	410/420	270	60	10
	N10 (Vermelhos North)	102/103/104/202/203/204	18	75	29

14.8 BLOCK MODEL, 2022 UPDATE

Separate block models were constructed for each domain, as detailed in Table 14-7. The block model attributes are presented in Table 14-8. Any overlaps in the block models between domains were adjusted by assigning null value to overlapping blocks.

Table 14-7: Block Model Dimensions Summary

Domain	Coordinate	Origin	Maximum
Pilar District			
Deepening	X	800	1500
	Y	1250	3650
	Z	-1700	500
MSB Sul / Baraúna	X	800	1500
	Y	1250	3650
	Z	--1700	500
P1P2*	X	700	1400
	Y	2600	3550
	Z	-250	500
Honey Pot	X	800	1500
	Y	1250	3650
	Z	-1700	500
S3	X	398000	400500
	Y	8902600	8907475
	Z	0	625
S10	X	402300	404800
	Y	8906500	8920250
	Z	0	2500

Domain	Coordinate	Origin	Maximum
Surubim District			
Surubim	X	404900	405450
	Y	8941300	8942300
	Z	-250	450
Lagoa da Mina	X	412350	412800
	Y	8949000	8949800
	Z	-50	450
C4	X	399200	401200
	Y	8928100	8931900
	Z	-800	500
Vermelhos District			
N7 (Vermelhos UG Mine)	X	396050	397050
	Y	8970000	8971350
	Z	-460	450
N8 (Vermelhos West)	X	396760	397300
	Y	8971140	8971940
	Z	500	1200
N10 (Vermelhos North)	X	397100	397900
	Y	8972700	8974325
	Z	-50	575

Block dimensions: 5 m x 5 m x 5 m (sub-blocks: 1.25 m x 1.25 m x 1.25 m); unrotated blocks.
UTM Coordinates, except UG Mine (Deepening, MSB Sul/Baraúna, P1P2) presented in local coordinates.

Table 14-8: Block Model Attributes Summary

Variable Name	Type	Description
CuT	Numeric	Estimated copper grade, recorded in total copper content (%Cu)
Density	Numeric	Estimated density
Resource	Numeric	Classified resources (1 = Measured, 2 = Indicated, 3 = Inferred)
Rock type	Numeric	Domains

GE21 and Ero Brasil, under the supervision of GE21, conducted a validation of all of the block models, comparing the geological wireframes and the block grade models, with a visual check and volumetric assessment. The validation indicated a satisfactory volumetric ratio, defined as the wireframe volume/block model volume. The results were within an acceptable limit of variation below 3.0%.

14.9 ESTIMATION PARAMETERS, UNCHANGED 2021 DOMAINS

For 9 domains within the Curaçá Valley, no new drilling or new mining activity occurred subsequent to the determination of the mineral resources as outlined in the 2021 Technical Report, which were prepared previously by GE21. These domains include: the East Limb, West Limb, R75 and Suçuarana of the Pilar District; C12, Cercado Velho and Terra do Sal of the Surubim District; and the N9 and N5 deposits of the Vermelhos District. A brief description of the variogram and block model parameters are set forth below.

As part of the validation process for the 2022 update, GE21 reviewed the database and mineral resource estimates prepared previously by GE21 for these domains for validation purposes and inclusion in the current mineral resource estimate. Additional information, including swath plots for these domains and additional EDA, can be found in the 2021 Technical Report.

Table 14-9: Summary of Variographic Analysis, Unchanged 2021 Domains

Domain	Sub-Domain	c0	c1	a1	c2	a2	Bearing	Plunge	Dip	MM	MSM
Pilar District											
East Limb	*insufficient samples to fit variograms*						196	-70	-10	1	2
West Limb	590	0.3	0.4	26	0.3	48	270	-80	-10	1	2.5
Suçuarana	560/ 570/ 580	0.2	0.42	0.38		26	32	11	49	44	22
R75	550	0.2	0.44	26	0.36	46	253	-58	19	1.1	2.3
Surubim District											
C12	1001/1002/1003	0.35	0.32	16	0.33	60	348	-40	72	1.1	3.8
Terra do Sal	100/ 110/ 120/ 130	0.2	0.2	0.6		25	25	5	40	75	15
	20 0/ 210/ 220/ 230	0.2	0.4	0.4		15	25	46.7	50	70	93.3
Cercado Velho	Main	0.12	0.47	15	0.42	100	100	-75	0	1.29	13
	Potential	0.12	0.35	44	0.53	110	280	-75	0	1.29	13
Vermelhos District											
N9 (Vermelhos East)	100/200	0.2	0.35	80	0.45	90	0	-30	85	2	8.2
N5 (Siriema)	100	0.01	0.0185	0.0155		25	18	14	100	20	15
	200	0.025	0.042	0.047		50	15	5	90	100	12
	200+300	0.025	0.035	0.034		40	10	4	100	60	10

Table 14-10: Block Model Summary, Unchanged 2021 Domains

Domain	Coordinate	Origin	Maximum
Pilar District			
East Limb	X	1100	1300
	Y	2400	2880
	Z	-150	200
West Limb	X	950	1100
	Y	2425	2700
	Z	-70	290
R75	X	404657	405017
	Y	8910534	8911030
	Z	120	510
Suçuarana	X	401247.5	401501.88
	Y	8894057.5	8896142.5
	Z	120	474.38

Domain	Coordinate	Origin	Maximum
Surubim District			
C12	X	403900	404400
	Y	8940800	8941300
	Z	-150	450
Cercado Velho	X	411783	413213
	Y	8947592.869	8949268
	Z	60	455
Terra do Sal	X	409982.5	410462.5
	Y	8934832.5	8935187.5
	Z	2.5	441.88
Vermelhos District			
N9 (Vermelhos East)	X	397000	397900
	Y	8970800	8971850
	Z	0	450
N5 (Siriema)	X	396182.5	396522.5
	Y	8969102.5	8970197.5
	Z	-297.5	447.5

Block dimensions: 5 m x 5 m x 5 m (sub-blocks: 1.25 m x 1.25 m x 1.25 m); unrotated blocks.

Table 14-11: Summary of grade estimate steps – distance (meters) and anisotropy, Unchanged 2021 Domains

Domain	Sub-Domain	Estimation Steps (meters)					Anisotropy	
		Step 1	Step 2	Step 3	Step 4	Step 5	Major/ Minor	Major/ Semi-major
Pilar District								
East Limb*		10	20	160	>160	-	1	2
West Limb	590	16	32	48	72	>72	1	2.5
R75	550	15	31	46	70	>70	1.1	2.3
Suçuarana	560/ 570/ 580	16	33	49	74	>74	1.1	2.2
Surubim District								
C12	1001/1002/1003	20	40	60	90	>90	1.1	3.8
Cercado Velho	Main	30	65	100	150	>150	1.29	13
	Potential	30	65	100	150	>150	1.29	13
Terra do Sal	100/ 110/ 120/ 130	23	47	70	106	>106	1.9	5.0
	200/ 210/ 220/ 230	25	50	75	113	>113	1.4	0.8
Vermelhos District								
N9 (Vermelhos East)	100/200	30	60	75	135	>135	2	8.2
N5 (Siriema)	100	33	67	100	150	>150	5.0	6.7
	200	33	67	100	150	>150	1.1	8.3
	200+300	33	67	100	150	>150	1.7	10.0

(*) Targets where grade estimate methodology was IDW

GE21 and Ero Brasil, under the supervision of GE21, conducted a validation of all of the block models from the unchanged 2021 domains, comparing the geological wireframes and the block grade models, with a visual check and volumetric assessment. The validation indicated a satisfactory volumetric ratio, defined as the wireframe volume/block model volume. The results were within an acceptable limit of variation of less than 3.0%

14.10 MINERAL RESOURCE ESTIMATION METHODOLOGY, 2022 UPDATE

The ordinary kriging method was used for copper grade estimation in mineralized bodies of the Curaçá Valley.

The mineral resources estimation observed orientation, type and continuity of the mineralization and the drill grid spacing, within each domain and mineralized sub-domain. Estimation of CuT (%) was conducted for the each of the block models, taking into consideration the results of the variographic analysis. A high-grade restriction method was applied to the composite copper grades to restrict the influence of the population outliers used in the ordinary kriging method. Outlier copper grades were determined for each domain and a limited search radius was applied for composite samples where the copper grade exceeded the outlier grade for each domain. Grades within these composites were capped to the outlier copper grade value on the first step. Applying a reduced search radius to outlier copper grades produced better results in local estimates as observed on the swath plots.

Kriging involved five steps, based on the maximum variographic range distance and the variographic anisotropic distances for each domain. The first step, (applied grade restriction), used approximately 1/3 of maximum variographic range; the second step: approximately 2/3 of maximum variographic range and third step equaled the maximum variographic range. The fourth step used 150% of the maximum variographic range. The last step included any blocks that were not considered in steps one, two or three. Neighborhood search strategy for grade estimation applied restrictions on the minimum number of samples (4), maximum number of samples (12) and maximum number of samples by any single drill hole as (2).

An outlier capped value was not applied in domains where individual assay-values significantly above the mean are not frequent. In those domains, ordinary kriging estimation steps were applied without any outlier treatment honoring the variographic output for those domains.

The table below summarizes steps of grade estimation. The first step has no anisotropy applied. Orientation of anisotropy ellipsoids for steps 2 to 4 is based on results of variographic analysis.

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Table 14-12: Summary of grade estimate steps – distance and anisotropy, 2022 Update

Domain	Sub-Domain	Estimation Steps (meters)					Anisotropy	
		Step 1	Step 2	Step 3	Step 4	Step 5	Major/ Semi-Major	Major/ Minor
Pilar District								
Deepening	2004	13	27	40	60	>60	1.3	2.6
	2005	17	33	50	75	>75	1.0	1.7
	5005	13	27	40	60	>60	1.0	3.3
MSB Sul / Barauna	3001	13	27	40	60	>60	1.3	2.6
	3002	18	37	55	83	>83	2.0	6.0
	6006	13	27	40	60	>60	1.3	2.6
P1P2	1001/ 1002/ 2005	16.5	33	50	75	>75	1.0	1.7
	1004/ 1005/ 1006	20	26	40	60	>60	1.0	2.7
	6006	16.5	33	50	75	>60	1.0	1.7
Honey Pot	1001/1002	17	33	50	75	>75	1.0	1.7
	1005/1006	13	27	40	60	>60	1.0	2.6
	2003/5005	9	19	28	42	>42	0.5	3.0
	2004/3001	10	20	30	45	>45	0.8	2.0
	6006	10	20	30	45	>45	0.8	0.8
S3	102/ 103/ 104	100	100	200	500	1000	1.0	2.5
S10	101/102/103/ 104/ 203/ 204/ 303/ 304/ 403/ 404/ 503/ 504	66.7	133.3	200	300	>300	1.6	14.3
Surubim District								
Surubim	101/ 102/ 103/ 104	28	57	85	128	>128	1.9	5.6
	201/ 202/ 203/ 204	26	51	77	116	>116	1.2	6.5
Lagoa da Mina	300/ 400/ 500	43	87	130	195	>195	2.4	3.3
C4	104 202/ 203/ 204 302/ 303/ 304 402/ 403/ 404 503/ 504 602/ 603/ 604	-	100	200	500	1000	1.0	2.5
Vermelhos District								
N7 (Vermelhos UG Mine)	100	15	45	68	101	>101	1.0	5.0
	200	5	70	105	158	>158	3.5	5.8
	500	20	40	60	90	>90	2.9	4.0
	300	12	55	110	40	>40	1.2	2.4
	400	20	60	90	135	>135	2.0	1.7
	450	6	25	38	56	>56	0.8	3.0
N8 (Vermelhos West)	110/ 120/ 210/ 220/ 410/ 420	30	80	120	>120	-	1.0	4.0
N10 (Vermelhos North)	102/ 103/ 104/ 202/ 203/ 204	43	87	130	195	>195	1.1	5.4

14.10.1 Local Bias Validation via Swath Plot Method, 2022 Update

Local validation via the Swath Plot method was performed to analyze the occurrence of any localized biases. The method sought to compare the average in estimated grades for the mineral resources model obtained using the ordinary kriging methodology, with the grades that were estimated using the Nearest Neighbor ("NN") method for the same x, y or z coordinates. Grade scatter plots were developed for copper grades versus coordinates, and no significant localized biases were observed when comparing the ordinary kriging to NN methods for the Measured and Indicated mineral resource estimate. See Appendix B of this Report for Swath Plot and NN analysis results for the updated 2022 mineral resource models.

Figure 14-10 to Figure 14-12 provide example swath plots for the Deepening Domain, whereby:

- "N_SAMPS" = number of samples;
- "N_CELLS/50" = number of blocks;
- "S_CUT" = Cu sample;
- "M_CUT" = Cu estimated by Ordinary Kriging; and,
- "M_CUNN" = Cu estimated by Nearest Neighbor.

The local bias in the x-axis estimate was not material.

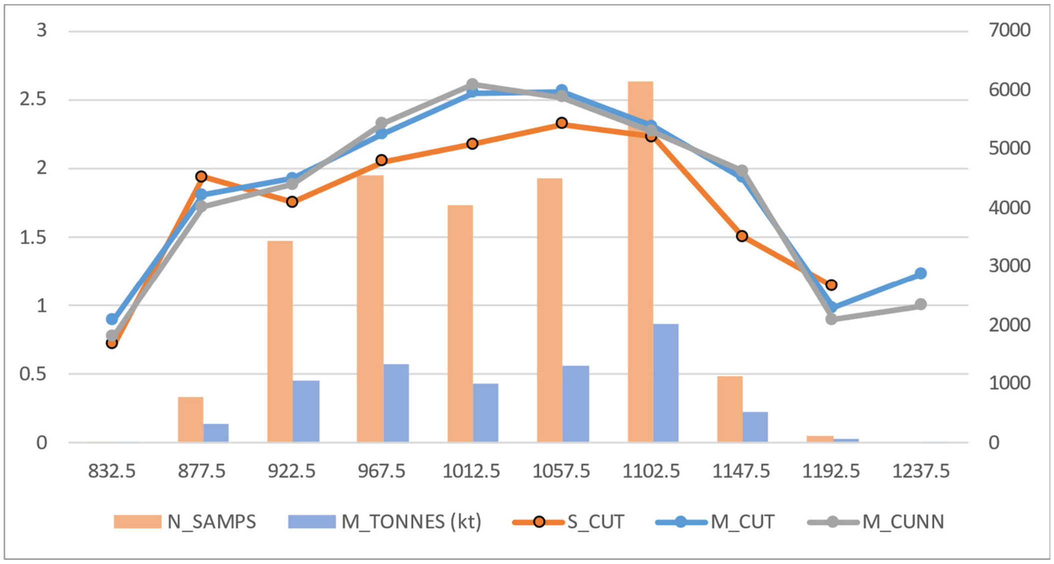


Figure 14-10: Swath Plot X CuT (%) – Deepening Domain (Ero Brasil, 2022)

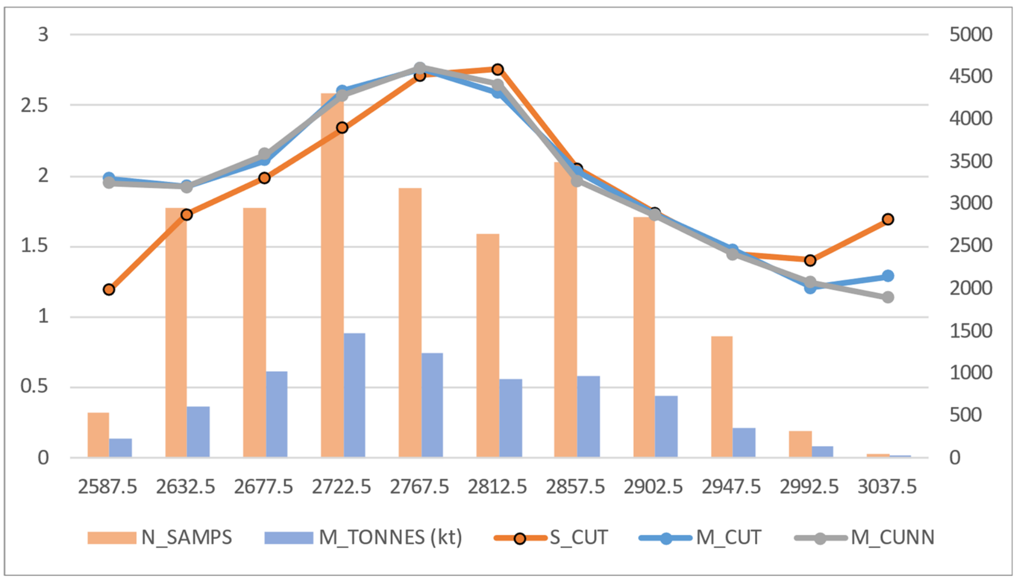


Figure 14-11: Swath Plot Y CuT (%) – Deepening Domain (Ero Brasil, 2022)

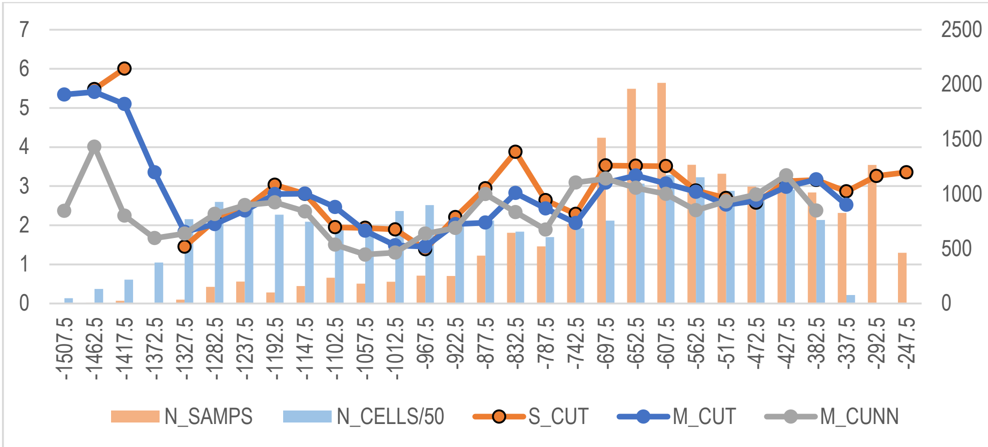


Figure 14-12: Swath Plot Z CuT (%) – Deepening Domain (Ero Brasil, 2022)

14.11 MINERAL RESOURCE CLASSIFICATION, 2022 UPDATE

Implementing the use of grade shells is an acceptable approach for defining mineralization that can be mined underground. In the case of the Caraíba Operations, a grade shell-based-approach incorporating a neighborhood spatial analysis was used to verify the economic extraction of material via underground methods. In both cases, application of cut-off grades for underground and open pit mineral resources considered estimated costs of extraction to ensure reasonable prospects for economic extraction.

A 0.51% Cu cut-off was applied for the Caraíba Operations mineral resources amenable to underground mining methods and a 0.21% Cu cut-off was applied for mineral resources amenable to open pit mining. These cut-off grades were considered jointly with currently available mineral rights and a mathematical optimization to demonstrate a Reasonable Prospects for Eventual Economic Extraction ("RPEEE") threshold for the current mineral resources estimate. 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 on sections spaced, on average, at approximately 25 m x 25 m to 12.5 m x 12.5 m spacing. GE21 considers that deposits with regular sampling grids and sufficient samples in mineralized zones to perform variographic analysis, as well as RPEEE thresholds, satisfied the definition of Indicated and Measured mineral resources as defined by CIM.

Considering the overall quality and quantity of data that was utilized in the mineral resource estimate, the estimate resource was classified as Measured, Indicated and Inferred according to the number of passes in the ordinary kriging method, as shown below, and using local geometric restrictions to guarantee the spatial continuity of classification.

Classification based on steps of estimate:

- Measured resources – Blocks estimated on Estimate Pass 1 and 2;
- Indicated resources – Blocks estimated on Estimate Pass 3 or 4; and
- Inferred resources – Blocks estimated on Estimate Pass 5

14.12 MINERAL RESOURCE ESTIMATE, 2022 UPDATE

To determine material within the defined mineralized shapes offering RPEEE, GE21 applied the Lerchs-Grossman method to evaluate deposits amenable to open pit mining and implemented a copper grade cut-off approach for deposits subject to underground mining. In both the open pit and underground cases, the costs for the extraction of copper from the mineralized volumes was considered as the foundation for the RPEEE analysis.

Mineral resources have been constrained within developed 3D grade-shells and lithology models applying a 0.45% and 0.20% copper grade envelope for high and marginal grade, respectively. Within these envelopes, mineral resources for underground ("UG") deposits were constrained to those volumes ensuring RPEEE after application of a 0.51% copper cut-off grade, as well as a 0.34% copper marginal cut-off grade. For open pit ("OP") deposits a cut-off grade of 0.16% copper was applied.

The low-grade envelope using a cut-off grade of 0.20% copper for UG deposits was used to develop a dilution envelope and development block model to better define the grade of blocks within the dilution envelope in the planning and design of underground stopes and planned development within the mineral reserve estimates and LOM production planning efforts.

The main parameters used to define the underground stopes and open pit shells for purposes of mineral resource estimation are detailed in tables presented below. The results from the cut-off grade methodology detailed below for both open pit and underground domains, were used solely for the purpose of testing RPEEE and do not represent an attempt to estimate mineral reserves. The results are used as a guide to assist in the preparation of a mineral resource estimate. Only the blocks within the conceptual pit envelope or selected RPEEE stopes for underground domains were considered as current mineral resource.

Table 14-13: Open Pit Mining Optimization Pit Parameters

COSTS	Unit.	US$
Total Mining Costs	USD/t handled	2.09
Processing Costs	USD/t process	5.65
G&A Costs	USD/t process	2.66

FINANCIAL INPUTS	Unit.	US$
Copper Price	USD/t.	7 496
Exchange Rate	BRL/USD	5.29
Net Smelter Return	%	94.53%

PHYSICAL INPUTS	Unit.	US$
Blocks Dimensios	X, Y, Z (m)	5 x 5 x 5
Resources	Class	Mea + Ind + Inf
Mining Recovery	%	100%
Mining Dilution	%	0%
Metallurgical Recovery	%	91%
Slope Angle	degrees	60

Table 14-14: Underground Mining Optimization Stope Parameters

Pass	1		2		3		4	
Inputs	**Value**	**Unit**	**Value**	**Unit**	**Value**	**Unit**	**Value**	**Unit**
Stope Dimension	20x10x35	m	20x10x25	m	20x5x15	m	5x5x5	M
Copper Price	7 496	US$/t	7 496	US$/t	7 496	US$/t	7 496	US$/t
Mining Cost	17.82	US$/t	17.82	US$/t	12.47	US$/t	12.47	US$/t
Processing Cost	9.31	US$/t	9.31	US$/t	9.31	US$/t	9.31	US$/t
G&A	5.45	US$/t	5.45	US$/t	-	US$/t	-	US$/t
Selling Cost	-	US$/t	-	US$/t	-	US$/t	-	US$/t
Mining Recovery	100	%	100	%	100	%	100	%
Dilution	-	%	-	%	-	%	-	%
Cut-off Grade	0.51	%	0.51	%	0.34		0.34	
Marginal Cut-off Grade						%		%
PCAF	1		1		1		1	
MCAF	1		1		1		1	
Metallurgical Recovery	91.00	%	91.00	%	91.00	%	91.00	%
Solution Quality	70.00	%	70.00	%	70.00	%	70.00	%
NSR	94.53	%	94.53	%	94.53	%	94.53	%

Following application of RPEEE criteria, Table 14-15 presents the 2022 updated mineral resources by expected mining method and, due to its importance to the Company's strategy, Table 14-16 further details the mineral resources for the Project Honeypot areas and Pilar UG Mine as at the Effective Date.

Table 14-15: Caraíba Operations Mineral Resource by Mine Type

Mining Method	Classification	Tonnage (000 tonnes)	Grade (Cu %)	Cu Contained (000 tonnes)
Underground Operations	Measured	34,224	1.44	493.2
	Indicated	35,389	1.48	524.8
	Measured & Indicated	**69,613**	**1.46**	**1,018.0**
	Inferred	35,888	1.15	411.4
Open Pit Operations	Measured	20,803	0.62	128.7
	Indicated	27,486	0.56	154.1
	Measured & Indicated	**48,289**	**0.59**	**282.8**
	Inferred	11,513	0.62	71.4
Total Underground and Open Pit	Measured	55,027	1.13	621.9
	Indicated	62,875	1.08	678.9
	Measured & Indicated	**117,901**	**1.10**	**1,300.8**
	Inferred	47,400	1.02	482.8

Mineral Resource Notes:

1. Mineral resource effective date of September 30, 2022.
2. Presented mineral resources inclusive of mineral reserves. All figures have been rounded to the relative accuracy of the estimates. Summed amounts may not add due to rounding.
3. Underground mineral resources have been constrained within newly developed 3D lithology models applying a 0.45% and 0.20% copper grade envelope for high and marginal grade, respectively. Within these envelopes, mineral resources for underground deposits were constrained using varying stope dimensions of up to 20m by 10m by 35m applying a 0.51% copper cut-off grade, as well as a 0.34% copper marginal cut-off grade. Mineral resources have been estimated using ordinary kriging inside 5m by 5m by 5m block sizes.
4. Open pit mineral resource estimates have been constrained within newly developed 3D lithology models using a 0.16% copper cut-off grade for open pit deposits. Mineral resources have been estimated using ordinary kriging inside 5m by 5m by 5m block sizes.

5. The Qualified Person for the Mineral Resource estimate is Sr. Porfírio Cabaleiro Rodriguez.
6. Mineral resource estimates were prepared in accordance with the CIM Standards, and the CIM Guidelines, using geostatistical and/or classical methods, plus economic and mining parameters appropriate to the deposit.

Mineral resources which are not mineral reserves do not have demonstrated economic viability.

Table 14-16: Pilar UG Mineral Resources

Pilar UG Mine	Classification	Tonnage (000 tonnes)	Grade (Cu %)	Cu Contained (000 tonnes)
Project Honeypot Areas	Measured	3,229	1.86	60.0
	Indicated	6,459	1.88	121.3
	Measured & Indicated	**9,687**	**1.87**	**181.3**
	Inferred	896	1.07	9.6
Total Pilar Mine, including Project Honeypot	Measured	29,806	1.38	412.4
	Indicated	23,947	1.73	413.3
	Measured & Indicated	**53,753**	**1.54**	**825.8**
	Inferred	16,993	1.42	241.3

Pilar UG Mine Mineral Resource Notes:

1. Mineral resource effective date of September 30, 2022.
2. Presented mineral resources inclusive of mineral reserves. All figures have been rounded to the relative accuracy of the estimates. Summed amounts may not add due to rounding.
3. Underground mineral resources have been constrained within newly developed 3D lithology models applying a 0.45% and 0.20% copper grade envelope for high and marginal grade, respectively. Within these envelopes, mineral resources for underground deposits were constrained using varying stope dimensions of up to 20m by 10m by 35m applying a 0.51% copper cut-off grade, as well as a 0.34% copper marginal cut-off grade. Mineral resources have been estimated using ordinary kriging inside 5m by 5m by 5m block sizes.
4. The Qualified Person for the Mineral Resource estimate is Sr. Porfírio Cabaleiro Rodriguez.
5. Mineral resource estimates were prepared in accordance with the CIM Standards, and the CIM Guidelines, using geostatistical and/or classical methods, plus economic and mining parameters appropriate to the deposit.

Mineral resources which are not mineral reserves do not have demonstrated economic viability.

14.13 QUALIFIED PERSONS OPINION

The QP responsible for the current mineral resource estimate is Sr. Porfírio Cabaleiro Rodriguez, a mining engineer with over 40 years of experience in the mining sector and extensive experience in mineral resource and mineral reserve estimation. Sr. Rodriguez is a Fellow of the Australian Institute of Geoscientists (“FAIG”), and was responsible as lead QP, for the direct supervision of the work performed by the GE21 technical team involved in the resource estimation process.

GE21 supervised and validated the current mineral resource estimate prepared by Ero Brasil through comparative estimates and validation tools as previously described. Comparative estimates were prepared from the Ero Brasil drilling database which was validated by GE21. In addition, an independent model was prepared using Leapfrog Geo software using implicit modelling and a similar strategy of that applied by Ero Brasil personnel to define geological domains as a cross-check. The variograms prepared by Ero Brasil were reproduced and applied in an independent grade estimate using Leapfrog Edge software. Resource classification based on “pass of estimate” was used to compare the tonnage, grade and contained metal content for each domain. GE21 assumed differences between the current mineral resource estimate and the cross-check performed by GE21 less than 5% of contained metal within each domain as acceptable. This cross-check validation performed by GE21 resulted in no material differences.

The authors of this Report agree with the mineral resource estimate and did not identify any overall or local grade biases, as demonstrated by Swath Plot validation performed. The authors found that the quality of the data is appropriate for the classification of the current mineral resource, in accordance with CIM Standards and CIM Guidelines. A confidence level analysis for the quality of the exploration data is summarized in the table below.

Table 14-17: Analysis of Criterion Used for the Mineral Resource Classification

Items	Qualified Persons Opinion	Confidence Level
Drilling techniques	Majority of drill holes used diamond drill-core, considered a high-quality reference.	High
Core logging	Core logging procedures are of good quality in general. Recent electronic logging (using iPads) has increased quality of the recent drill programs since Ero Copper became involved.	Moderate to high
Core recovery	Core recovery is closely monitored by the Ero Brasil geology team and are in general very good due to the competent nature of the rock.	High
Sample preparation	Sample preparation procedures were verified. The procedures were discussed and are well documented by Ero Brasil.	Moderate to high
Analysis of data quality	Ero Brasil has a well-coordinated QA/QC program; GE21 recommends the implementation of additional blank standards and a more complete elemental analysis, mainly for nickel, platinum group elements and gold.	High
Drilling survey	Ero Brasil procedures conform with industry best practices.	High
Core sampling density	The sampling plan is based on geological logging, resulting in localized gaps in sampling, which can cause localized difficulties in defining continuity of mineralization.	Moderate
Data Bank Integrity	Database management is validated by certified software; however, not all historic information has been registered. The recovery of the historic information is in progress.	Moderate
Density	Density estimation procedures follow industry practices; however, the density measurement is not routinely performed across all mineral deposits and domains. GE21 recommends adoption of a QA/QC program for density measurements.	High to moderate
Modelling and grade estimates	The mineralization (grade shell) model shows adequate adherence in higher drilling density areas. The block model is sub-blocked accordingly and grade was estimated within the blocks. Outlier treatment was adequate. Grade estimate by ordinary kriging is the best suited for these deposits, which have enough samples for variography and kriging; and while some variograms did not present high confidence for current sample density, the estimation strategy used is adequate as demonstrated in the validation check methods employed.	High

15 MINERAL RESERVE ESTIMATES

This chapter presents the mineral reserve estimate for Ero Brasil's mineral assets of the Caraíba Operations comprising the underground mines (UG) and open pit mines (OP) within the Pilar, Vermelhos and Surubim Districts of the Curaçá Valley, State of Bahia, Brazil.

The mineral reserve estimate is that portion of the mineral resource estimate that has been identified as having demonstrated economic viability within open pit and/or underground mine designs after incorporating modifying factors such as mining recovery, waste dilution and economic considerations. The mineral reserve estimate forms the basis for the production plan.

The mineral reserves for the Pilar District (which includes Pilar UG Mine and Suçuarana OP), Vermelhos District (which includes Vermelhos UG Mine, N8/N9 OP Mine and the N5 (Siriema) OP Mine) and Surubim District (which includes the Surubim Mine and C12 OP Mine) are derived from the Measured and Indicated mineral resources as defined within the resource block models following the application of economic and other modifying factors further described below. Inferred mineral resources, where unavoidably mined within a defined mining shape have been assigned zero grade. Dilution occurring from Measured and Indicated resource blocks within the mineral reserve plan was assigned grade based upon the estimated mineral resource grade of the blocks included in the dilution envelope.

Total combined Underground Proven and Probable Mineral Reserves are estimated to be 39,461 kt at 1.42% Cu as at the Effective Date compared to the 2021 mineral reserve of 29,974 kt grading 1.44% copper, with additions from underground drilling success being offset by the year's mine depletion. Total combined Open Pit Proven and Probable Mineral reserves are estimated to be 43,306 kt grading 0.54% Cu compared to the 2021 estimate of 29,306 kt grading 0.60% copper. The mineral reserve increase is largely due to Project Honeypot, which added 8.1Mt grading 1.59% copper to the reserve framework, and an additional 4.6Mt grading 1.08% copper was added within the Upper Level areas.

Mineral reserves were classified according to the CIM Standards and the CIM Guidelines.

15.1 MINERAL RESERVES SUMMARY

Mineral reserve cost assumptions are based on actual operating cost data during the 18-month period from January 1, 2021, to June 30, 2022. The USD:BRL rate of 5.29 was selected based on the average rate during this same period.

A summary of the mineral reserve estimate parameters is provided below:

Table 15-1: Mineral Reserve Estimate Parameters

Mining Costs (US$/tonne ore mined)	
Pilar UG Mine	$29.68
Vermelhos UG Mine	$27.89
Surubim & C12 OP Mine	$2.09
Suçuarana OP Mine	$2.09
N8/N9 & Siriema (N5) OP Mines	$2.09
Transportation Costs (US$/tonne to mill)	
Pilar Mine	(none)
Vermelhos UG Mine	$10.05
Surubim & C12 OP Mine	$3.19
Suçuarana mine	$1.95
N8/N9 & Siriema (N5) OP Mines	$6.47
Processing Costs (US$/tonne milled)	
Pilar & Vermelhos Mines	$9.31
Surubim & C12 OP Mine	$5.70
Suçuarana, N8/N9 & Siriema (N5) OP Mines	$5.70
Metallurgical Recovery (average)	
Pilar UG Mine	90.4%
Vermelhos UG Mine	90.9%
Surubim OP / C12 OP	85.9%
N8/N9 & Siriema (N5) OP Mines	87.5%
Suçuarana OP Mine	84.8%
LME Copper Price (US$/lb)	**$3.30**
Net Smelter Return	**97.66%**
Transport & Sales Costs (US$/tonne copper)	**$99.40**
CFEM Royalty (after tax)	**1.55%**
Foreign Exchange Rate (USD:BRL)	5.29

Reserve Parameters Notes:

1. All road-maintenance costs associated with the Curaçá Valley haul road have been allocated to the Vermelhos UG Mine. Calculated differences between open pit mining and processing costs are a result of additional incurred costs related to contract mining vs. employee operated and the allocation of mining and processing administrative / fixed costs between mines.
2. Metallurgical recoveries vary by deposit. G&A costs of US$5.45 per tonne were applied to the current operating underground mining operations of the Pilar and Vermelhos Mines.
3. USD:BRL foreign exchange rate of 5.29 applied to all mines, except the underground portion of the Surubim Mine, as the mine design did not change from 2021, and was based on a USD:BRL foreign exchange rate of 5.23. London metal exchange long-term copper price ("LME Copper Price") was based on US$3.30 per lb. for all mines, except the underground portion of the Surubim Mine, as the mine design did not change from 2021, and was based on US$2.75 per lb.
4. Compensação Financeira pela Exploração de Recursos Minerais ("CFEM") royalty rate was based on a blended net after-tax rate of 1.55% across all mines, except the Surubim Mine, as the mine design did not change from 2021, and is based on a rate of 2.00%.
5. Transport and sales costs of US$99.40 per tonne copper has been embedded within the Net Smelter Return value.

Other modifying factors considered in the determination of the mineral reserve estimate include:

- A SMU dilution methodology for estimating dilution has been applied to N8 (7% dilution), N9 (13%), N5 OP (17%), Surubim Mine (17%), C12 OP (12%) and Suçuarana OP Mine (4%). The conventional definition of the SMU is the smallest volume of material on which ore/waste classification is determined and relates to the smallest unit that can be mined selectively. The Vermelhos UG Mine considers 10% dilution, based on mining method and stope geometry. Within the Pilar UG Mine, a 1.0m operational dilution method was applied to the hanging wall and footwall, except for the Deepening Project, which applied 0.5m of operational dilution, resulting in a planned plus operational dilution of 27%, on average. Project Honeypot and the Upper Levels of the Pilar UG Mine consider 32% dilution, on average.

- Maximum bench height of 15m for open pit mines. Maximum underground stope dimensions based on geotechnical assessments from previous studies and past operating experience within each mining area, combined with evaluation of induced stresses and the RMR.

- VRM method with cemented paste fill was selected for the Pilar UG Mine, where the method is currently in use. For the Vermelhos UG Mine, Sublevel with CRF is the mining method currently in use on consideration of the dip, plunge and thickness of the orebodies, the RQD and overall competence of the host rock.

- Mining recovery of approximately 98% (avg.) has been applied for open pit mines. The Pilar UG Mine and Vermelhos UG Mine assume 96% and 95% mine recovery, respectively.

- Within designed stopes, all contained material was assumed to be mined with no selectivity. Inferred mineral resources, where unavoidably included within a defined mining shape have been included in the mineral reserves estimate at zero grade. Mining dilution resulting from Measured and Indicated blocks was assigned the grade of those blocks captured in the dilution envelope using the estimated grade within the blocks of the dilution and development model.

The 2022 updated mineral reserve estimate for the underground and open pit deposits and mines of the Curaçá Valley are shown in the table below:

Table 15-2: Caraíba Operations Mineral Reserve Estimate, 2022

	Classification	Tonnage (000 tonnes)	Grade (Cu %)	Cu Contained (000 tonnes)
Reserves, Underground				
Pilar UG, Deepening Extension Zone (Pilar Mine below Level -965)	Proven	774	1.16	9.0
	Probable	10,201	1.76	179.1
Pilar UG, Ex-Deepening & Ex-Honeypot (Pilar Mine above Level -965)	Proven	11,722	1.18	138.3
	Probable	4,118	1.06	43.6
Pilar UG, Honeypot	Proven	2,595	1.66	43.1
	Probable	5,551	1.56	86.6
Vermelhos UG	Proven	2,245	1.57	35.3
	Probable	2,255	1.05	23.7
Total Proven		**17,336**	**1.30**	**225.6**
Total Probable		**22,125**	**1.51**	**333.1**
Total Proven & Probable, Underground		**39,461**	**1.42**	**558.7**
Reserves, Open Pit				
Vermelhos (N8, N9 & N5/Siriema)	Proven	9,794	0.50	49.0
	Probable	22,048	0.53	116.6
Surubim (Surubim & C12)	Proven	4,343	0.80	34.9
	Probable	1,432	0.63	9.0
Suçuarana	Proven	5,011	0.43	21.6
	Probable	678	0.42	2.9
Total Proven		**19,148**	**0.55**	**105.5**
Total Probable		**24,158**	**0.53**	**128.4**
Total Proven & Probable, Open Pit		**43,306**	**0.54**	**233.9**
Total Proven		**36,484**	**0.91**	**331.1**
Total Probable		**46,283**	**1.00**	**461.5**
Total Proven & Probable, Open Pit & Underground		**82,767**	**0.96**	**792.6**

Mineral Reserve Notes:

1. Mineral reserve effective date of September 30, 2022. All figures have been rounded to the relative accuracy of the estimates. Summed amounts may not add due to rounding.
2. Mineral reserve estimates were prepared in accordance with the CIM Standards, and the CIM Guidelines, using geostatistical and/or classical methods, plus economic and mining parameters appropriate for the deposit. Mineral reserves are based on a long-term copper price of US$3.30 per lb, and a USD:BRL foreign exchange rate of 5.29, except Surubim UG mine copper price of US$2.75 per lb and a USD:BRL foreign exchange rate of 5.23. Mineral reserves are the economic portion of the Measured and Indicated mineral resources. Mining dilution and recovery factors vary for specific mineral reserve sources and are influenced by factors such as deposit type, deposit shape, stope orientation and selected mining method. Inferred resource blocks, where unavoidably mined, were assigned zero grade. Dilution occurring from Measured & Indicated resource blocks was assigned grade based upon the mineral resource grade of the blocks included in the dilution envelope.
3. The Qualified Persons for the Mineral Reserve estimate are Dr. Beck Nader and Mr A. Sepúlveda.
4. Tonnages are rounded to the nearest 1,000 t; copper grades are rounded to two decimal places. Tonnage and grade measurements are in metric units; contained copper is reported as thousands of tonnes. Rounding as required by reporting guidelines may result in summation differences.
5. The Surubim Mine mineral reserves are presented inclusive of open pit and underground estimates, as the underground portion comprises a single stope beneath the open pit.

15.2 MINERAL RESERVE ESTIMATION METHODOLOGY, OPEN PIT

As shown in the general map of Curaçá Valley Open Pit projects, Figure 15-1, the N8/N9 and N5 (Siriema) OP Mines are comprised of two adjacent open pits, encompassing three orebodies, located approximately

80 km north of the Pilar UG Mine and Caraíba Mill. The center of the mineralized bodies comprising the N8/N9 is located approximately 1.1 km to the north north-east of the main Vermelhos UG Mine, and the N5 (Siriema) OP Mine is located approximately 700m south of the main Vermelhos UG Mine.

The mineral reserve estimates as they relate to the Vermelhos District and exploration target areas as outlined by the Company are in continued growth phase. The most significant recent increases in contained copper for the updated mineral reserves within the Vermelhos District occurred within the N8/N9 deposit and N5 (Siriema), both near-surface and to depth.

The Surubim and C12 OP mines are located at the center of the Surubim District distant approximately 33km north of the Pilar UG Mine and Caraíba Mill and The Surubim is currently in operation. The Suçuarana OP Mine is located at the Pilar District, approximately 20 km south of the Pilar UG Mine.

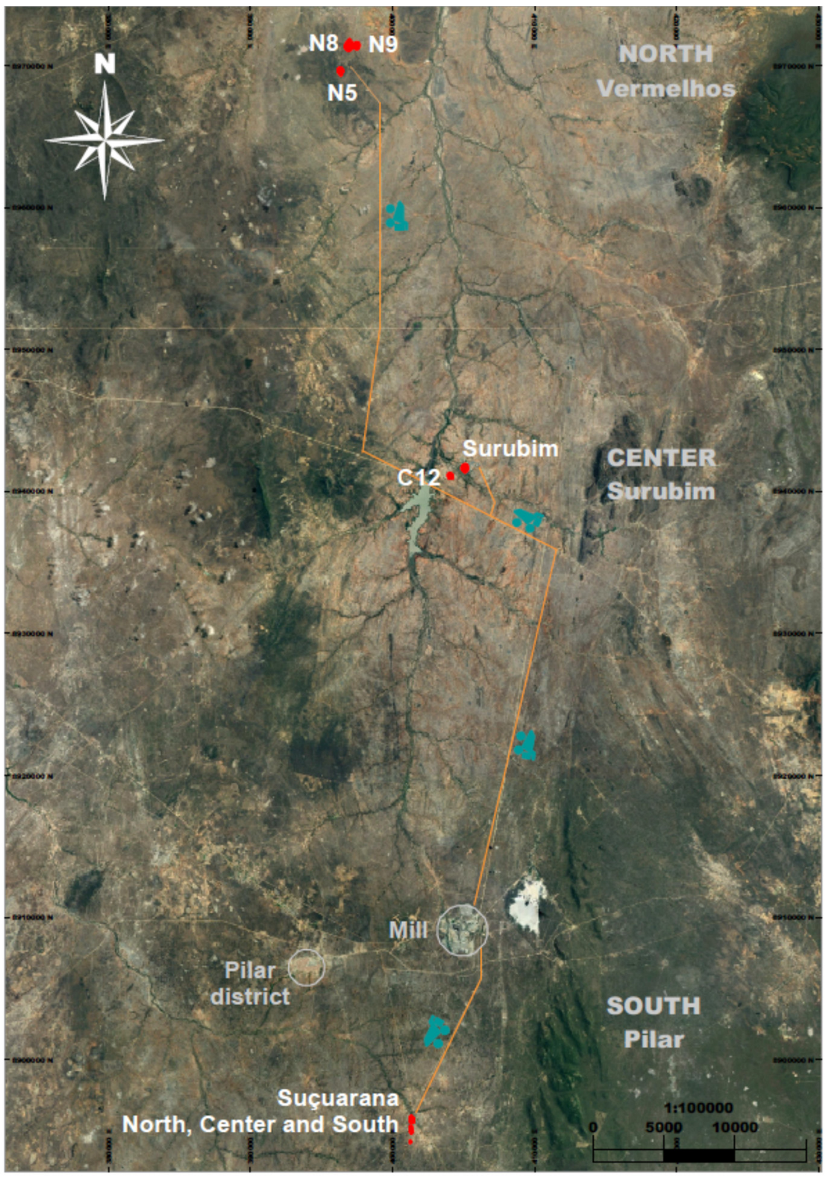


Figure 15-1: General map of the Caraíba Operations Open Pit projects (Ero Brasil, 2022)

Ore mined from open pit operations throughout the Caraíba Operations is processed using conventional crushing and flotation at the Caraíba Mill, located adjacent to the Pilar UG Mine. As an interim processing step, ore sorting will be integrated into the Company's operations within the Vermelhos District in 2031 and applied to the open pit deposits of N8/N9 and N5 (Siriema) to reduce waste material transported to the mill, thereby improving mill head-grades while reducing transport and processing costs. As an added benefit, the operations are expected use less water and power and generate significantly less flotation tailings which is aligned with the Company's sustainability commitments in the region.

15.2.1 Mineral Reserve Estimation Parameters

The pit optimization was performed based on all available Measured and Indicated mineral resources. The classic methodology for selecting the optimal mathematical pit consists of generating a series of pit optimization runs that deliver the maximum net present value ("NPV") obtained through the application of the Lerchs-Grossman algorithm. The pit shells, incorporating geotechnical design constraints, were optimized using the Datamine NPV Scheduler software and the final pit selected resulted in the highest accumulated NPV. The stated mineral reserves are derived from the Measured and Indicated mineral resources as defined within the resource block models, applied the technical and economic parameters, as well modifying factors and densities (pre- and post-swelling) for each open pit as further described below in Table 15-3.

Table 15-3: Density Parameters - OP Optimization

Density	Unit.	Surubim	C12	N8	N9	N5 (Siriema)	Suçuarana
Ore (Sulfide)	t/m³	3.02	2.97	3.05	2.98	2.94	3.07
Ore (Oxide)	t/m³	3.00	2.92	2.88	2.87	2.87	2.99
Waste in-situ	t/m³	2.83	2.79	2.72	2.73	2.77	2.81
Unconsolidated waste	t/m³	1.92	1.86	1.86	1.86	1.86	1.86
Soil	t/m³	2.78	2.78	2.72	2.71	2.71	2.78

For open pit design optimization, a pit slope criterion was applied for each geotechnical sector of the N8/N9 & N5 (Siriema) OP Mines, Surubim & C12 OP Mine and Suçuarana OP Mines as described in the Table 15-4 below.

Table 15-4: Geotechnical Pit Slopes Parameters - OP Optimization

Geotechnical Pit Slopes	Unit.	Surubim	N8/N9/ N5 (Siriema)	C12 / Suçuarana
Overall Slope Angle	Deg °	55 W / 52.5 E/ 35.5 above level 380 N&S	55	55
Bench Face angle	Deg °	70 W&E/ 45 above level 380 N&S	75	75

For consideration of economic modifying factors, all costs related to the mine and process of one tonne of ore. The COG calculation has been designed to include mining, general and administrative, transportation from mine to mill, processing costs, freight of the product to the point of sale, treatment and refining, as well as taxes related to the income generated from the sales of the product.

Costs are influenced by the price of input materials, as well as the USD:BRL foreign exchange rate. An 18-month moving average for both input costs and the average USD:BRL foreign exchange rate is applied for the COG calculation.

The total *NSR* applied in the COG calculation for the 2022 update of mineral reserves results was 97.66%, which represents the percentage of payable copper sold in the concentrate.

With these assumptions it was possible to generate an economic mineral reserve COG based upon the long-term copper price (LME Price), using the following equation:

$$General\ Cut - Off\ Grade = \frac{Mining\ Cost + Transport\ Cost + Plant\ Cost}{REC. \times LME\ Price \times NSR} \times 100$$

Where,

- REC. = Metallurgical recovery (%)
- LME Price = Copper Price (BRL/t Cu)
- NSR = Net Smelter Return (%)

For copper price and exchange rate the 18-month average basis was used, corresponding to the input pricing period selected for the 2022 mineral reserve estimate, which results in US$7,275 per tonne (US$3.30 per lb.) copper price and USD:BRL foreign exchange rate of 5.29. The break-even and marginal COG parameters and for mineral reserves is listed below for each open pit project:

Table 15-5: Open Pit Mines - COG Calculation

Economic Parameters		Surubim / C12	N8/N9/N5 (Siriema)	Suçuarana
Total Mining Costs	**BRL/ton**	**11.08**	**11.08**	**11.08**
Mining Costs	BRL/ton	11.08	11.08	11.08
Development Costs	BRL/ton	0.00	0.00	0.00
Transportation Costs	**BRL/ton**	**16.86**	**34.20**	**10.33**
Fix Costs	BRL/ton	1.63	0.00	0.22
Variable Costs	BRL/ton	15.23	34.20	10.11
Processing Costs (Fix Costs)	**BRL/ton**	**30.14**	**30.14**	**30.14**
Fix Costs	BRL/ton	0.00	0.00	0.00
Variable Costs	BRL/ton	30.14	30.14	30.14
G&A Costs	**BRL/ton**	**0.00**	**0.00**	**0.00**
TOTAL COSTS (w/o Sales costs)	**BRL/ton**	**58.09**	**75.42**	**51.55**
Metallurgical Recovery	**%**	**85.92%**	**87.50%**	**84.82%**
Copper Price	**BRL/ton**	**38,486**	**38,486**	**38,486**
Foreign Exchange Rate	**R$:US$**	**5.29**	**5.29**	**5.29**
LME	**US$/lb**	**3.30**	**3.30**	**3.30**
LME	**US$/t**	**7,275**	**7,275**	**7,275**
NSR	**%**	**97.66%**	**97.66%**	**97.66%**
Royalty & Taxes (PIS/COFINS/ICMS/CFEM)	**%**	**1.55%**	**1.55%**	**1.55%**
COG (Cu %)	**Break-even**	**0.18%**	**0.23%**	**0.16%**
	Marginal	**0.15%**	**0.20%**	**0.13%**

For the purposes of the current LOM production plan as outlined, marginal material and the oxide ore mined throughout each of the pit designs was treated as waste; however, by design this material will be placed in near-mine stockpiles adjacent to the pit for potential future processing. All these steps result in the Mineral Reserve estimation summarized as presented in Table 15-1.

15.2.2 **Open Pit Optimization**

The final design pit was updated for all open pit projects. Final design was based on incorporating updated resources, geotechnical design constraints and all technical and economic data as previously outlined.

The mathematically generated pit shells for each project sought to evaluate each open pit size at different revenue factors. Low revenue factors represent small pits that would be economic at low metal prices, consisting of either high-grade selective mining, low strip ratios, or both. Higher revenue factor pits will generally be larger in size since higher metal prices can make lower grade material more economic, and the design more accommodative of increased stripping, thereby expanding the size of the pit. The open pit scenario generating the highest NPV was selected for further design and in defining the current mineral reserves.

15.2.2.1 Vermelhos District: N8/N9 OP Mine & N5 (Siriema) OP Mine

In the Vermelhos District there are 3 open pit projects. For all pits in the Vermelhos District the 100% revenue factor with the highest NPV and the best strip ratio was selected for final design. In order to design the N8 pit, a small north portion of the N7 (Vermelhos UG Mine) block model was added to N8. The results of the open pit optimization scenarios and the final pit selected are presented in the figures below:

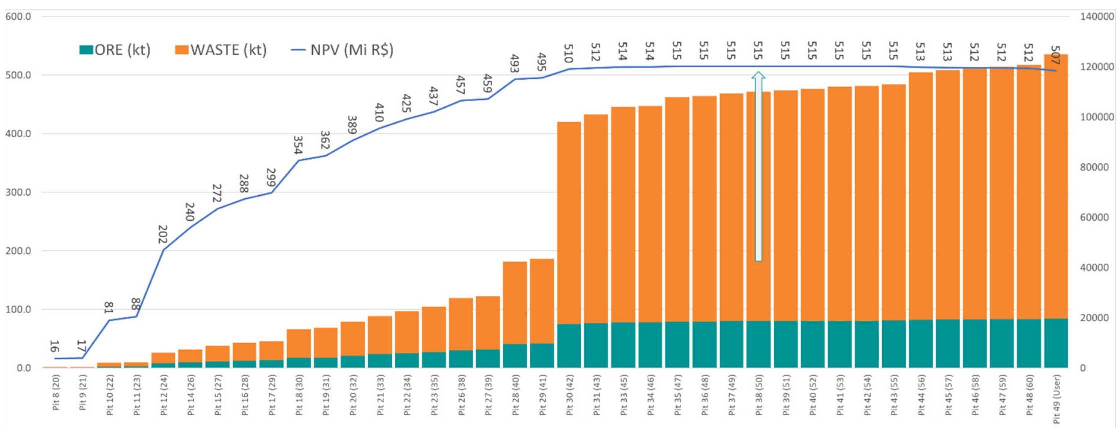


Figure 15-2: N8 Pit Optimization Results (Ero Brasil, 2022)

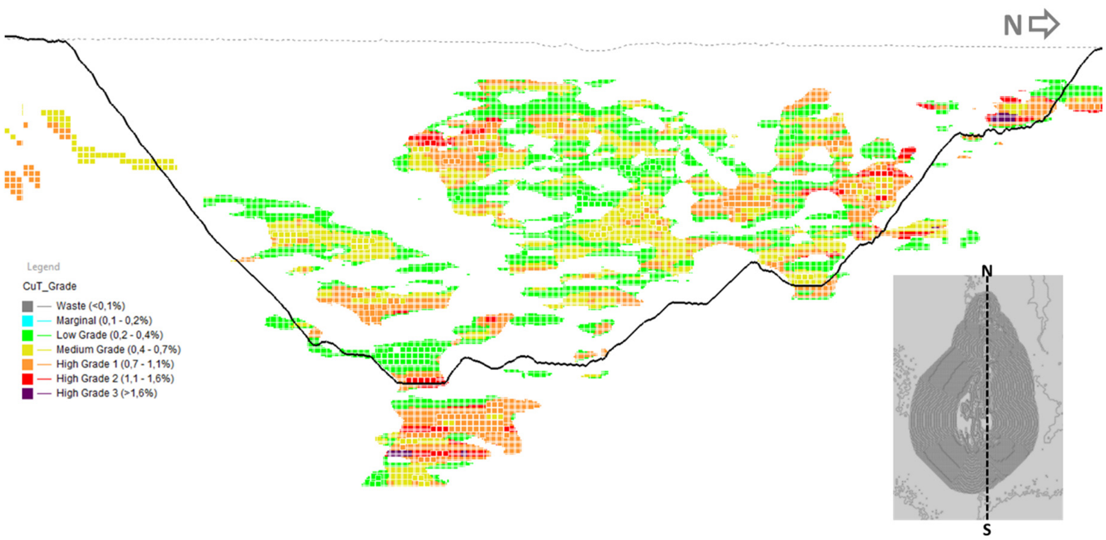


Figure 15-3: Final N8 Pit selected - Pit 38 (50) shown against the block model grade distribution. Block size of 2.5m x 5m x 5m for scale (Ero Brasil, 2022)

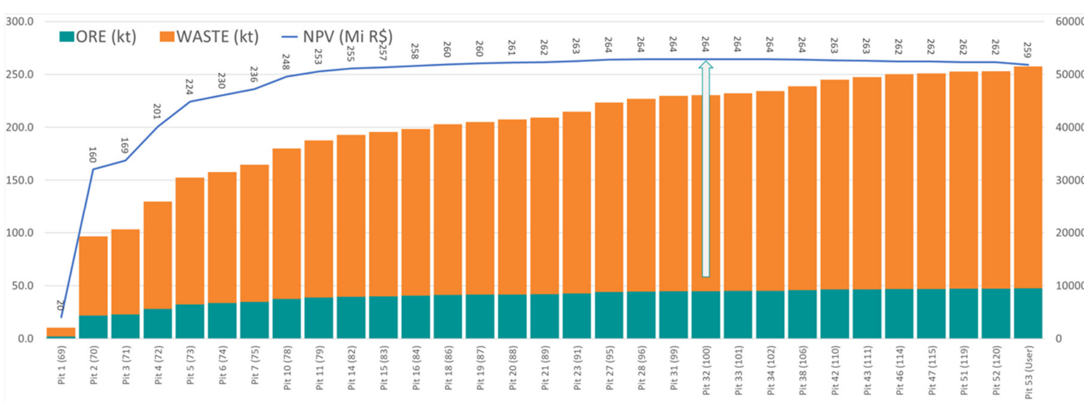


Figure 15-4: N9 Pit Optimization Results (Ero Brasil, 2022)

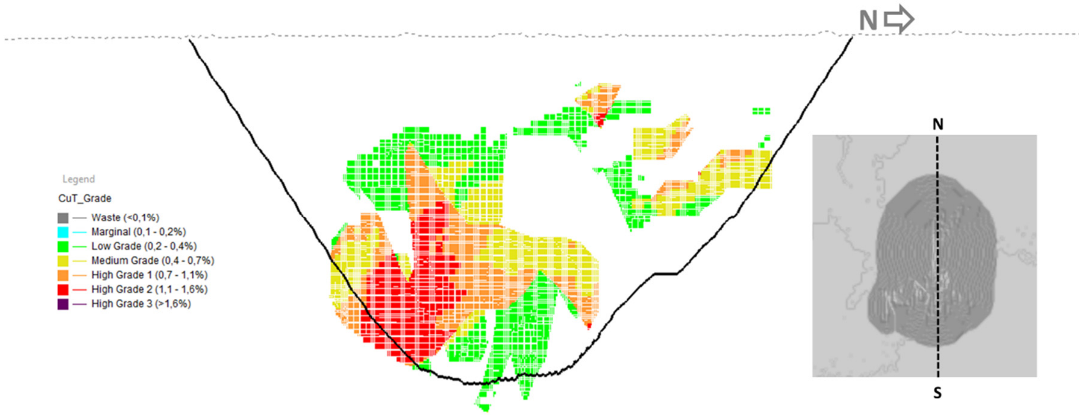


Figure 15-5: Final N9 Pit selected - Pit 32 (100) shown against the block model grade distribution. Block size of 2.5m x 5m x 5m for scale (Ero Brasil, 2022)

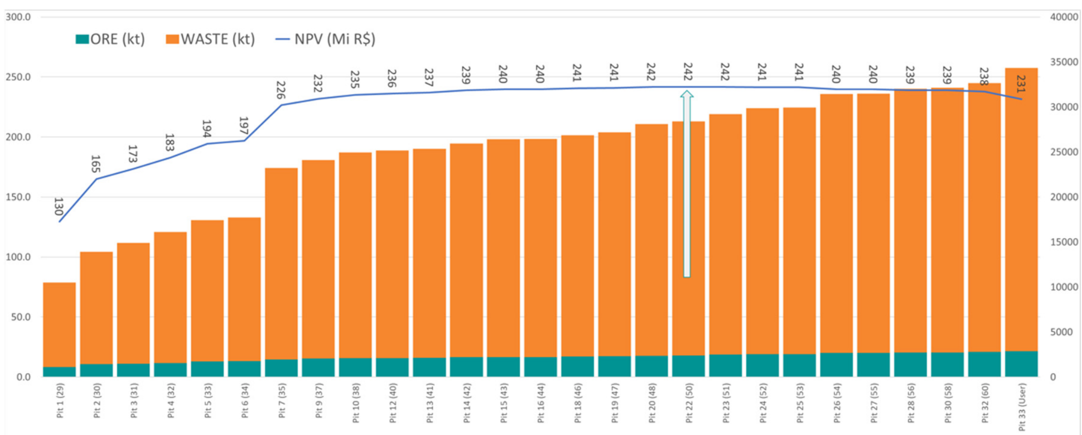


Figure 15-6: N5 (Siriema) Pit Optimization Results (Ero Brasil, 2022)

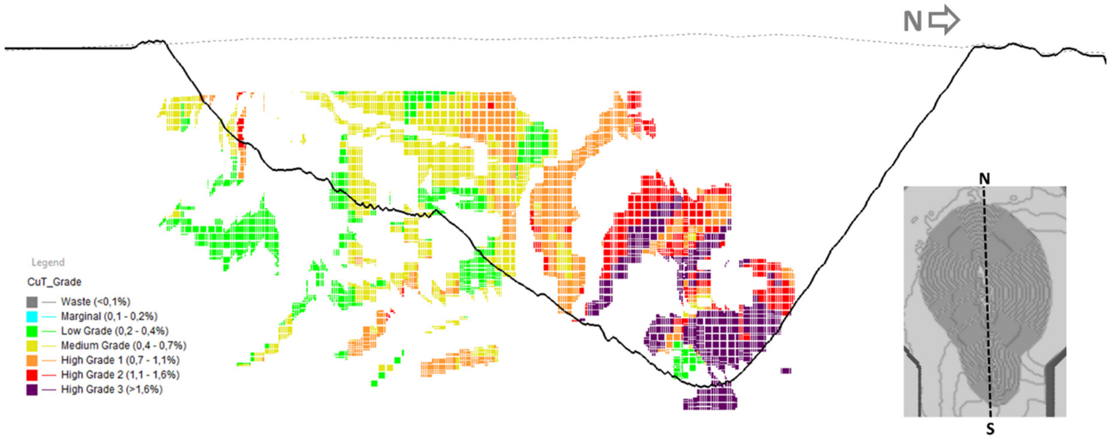


Figure 15-7: Final N5 Pit selected - Pit 22 (50) shown against the block model grade distribution. Block size of 2.5m x 5m x 5m for scale (Ero Brasil, 2022)

15.2.2.2 Surubim District: Surubim & C12 OP Mines

For all pits in the Surubim District the 100% revenue factor with the highest NPV and the best strip ratio was selected for final design. The results of the open pit optimization scenarios and the final pit selected are presented in the figures below:

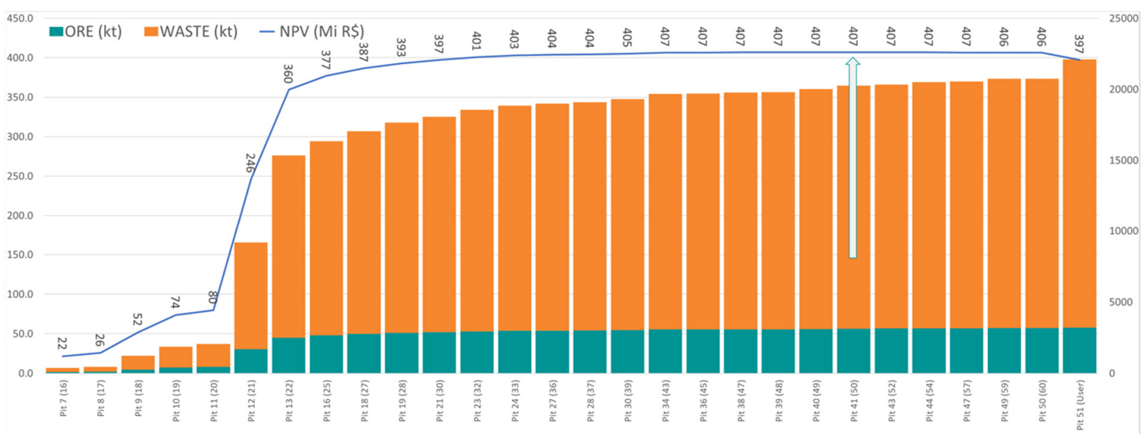


Figure 15-8: Surubim Pit Optimization Results (Ero Brasil, 2022)

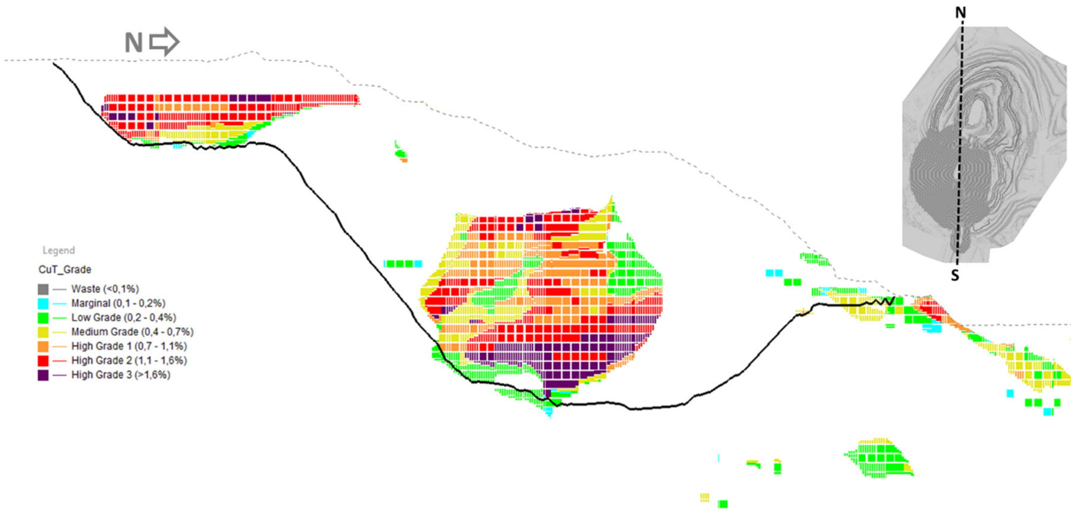


Figure 15-9: Final Surubim Pit selected – Pit 41 (50) shown against the block model grade distribution. Block size of 2.5m x 5m x 5m for scale (Ero Brasil, 2022)

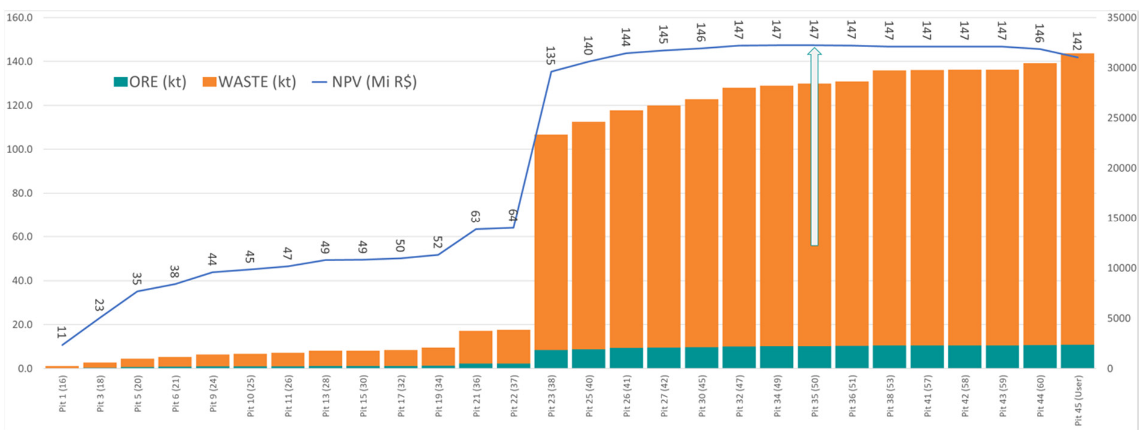


Figure 15-10: C12 Pit Optimization Results (Ero Brasil, 2022)

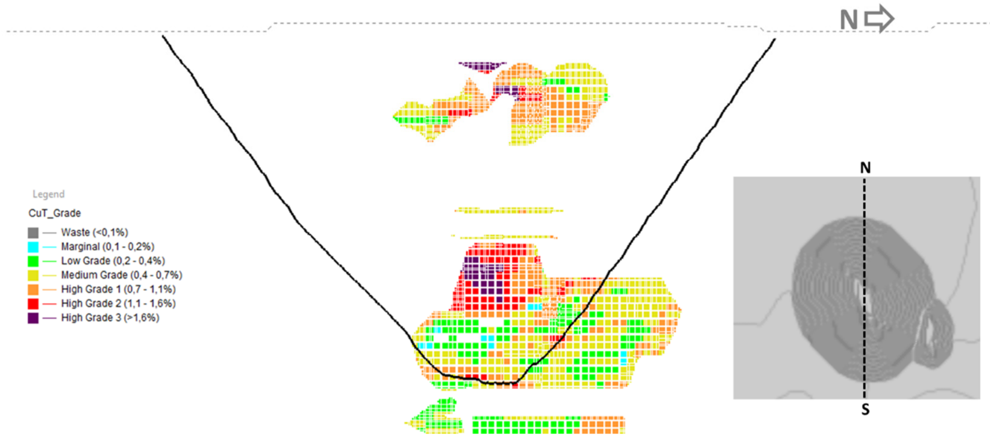


Figure 15-11: Final C12 Pit selected - Pit 35 (50) shown against the block model grade distribution. Block size of 2.5m x 5m x 5m for scale (Ero Brasil, 2022)

15.2.2.3 Pilar District: Suçuarana OP Mine

For all pits in the Pilar District the 100% revenue factor with the highest NPV and the best strip ratio was selected for final design. The results of the open pit optimization scenarios and the final pit selected are presented in the figures below:

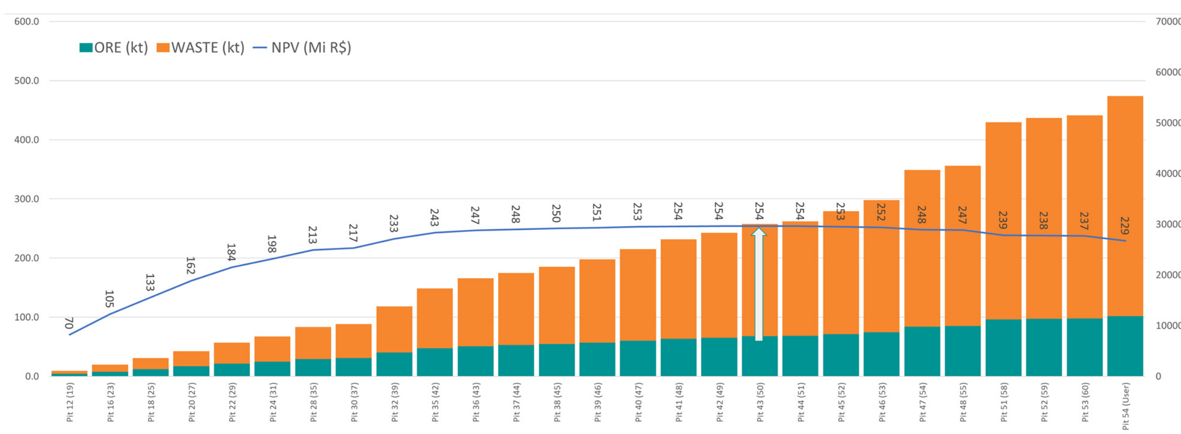


Figure 15-12: Suçuarana South Pit Optimization Results (Ero Brasil, 2022)

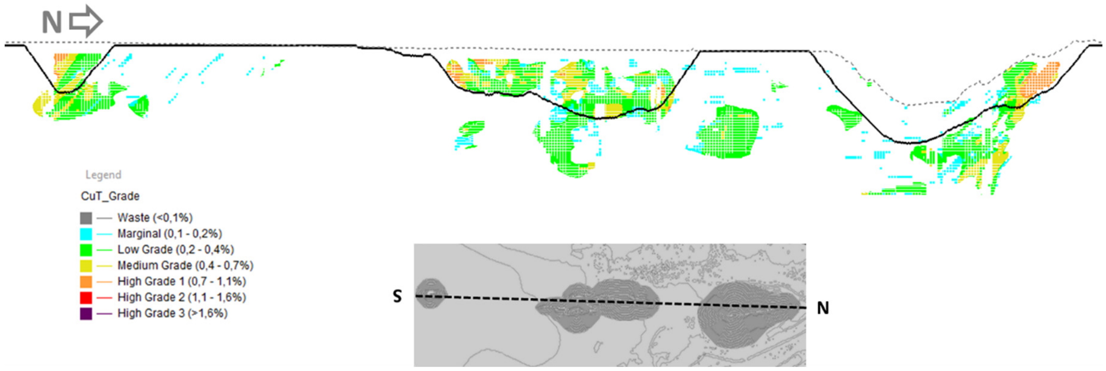


Figure 15-13: Final Suçuarana South Pit selected - Pit 43 (50) shown against the block model grade distribution. Block size of 2.5m x 5m x 5m for scale (Ero Brasil, 2022)

15.2.3 Final Pit Designs

The next step in the mineral reserve estimate process was to design an operational pit incorporating berms and haulage ramps as well as incorporation of slope angles based on geotechnical analyses. The operation of the pit followed geotechnical criteria and parameters defined by the Ero Brasil geotechnical team using both available geotechnical datasets and operational experience where applicable. Existing pit criteria were observed for re-starting operations, such as defining limits between the available ore and the existing main ramp, where applicable. The geotechnical parameters for each sector within the mine were incorporated into the detailed pit design. Additional practical constraints were incorporated into the design primarily pertaining to existing infrastructure, timing of the mining sequence for these mines, personnel requirements, ore transport distances as well as ore-sorting in the case of the Vermelhos District. The detailed design of the open pit mines was performed based upon the extensive operational experience within the open pit operations throughout the Curaçá Valley as well as application of geotechnical constraints.

The contours of the optimal mathematical pit were subsequently designed following the classic procedure that consists of the tracing of the toes and crests of the benches, access ramps and safety berms, thus allowing for the safe and efficient conduction of mining operations.

Table 15-6, below, lists all of the geometric parameters used in the operational pit design for each open pit project. For all geotechnical sectors, the slopes used in the optimization model were flattened from the geotechnical design overall slope angle to account for the placement of haulage ramps in the final pit design. These adjustments were made based on prior operational experience of the Caraíba Operations open pit mines.

Table 15-6: Geometric Parameters - Operational Pit Design

Geometric Parameters	Unit.	Surubim	N8/N9/N5 (Siriema)	C12 OP/ Suçuarana
Overall Slope Angle	°	55 W / 52.5 E	55	55
Bench Face angle	°	70	75	75
Bench Face angle unconsolidated waste	°	45	45	45
Berm Width	m	3.4 W / 4.0 E	6.5	4
Bench Height	m	10	15	10
Minimum operational area width	m	30	30	30
Maximum bottom pit depth	m	5	5	5
Minimum bottom pit width	m	25	25	25
Road Gradient	%	12	12	12
Road Width	m	12	12	12

15.2.3.1 Vermelhos District: N8/N9 OP Mine & N5 (Siriema) OP Mine

The N8 and N9 open pit mines had the operational pit design improved based on a modestly lower COG (from 0.24% in 2021 to 0.23% in 2022), resulting in a significant change in N8 – improving contained metal by approximately 50k tonnes into the mineral reserves. Furthermore, in N8 the calculated dilution was reduced from 10% to 7%. Below is illustrated the N8 and N9 final pits design in plant and the sections N-S and E-W showing the block model and the range of grades from waste to high grade of copper (Cu%), as well the mining phases until the last Phase 5 and Phase 3, respectively, or final pit design.

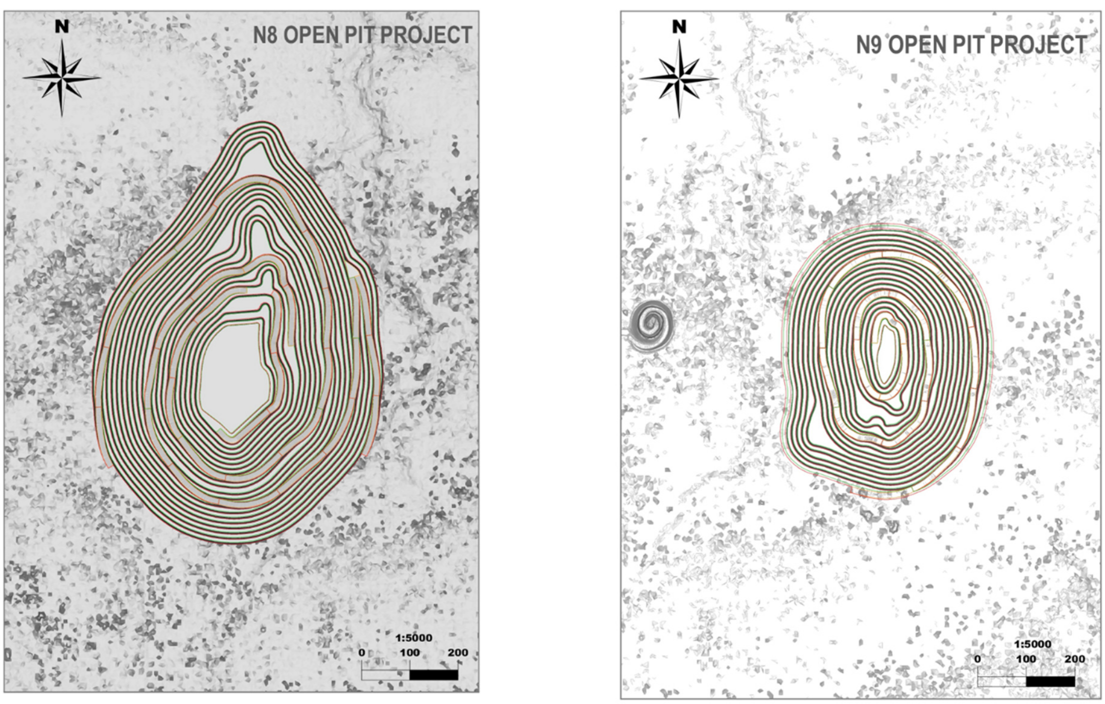


Figure 15-14: Final Operational N8 (left) and N9 (right) Pits (Ero Brasil, 2022)

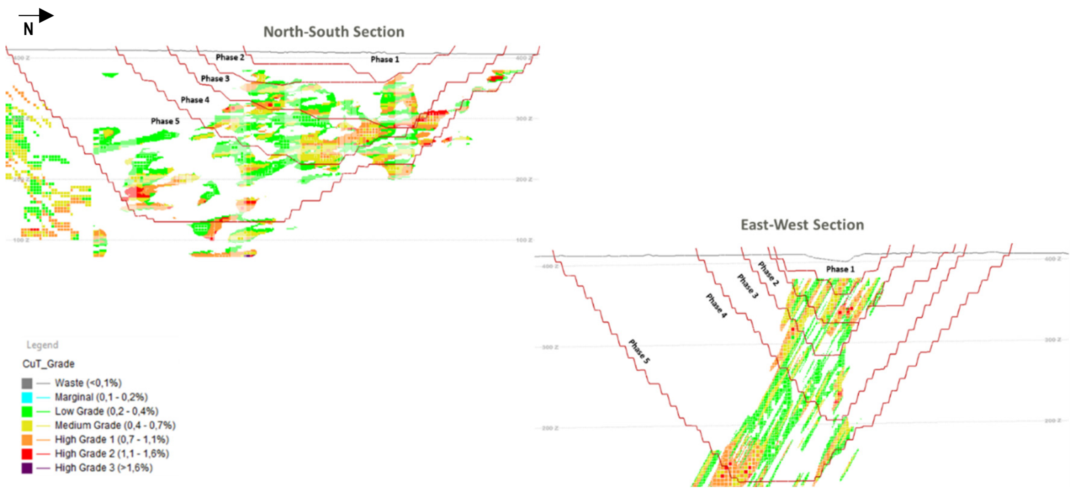


Figure 15-15: Operational N8 Pit Phases and Cu (%) grade distribution (Ero Brasil, 2022)

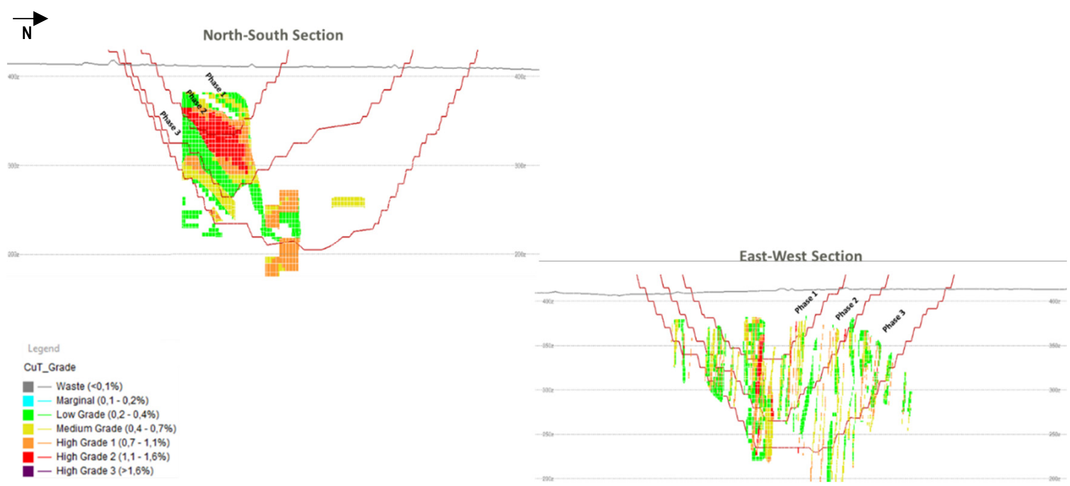


Figure 15-16: Operational N9 Pit Phases and Cu (%) grade distribution. Block size of 2.5m x 5m x 5m for scale (Ero Brasil, 2022)

The N5 (Siriema) project had the operational pit design improved based on a modestly lower COG (from 0.24% in 2021 to 0.23% in 2022) without significant changes on tonnes and grade. The N5 final pits design in plant and the sections N-S and E-W showing the block model and the range of grades from waste to high grade of copper (Cu%), as well the mining phases until the last Phase 2 or final pit design are illustrated below.

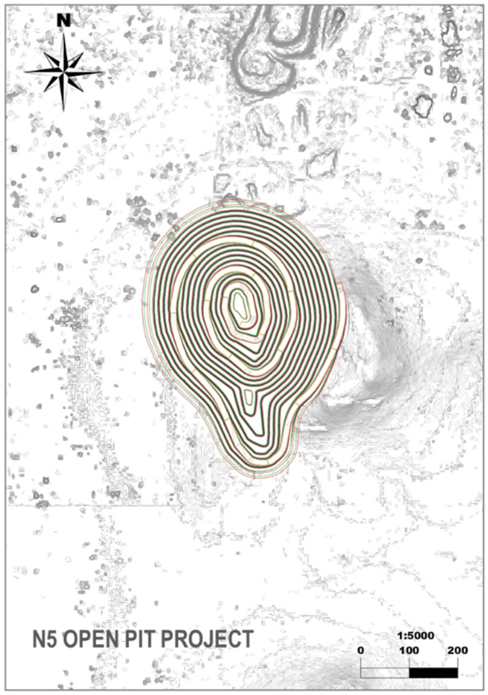


Figure 15-17: Final Operational N5 (Siriema) Pit (Ero Brasil, 2022)

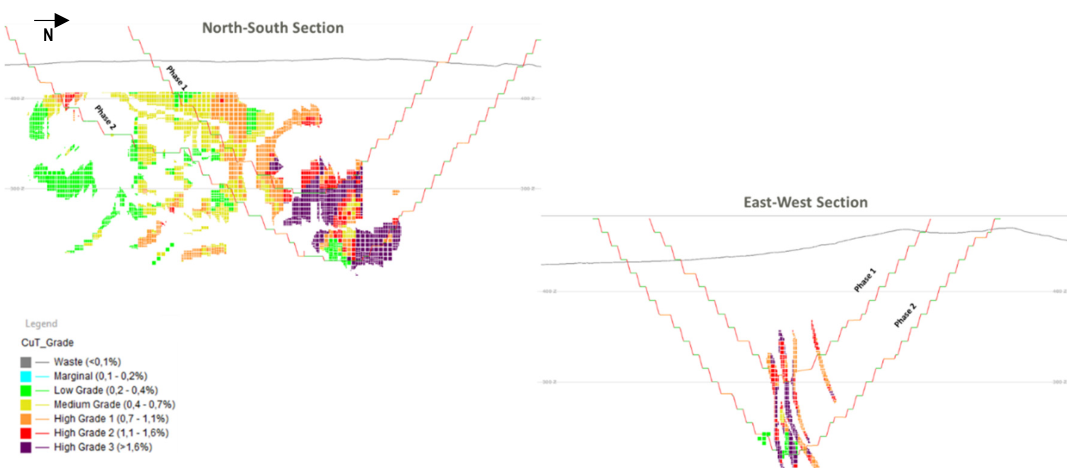


Figure 15-18: Operational N9 Pit Phases and Cu (%) grade distribution. Block size of 2.5m x 5m x 5m for scale (Ero Brasil, 2022)

15.2.3.2 Surubim District: Surubim & C12 OP Mines

The Surubim pit design was improved based on a modestly lower COG grade (from 0.19% in 2021 to 0.18% in 2022). Additionally, as much of the stripping and haulage roads were completed since 2021, the remaining waste and the strip ratio were improved year-on-year. The Surubim final pit design in plan and the sections N-S and E-W showing the block model and the range of grades from waste to high grade of copper (Cu%), as well the mining phases until the last Phase 3 or final pit design are illustrated below.

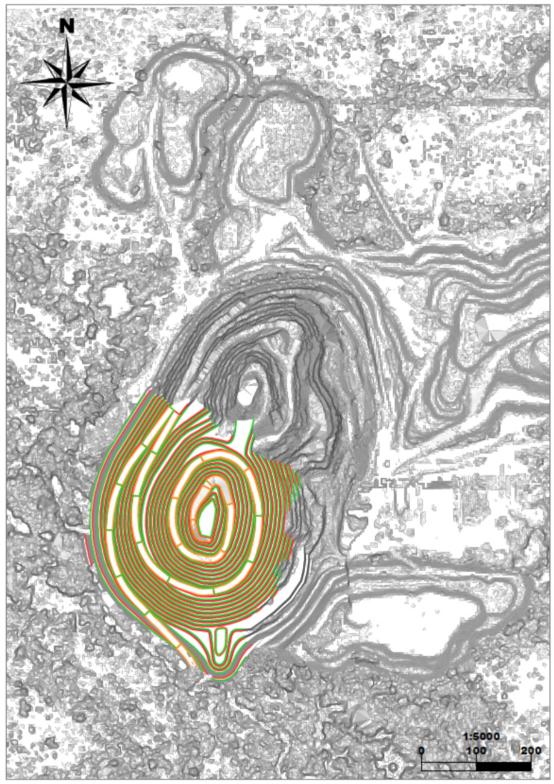


Figure 15-19: Final Operational Surubim Pit (Ero Brasil, 2022)

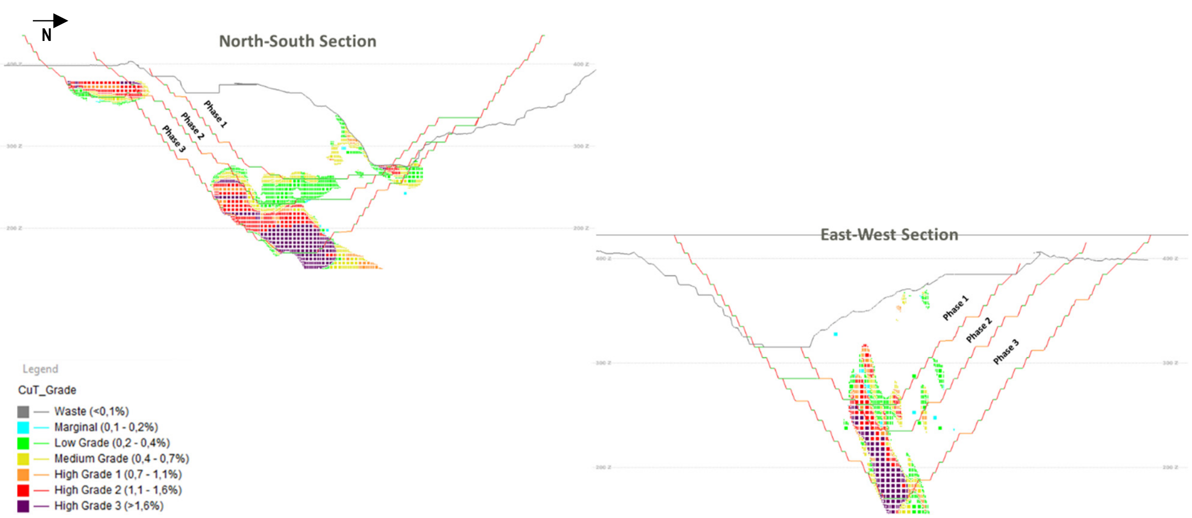


Figure 15-20: Operational Surubim Pit Phases and Cu (%) grade distribution. Block size of 2.5m x 5m x 5m for scale (Ero Brasil, 2022)

The C12 pit design similar to the Surubim Mine, had an improvement in the operational design based on a modestly lower COG grade (from 0.19% in 2021 to 0.18% in 2022), however without significant changes on tonnes but with a lower strip ratio. The C12 final pit design in plan and the sections N-S and E-W showing the block model and the range of grades from waste to high grade of copper (Cu%), as well the mining phases until the last Phase 2 or final pit design is illustrated below.

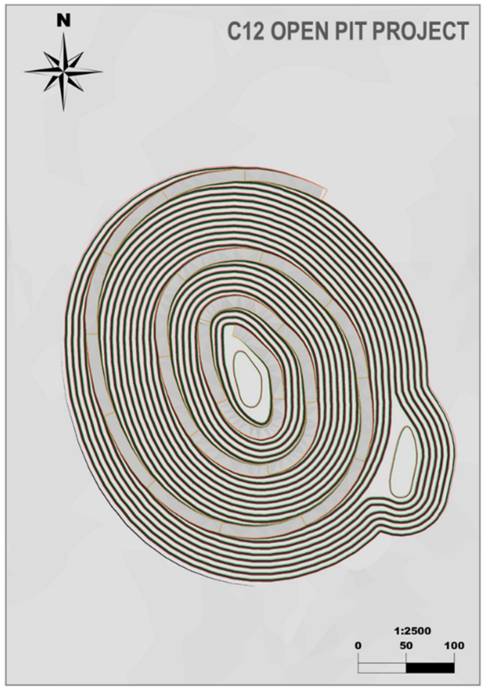


Figure 15-21: Final Operational C12 Pit (Ero Brasil, 2022)

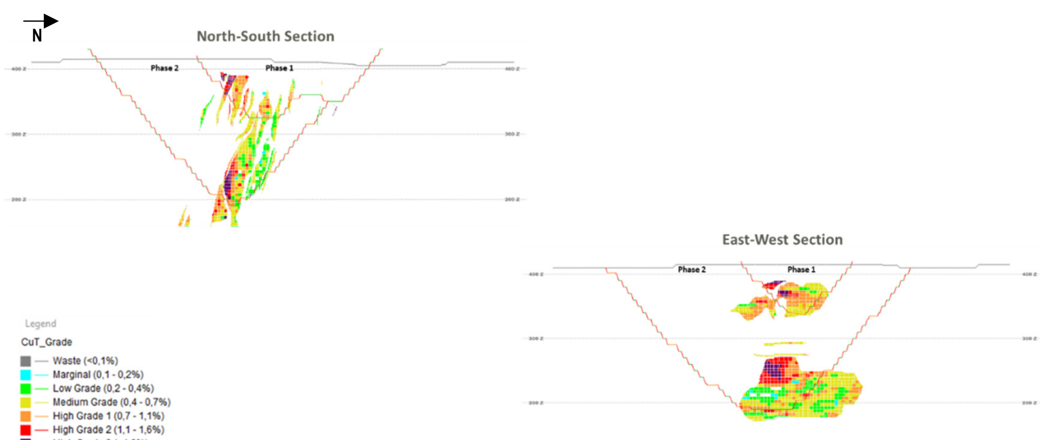


Figure 15-22: Operational C12 Pit Phases and Cu (%) grades . Block size of 2.5m x 5m x 5m for scale (Ero Brasil, 2022)

15.2.3.3 Pilar District: Suçuarana OP Mines

The Suçuarana open pit project contains 3 discrete pits that had the operational pit design improved based on a modestly lower COG (from 0. 0.17% in 2021 to 0.16% in 2022) resulting in a significant change in tonnes of contained metal in the mineral reserves. In addition, the calculated dilution was reduced from 10% to 4%. The Suçuarana final pits design in plan and section (N-S and E-W) showing the block model and the range of grades from waste to high grade of copper (Cu%) are shown below.

Figure 15-23: Final Operational Suçuarana South Pits (Ero Brasil, 2022)

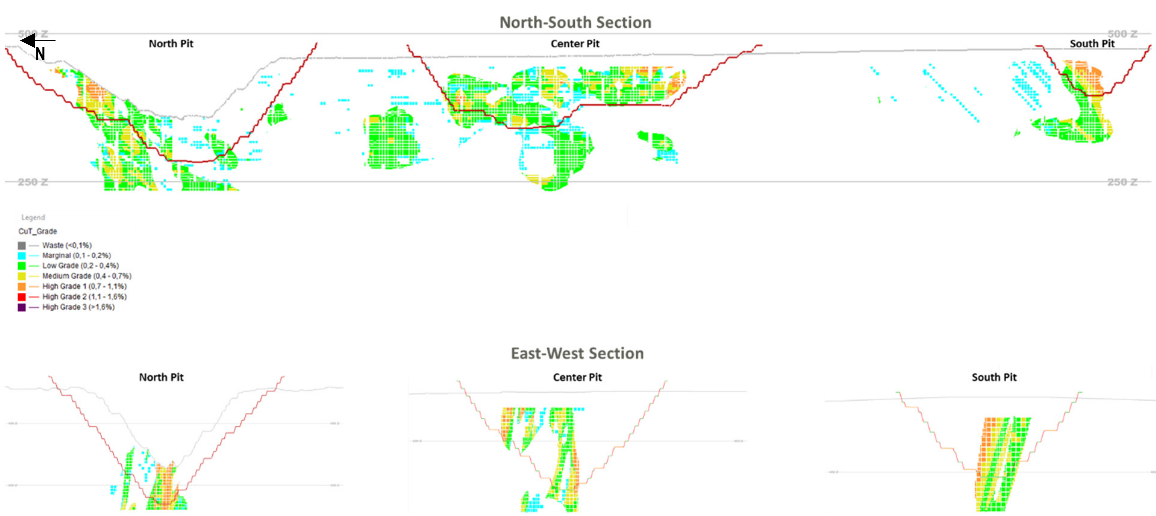


Figure 15-24: Operational Suçuarana Final Pit and Cu (%) grades. Block size of 2.5m x 5m x 5m for scale (Ero Brasil, 2022)

15.2.4 Modifying Factors, Open Pit Mining

The modifying factors applied to the mineral reserve estimates for the open pit mineral reserves of the Caraíba Operations, including the N8/N9 & N5 (Siriema) OP Mines, Surubim Mine and Suçuarana OP Mine are operational dilution, mining recovery and metallurgical recovery.

Dilution refers to the waste material that is not separated from the ore during the operation and is mined with ore. This waste material is mixed with ore and sent to the processing. In summary, dilution increases the tonnes of ore while decreasing its grade due to the incorporation of waste or low-grade marginal blocks. It usually expressed in percent format.

Referring to a specific mining block, dilution happens in two different areas. Due to the nature of the geology of the deposit, a mining block may contain waste inclusions or low-grade pockets of ore that cannot be separated and are inevitably mined with the mining block. This is called internal dilution. Internal dilution is difficult if not impossible to avoid. External dilution, also called contact dilution, refers to the waste outside of the orebody that is mined within the mining block. External dilution varies based on geology, shape of orebody, drilling and blasting techniques, scale of operation and equipment size. This is the type of dilution that can be controlled using proper equipment and mining practices.

The methodology chosen to estimate the dilution in N8/N9 and N5 (Siriema) OP, Surubim & C12 OP and Suçuarana OP uses the concept of SMU (Figure 15-4). The conventional definition of the SMU is the smallest volume of material on which ore/waste classification is determined and relates to the smallest unit that can be mined selectively.

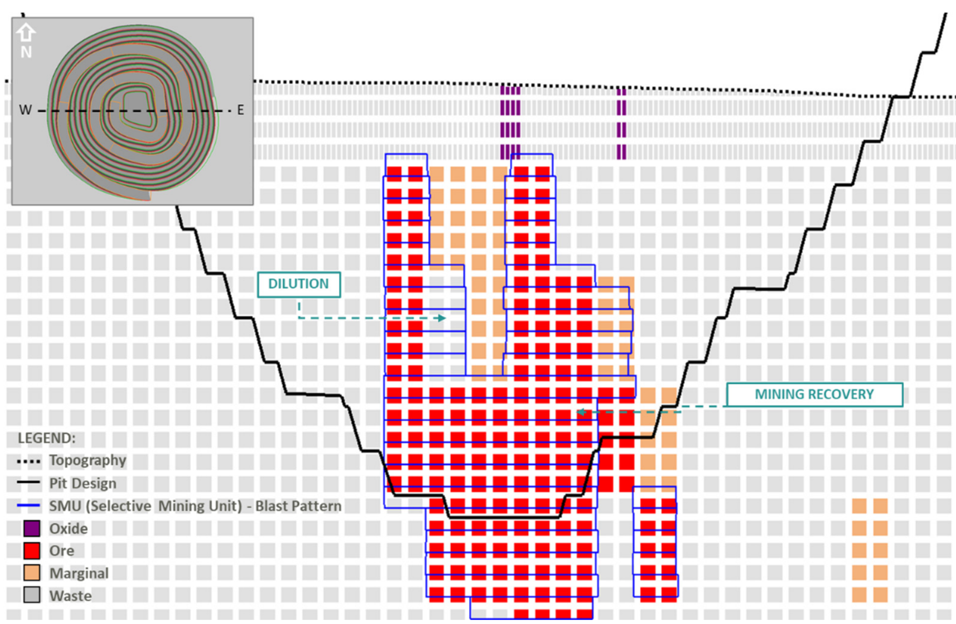


Figure 15-25: Illustrative SMU Methodology (Ero Brasil, 2022)

By considering an SMU as an underground stope, it is possible to use Datamine's Mineable Shapes Optimizer ("MSO"), to model dilution in a narrow-vein deposit. MSO was used to create wireframes for each mining unit over the entire deposit. Using stope wireframes, the block model could then be sub-blocked and assigned as either "ore" (inside the stope wireframe) or "waste" (outside the stope wireframe) prior to optimization. The material within the MSO generated stopes is specified as ore and is inclusive of planned dilution (on the footwall, hanging wall or both).

The size of the SMU selected was based on a 2.5 x 5.0 x 5.0m (X Y Z) block for all open pit mines on consideration of the existing mining fleet and the current blast-hole grid practice in use at the Surubim Mine, which measures 2.4 m x 4.8 m on average. From the geological point of view, the SMU size is consistent with the known dimensions of the mineralized bodies, and their relative continuity in plan and depth. In order to calculate dilution, the following formula was used:

$$Diluent = Waste + Oxide\ Ore + Soil$$

$$Total\ Mass = Waste + Oxide\ Ore + Soil + Sulfide\ Ore + Marginal\ Ore$$

$$Dilution = \frac{Diluent}{Total\ Mass} \times 100$$

As a result, the dilution of the copper grade is estimated through the calculated dilution for the total mass, thus reducing grade inside of the SMU. It is important to highlight that the waste and the oxide ore diluents have copper grade greater than zero, so the total contained metal can be greater despite a reduction in copper grade, after application of dilution. For the Surubim Mine, the dilution applied in the current mineral reserve estimate is based on the operational historic average.

For the C12 OP and Suçuarana OP Mines, mining recovery was estimated by tabulating blocks of ore – defined as material that is above the COG and outside the oxide zone, with marginal ore, defined as blocks above the marginal COG and below the COG versus blocks below the marginal COG. In practice, if material is smaller than the SMU, but above the COG, then it is considered as non-recoverable. For the Surubim Mine, the mining recovery applied in the current mineral reserve estimate is based on the operational historic average.

The table below summarizes the modifying factors used in all open pit mines:

Table 15-7: Modifying Factors for Open Pit projects

Project	Mining Rec (%)	Dilution (%)
Surubim	99.0	17.0
C12	98.0	12.0
N8	98.0	7.0
N9	98.0	13.0
N5 (Siriema)	97.0	17.0
Suçuarana	98.0	4.0

Metallurgical recovery curves as a function of grade were used to estimate recoveries, accordingly the Table 15-8 and the Figure 15-4, consistent with the approach in prior mineral reserve estimates undertaken by the Company. Additional information regarding metallurgical testing and recoveries can be found in Chapter 13 of this Report. Table 15-8 presents the metallurgical recovery for the mix of ore sources from the three districts at each copper grade profile.

Table 15-8: Metallurgical Recovery by District

CuT (%)	Vermelhos (North) District	Surubim (Center) District	Pilar (South) District	Blended (with HIG Mill)
0.30	85.70	80.14	83.65	84.30
0.40	86.71	81.80	84.82	85.52
0.50	87.50	83.10	85.72	86.46
0.60	88.14	84.18	86.46	87.23
0.70	88.68	85.11	87.09	87.89
0.80	89.15	85.92	87.63	88.45
0.90	89.57	86.64	88.11	88.95
1.00	89.94	87.29	88.53	89.39
1.10	90.27	87.88	88.92	89.80
1.20	90.58	88.42	89.27	90.17
1.30	90.86	88.92	89.60	90.50
1.40	91.12	89.39	89.90	90.82
1.50	91.36	89.83	90.18	91.11
1.60	91.59	90.24	90.44	91.38
1.70	91.80	90.63	90.69	91.64
1.80	92.00	91.00	90.92	91.88

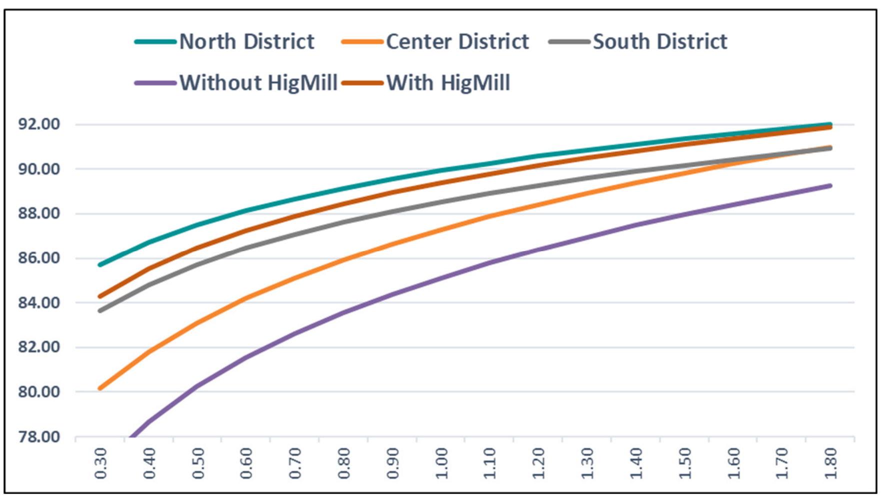


Figure 15-26: Metallurgical recovery curves as a function of copper grade, by District (Ero Brasil, 2022)

Based on the curves and expected average grade for each mine project, the following recoveries for the COG calculation were used:

Table 15-9: Open Pit Metallurgical Recovery Summary

Open Pit Mine	Grade (%)	Metallurgical Rec (%)
Surubim OP / C12 OP	0.80	85.92
N8/N9 & N5 (Siriema) OP	0.50	87.50
Suçuarana OP	0.40	84.82

The authors of this Report note that the forecast increase in metallurgical recoveries applied in LOM production planning efforts as a result of the commissioned and operational HIG Mill were not considered when estimating the current mineral reserves for open pit mines.

15.3 MINERAL RESERVE ESTIMATION METHODOLOGY, UNDERGROUND

There are three underground mines within the Caraíba Operations mineral reserve estimate, which includes the Pilar UG Mine (inclusive of the Deepening Project, Project Honeypot and additional mining areas within the upper levels of the Pilar Mine, including P1P2, R22, MSBW and Baraúna collectively known as the "Upper Areas"), the Vermelhos UG Mine and a single underground production level of the Surubim Mine. Current mining operations occur within the Pilar UG Mine and Vermelhos UG Mine. Current operational rates for the Pilar UG Mine and the Vermelhos UG/Mine are approximately 5,600 t/d and 3,000 t/d, respectively. Production volumes from underground mining operations of the Pilar Mine are expected to increase after the completion of a new external shaft from surface.

15.3.1 Mineral Reserve Estimation Parameters

The underground mineral reserve estimation was performed based on all available Measured and Indicated mineral resources as defined within the resource block models, applied the technical and economic parameters, the COG as well as modifying factors and densities. Densities for each underground mine is detailed below in Table 15-10:

Table 15-10: Density Parameters – UG Reserve Estimation

Density	Unit.	Pilar UG Mine	Vermelhos UG Mine	Surubim Mine (underground)
Ore (Sulfide)	t/m³	3.13	2.98	3.02
Waste in-situ	t/m³	2.92	2.89	2.98
Swelled waste	t/m³	1.92	1.86	1.92

The mine layout of the Pilar UG Mine, including Honeypot & Upper Areas considers that the primary ramp will continue from the current level -980 with development headings measuring 5.0m wide by 5.5m high with an arched back. These dimensions provide sufficient clearance for all underground equipment. The ramp will be developed at a maximum gradient of 15%. The ramp is located along the mineralization moving slightly to the north and is designed to be, on average, approximately 50m offset from the closest planned stopes.

The transport level development heading dimensions will be 5.0m wide by 5.5m high with an arched back. These are the same dimensions as the ramp and provide sufficient clearance for conventional trucks as well as secondary ventilation. Transport levels will be developed from the primary ramp and are designed on 26m vertical spacing, 30m from the planned stopes on each level.

Drilling and production drifts will be 4.5m wide by 4.8m high on heading following the hanging wall. Connection access between drilling and transport drifts will be 4.5m wide by 4.8m high.

For the Deepening Project stope dimensions for transverse stopes will be constrained to 15m wide, 26m high and the orebody width for length. In the case of longitudinal stopes the dimensions will be less than 15m wide, 26m high and 30m long. Table 15-11, below, lists information about the technical parameters used in Pilar UG, Vermelhos UG and Surubim Mine underground designs:

Table 15-11: Technical Parameters - UG Design

Geometric Parameters - Mine Development	Pilar UG Mine	Vermelhos UG Mine	Surubim Mine (undergound)
Section - Horizontal Development	Arch-squared	Arch-squared	Arch-squared
	5.0m x 5.5m	5.0m x 5.5m	5.0m x 5.5m
	4.5m x 4.80m	4.5m x 5.00m	4.5m x 5.00m
Section - Vertical Development	Circular	Circular	Circular
	3.10m / 4.5m	3.10m / 4.5m	3.10m / 4.5m
	Square	Square	Square
	5.0m x 5.0m	5.0m x 5.0m	5.0m x 5.0m
Slope (grid)	+1% (horizontal)	+1% (horizontal)	+1% (horizontal)
	+/- 15% (maximum)	+/- 15% (maximum)	+/- 15% (maximum)
Min. radius of curvature. Ramp	25m	25m	25m
Geometric Parameters - Stopes			
Min. Stope Width	5m	15m	8m
Max. Stope Width	30m	35m	30m
Access Distance to Production Galleries	25-35m	25-35m	25-35m
Stope Height	26 – 50m	26 – 50m	35m

For consideration of economic modifying factors, all costs related to the mine and process of one tonne of ore. The COG calculation has been designed to include mining, general and administrative, transportation from mine to mill, processing costs, freight of the product to the point of sale, treatment and refining, as well as taxes related to the income generated from the sales of the product.

Costs are influenced by the price of input materials, as well as the USD:BRL foreign exchange rate. An 18-month moving average for both input costs and the average USD:BRL foreign exchange rate is applied for the COG calculation.

The total *NSR* applied in the COG calculation for the 2022 update of mineral reserves results was 97.66%, which represents the percentage of payable copper sold in the concentrate.

With these assumptions it was possible to generate an economic mineral reserve COG based upon the long-term copper price (LME Price), using the following equation:

$$General\ Cut-Off\ Grade = \frac{Mining\ Cost + Transport\ Cost + Plant\ Cost}{REC. \times LME\ Price \times NSR} \times 100$$

Where,

- *REC.* = Metallurgical recovery (%)

- *LME* Price = Copper Price (BRL/t Cu)
- *NSR* = Net Smelter Return (%)

For copper price and exchange rate the 18-month average basis was used, corresponding to the input pricing period selected for the 2022 mineral reserve estimate, which results in US$7,275 per tonne copper price and USD:BRL foreign exchange rate of 5.29. The break-even and marginal COG parameters and for mineral reserves is listed below for each open pit project:

Table 15-12: Underground Mines - COG Calculation

Economic Parameters		Pilar UG	Vermelhos UG	Surubim UG
	Unit.	2022	2022	2022
Total Mining Costs	**BRL/ton**	**157.03**	**147.52**	**153.35**
Mining Costs	BRL/ton	94.24	98.17	95.76
Development Costs	BRL/ton	62.79	49.34	57.58
Transportation Costs	**BRL/ton**	**0.00**	**53.19**	**16.86**
Fix Costs	BRL/ton	0.00	18.99	1.63
Variable Costs	BRL/ton	0.00	34.20	15.23
Processing Costs (Fix Costs)	**BRL/ton**	**49.27**	**49.27**	**30.14**
Fix Costs	BRL/ton	19.13	19.13	0.00
Variable Costs	BRL/ton	30.14	30.14	30.14
G&A Costs	**BRL/ton**	**28.83**	**28.83**	**0.00**
TOTAL COSTS (w/o Sales costs)	**BRL/ton**	**235.13**	**278.80**	**200.35**
Metallurgical Recovery	**%**	**90.44%**	**90.86%**	**86.64%**
Copper Price	**BRL/ton**	**38,486**	**38,486**	**38,486**
Foreign Exchange Rate	**R$:US$**	**5.29**	**5.29**	**5.29**
LME	**US$/lb**	**3.30**	**3.30**	**3.30**
LME	**US$/t**	**7,275**	**7,275**	**7,275**
NSR	**%**	**97.66%**	**97.66%**	**97.66%**
Royalty & Taxes (PIS/COFINS/ICMS/CFEM)	**%**	**1.55%**	**1.55%**	**1.55%**
COG (Cu%)	**Break-even %**	**0.70%**	**0.83%**	**0.63%**
	UG Development %	**0.23%**	**0.39%**	**0.15%**
	Marginal %	**0.52%**	**0.68%**	**0.45%**

15.3.2 **Pilar UG Mine**

15.3.2.1 Stope Optimization

The starting basis for mineral reserve estimation underground was to validate the depletion of mined areas. The depletion methodology consisted of compiling all mine surveys of excavated areas, then validating all triangulations, together with information of drilling plans, historic mining plans and performing a spatial reconciliation. With all compiled datasets, a wireframe of the depletion was generated. As was required, and particularly within Project Honeypot, additional drillholes were executed with the sole purpose of confirming the confidence in the depletion model.

As can be seen in the Figure 15-27**,** the Pilar UG was divided in four main mining areas, area one between level -400 and level -965 (in green color); area two between level -78 and level -400 (in orange color) which includes Project Honeypot; area three, which was reserved for the Baraúna mining area (in cyan blue color) and area 4, the P1P2 / R22 region (in blue color). Of note, levels within the Deepening Project levels have not been mined yet and therefore there is no depletion.

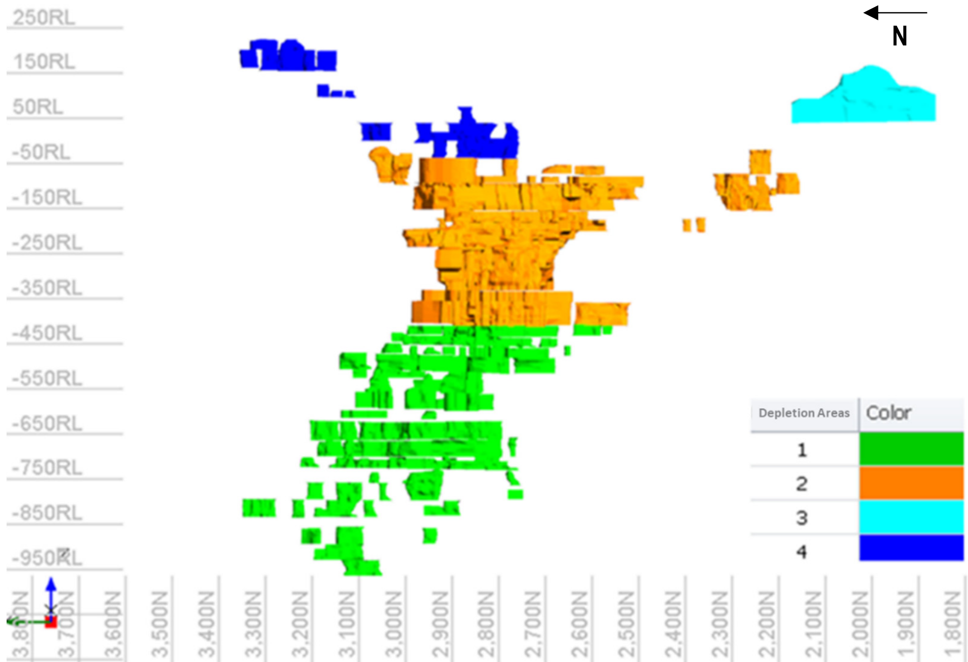


Figure 15-27: Pilar UG Wireframe depletion model

The Mineable Shape Optimizer (Datamine "MSO"), as well the Shape Optimizer ("SO") module included in the DESWIK design software were used to determine potential mining inventories and deposit continuity for the defined COG of the Pilar UG Mine. Software packages were used to determine practical mining shapes in all the areas and sectors, with the exception of Sector 1 and Sector 2 of the and Honeypot & Upper Areas resources. In these areas, a manual design combined with the use of SO undertaken level by level throughout the areas, was used to avoid including any partial old stopes already exploited and backfilled.

The software runs were performed using only Measured and Indicated resources and included an allowance for external dilution. Inferred resource grades were set to zero within MSO. The stope optimization was performed using all available Measured and Indicated mineral resources as defined within the resource block models after the application of modifying factors as previously described. Where unavoidably mined, Inferred resource blocks from the results of optimization were discounted using the following approach:

- Inferred resource blocks were assigned zero grade;
- If a designed stope had more than 50% of its tonnage derived from Inferred resource blocks, the stope was eliminated from the mineral reserve estimate; and,
- If Inferred resource blocks were unavoidably included in a stope design and were less than 50% of the designed stope grades tonnage, they were only included in the mineral reserve estimate if the total stope grade was above COG.

The Pilar UG Mine optimized stopes are shown in Figure 15-28 – colors represent average stope grades.

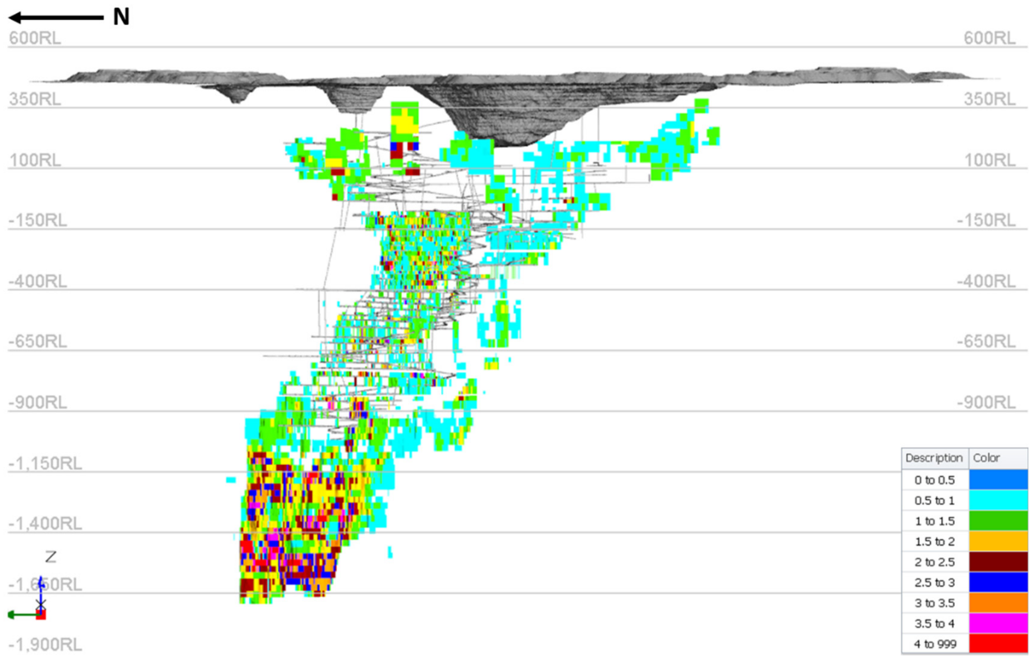


Figure 15-28: Pilar UG Optimized Stopes

15.3.2.2 Pilar UG Mine Design

The Pilar UG Mine has been in operation for approximately 34 years and has employed the following mining methods: Sublevel Stoping, VRM and Vertical Crater Retreat ("VCR"). For mine planning purposes, the underground mine is divided into eight main sub-zones: Deepening (above level -965), Deepening Project (below level -965), MSBS, P1P2NE/ R22UG, P1P2W, MSBW, Baraúna and the Honeypot & Upper Areas.

For production within the Deepening Project, considering the geological and geotechnical characteristics of the orebody, the selected mining method is open blast hole stoping, with delayed paste-fill. This mining method is applied either transverse or longitudinal to the orebody, based on the width of the mining zone, and is currently in use at the mine. The mine design has incorporated geotechnical recommendations to define production stopes, access to the production stopes as well as associated infrastructure and support requirements.

Paste strength was estimated for several applications throughout the mine as will be required throughout the LOM plan. Suggested values have been derived from work undertaken by Ingeroc and Joe Burke (Ero Copper Geotechnical Consultant) for the Deepening Zone will be used within Honeypot and the upper levels of the Pilar Mine. The recommendations are shown in Table 15-13.

Table 15-13- Paste Strength Recommendations for Different Applications

Application	Paste Strength	Comments
Stope filling	0.40 MPa	To open a stope neighboring another with Paste
Paste to allow working Below	2.00 MPa	To work under a stope filled with Paste preventing failure
To develop a tunnel in Paste	1.23 MPa	Tunnels will be developed in stronger paste (4 MPa)

In total over the LOM plan, the mine is expected to contain 59 production sub-levels starting at level +350 to level -1,693. Levels are developed to access the extent of the strike length of the deposit and connect the development to the return air raise ("RAR") in the north and south and fresh air raise ("FAR") along the middle of the development to establish flow-through ventilation.

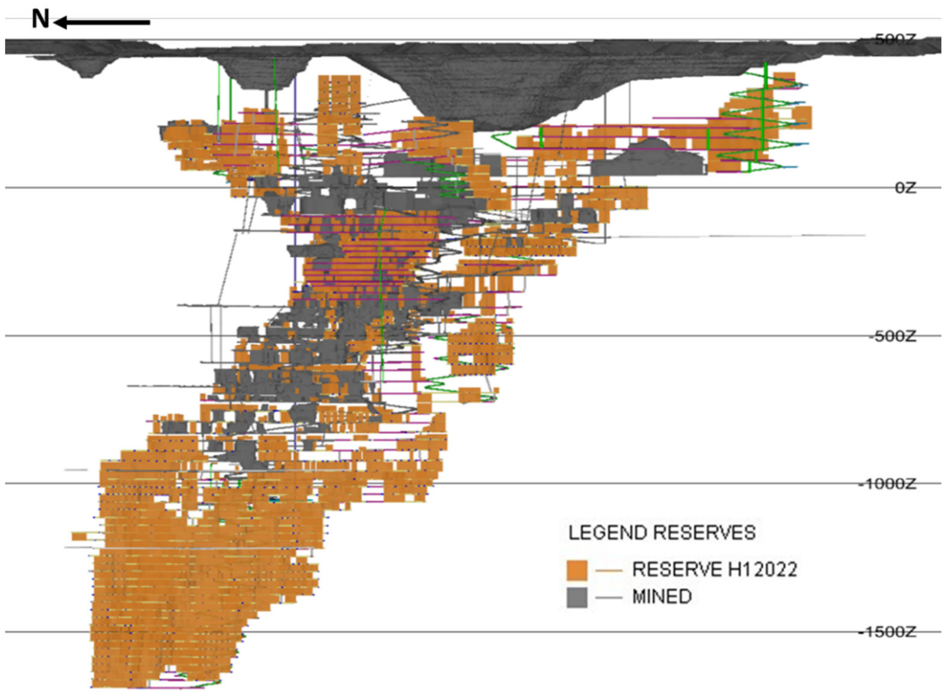


Figure 15-29: Overall of Pilar UG Mine, including Honeypot, Upper Areas & Deepening Project Mineral Reserves (Ero Brasil, 2022)

15.3.2.3 Pilar UG Mine: Honeypot & Upper Areas

The main objective of the Honeypot & Upper Areas Project was to incorporate remaining mineral resources from retrievable areas of the Pilar UG Mine so they could be added to the mineral reserves of the Company. The overall goal of the initiative was to integrate new areas to the existing operation with minimum disruption while optimizing the integrated Pilar mining operations to improve productivity and lower costs.

The study considered bringing the upper portions of the mine up to a higher production rate relative to historic rates, eventually supplementing a total underground output of 2.6-3.0 Mtpa from the Pilar UG Mine. The strategy requires the definition and planned extraction of additional reserves from the upper portion of the mine above level -965.

Five key areas were identified with potential to yield additional reserves for incorporation into the mine plan. These areas are identified below, with Sector 1 and Sector 2 corresponding to previously mined areas with the potential for resources and reserve additions:

- Sector 1: Level -700 to -965
- Sector 2: Level -78 to -400 (Project Honeypot)
- Sector 3: Integration of Baraúna towards crown pillar
- Sector 4: Sill Pillar of P1P2NE & Crown Pillar of R22UG

- Sector 5: Extension of MSBW towards R22UG

Geotechnical data compilation and analysis showed that that the geotechnical rock classification for all the sectors at Honeypot & Upper Areas are from good to very good conditions and, as a result, recommended stope dimensions were:

- In non-faulted zones: 10 m width x 20 m length x 35 m height (maximum);
- In fault zones, the size of stopes is reduced to 10 m width x 15 m length x 35 m height (maximum); and
- No sill pillars and rib pillars are generally suggested.

The selected mining method for the Honeypot & Upper Areas will be long-hole stoping, with two variants: Transverse Stopes ("TS") where the orebody width is above 15 m, and Longitudinal Stopes or Benching ("BS") for widths lower than 15m. A minimum stope width of 5 m was defined, consistent with the minimum stope width assumed across the Caraíba Operations. Dilution was applied following the geotechnical and operational recommendations.

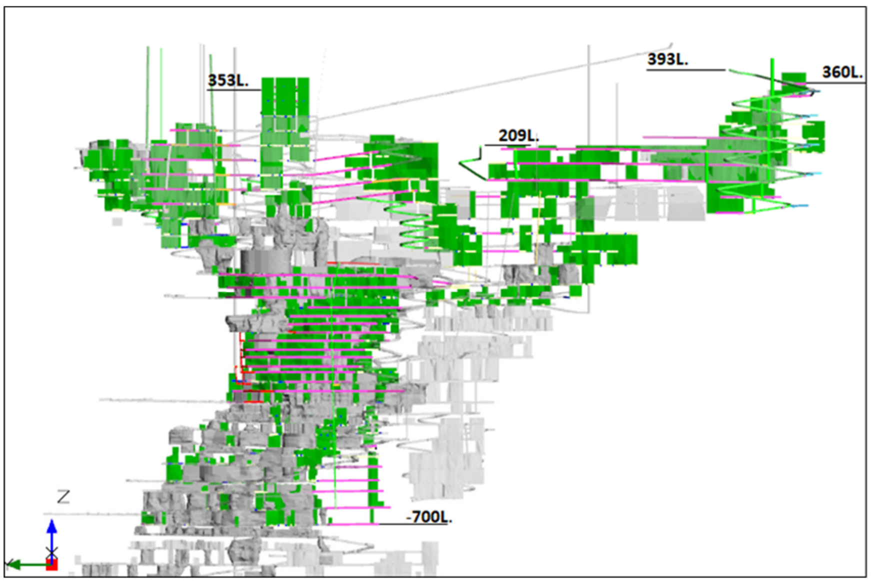


Figure 15-30: General Layout of Honeypot & Upper Areas (Ero Brasil, 2022)

15.3.3 **Vermelhos UG Mine**

15.3.3.1 Stopes Optimization

The starting basis for mineral reserve estimation underground was to validate the depletion of mined areas. The depletion methodology consisted of compiling all mine surveys of excavated areas, then validating all triangulations, together with information of drilling plans, historic mining plans and performing a spatial reconciliation. With all compiled datasets, a wireframe of the depletion was generated.

As can be seen in Figure 15-31: Vermelhos UG Mine Depletion Wireframe**,** this depletion process was applied in the Vermelhos UG Mine where, to date, only the main Vermelhos orebodies have been mining.

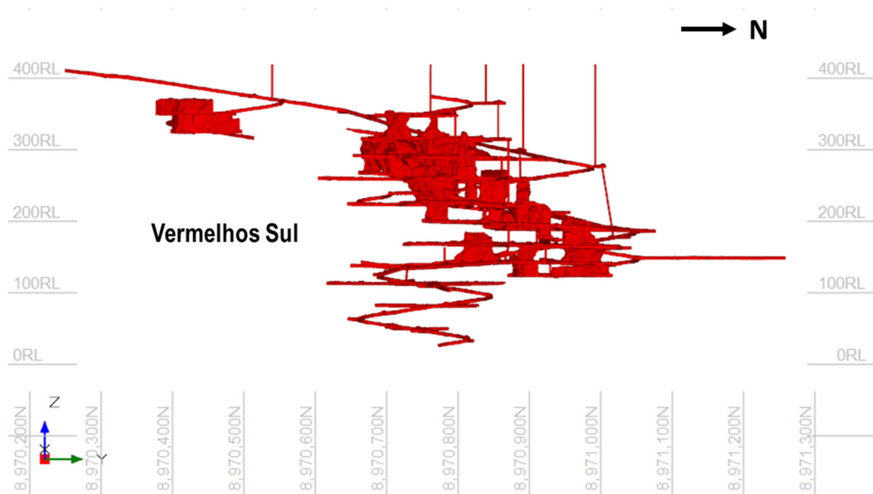


Figure 15-31: Vermelhos UG Mine Depletion Wireframe

Datamine MSO, as well as the SO modules included in the DESWIK design software were used to determine potential mining inventories and deposit continuity for the defined COG of the Vermelhos UG Mine. Software packages were used to determine practical mining shapes in all areas of the mine.

The software runs were performed using only Measured and Indicated resources and included an allowance for external dilution. Inferred resource grades were set to zero within MSO. The stope optimization was performed using all available Measured and Indicated mineral resources as defined within the resource block models after the application of modifying factors as previously described. Where unavoidably mined, Inferred resource blocks from the results of optimization were discounted using the following approach:

- Inferred resource blocks were assigned zero grade;
- If a designed stope had more than 50% of its tonnage derived from Inferred resource blocks, the stope was eliminated from the mineral reserve estimate; and,
- If Inferred resource blocks were unavoidably included in a stope design and were less than 50% of the designed stope grades tonnage, they were only included in the mineral reserve estimate if the total stope grade was above COG.

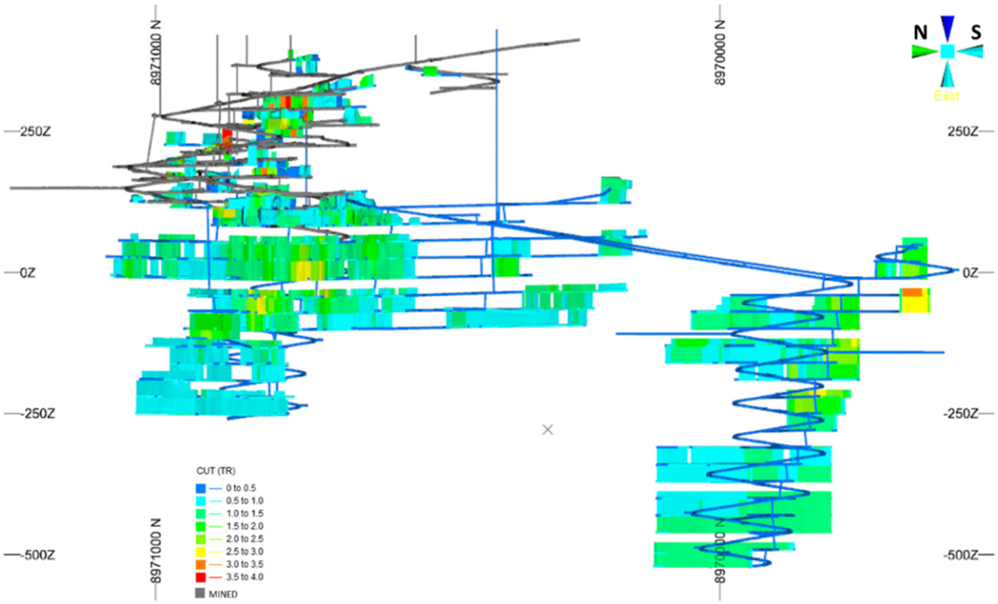


Figure 15-32: Vermelhos UG Optimized Stopes detailing average planned copper grade per stope

15.3.3.2 Vermelhos UG Mine Design

After completion of the SO runs, the Studio UG module of Datamine software was used to perform detailed design of the Vermelhos UG Mine mineral reserves. Mineral reserves for the Vermelhos UG Mine were divided into two primary mine planning areas given the nature of the operations and the planned development to extract the East Zone as currently envisioned. The mineral reserves are based upon the Measured and Indicated mineral resources in Vermelhos UG Mine design. The mineral reserve estimate considered the technical and economic parameters needed to define the stopes and mining development, as previously outlined.

Considering the geological and geotechnical characteristics of the deposit, the recommended mining method for the Vermelhos UG Mine is sub-level open stoping ("SOS") method, with rock-fill being used to fill previously mined stopes.

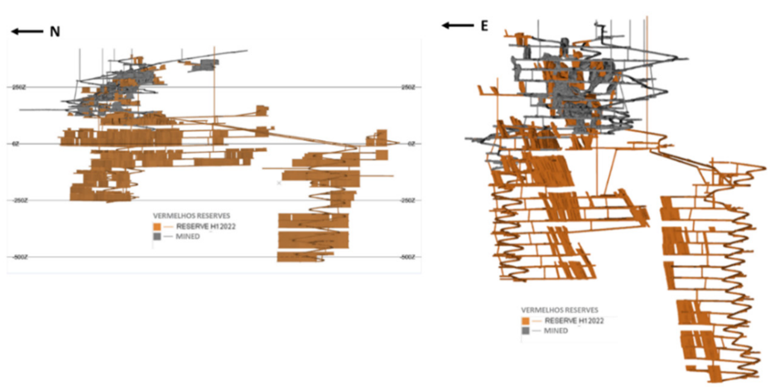


Figure 15-33: North-South schematic profile of the Vermelhos UG Mine (Ero Brasil, 2022)

15.3.4 Surubim Mine, Underground Production

The mineral reserves for the underground portion of the Surubim Mine emerged as an opportunity to recovery identified mineral resources at the bottom of the Surubim open pit. The mineral reserves have been designed as an underground project made up to one production stope and two transport levels for development. The mining method chosen was SOS. The reserve was estimated considering the technical and economic parameters needed to define the stopes.

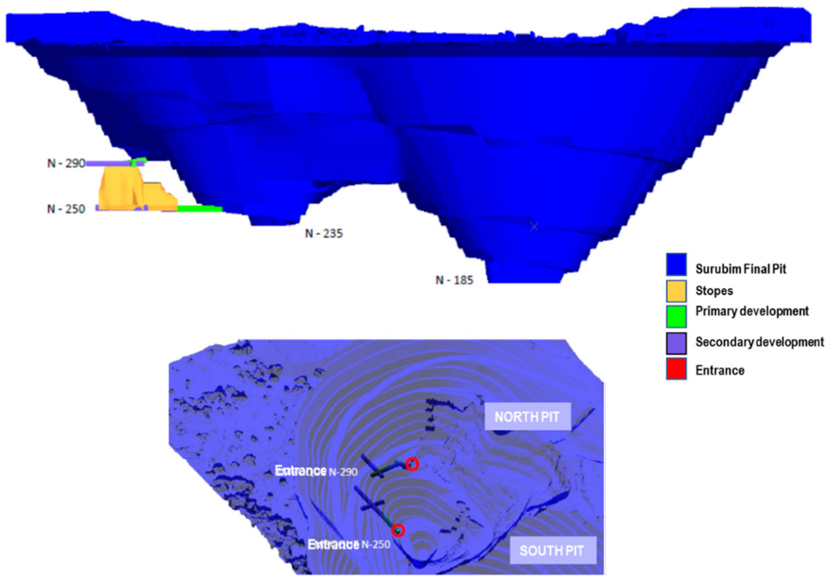


Figure 15-34: Long-Section and plan-view of the Surubim UG Mine Mineral Reserve

(Ero Brasil, 2022)

As the development and production levels reflect only a single operating stope, the underground contribution the Surubim Mine's mineral reserves, contributions from both open pit and underground mining methods have been combined into the current mineral reserve estimate for the Surubim Mine.

15.3.5 Modifying Factors, UG Mineral Reserves

The modifying factors considered for the mineral reserve estimation of the Pilar UG Mine, including the Deepening Project and Project Honeypot, the Vermelhos UG Mine and the Surubim UG Mine include operational dilution, mining recovery and metallurgical recovery.

For the Pilar UG Mine modeled stope dilution from a geotechnical viewpoint was estimated using the equivalent linear over-break slough ("ELOS") method (after Clark and Pakalnis, 1997) based on design stope dimensions. The ELOS method is influenced by the rock mass condition of an unconfined stope wall, induced stresses, joint orientation and stope orientation for a given volume. Dilution was estimated in Studio UG Datamine software and in Deswik software, incorporating an additional 1.0 m in the hanging wall and 1.0 m in the footwall. Dilution envelopes considered grades from the mineral resource block model. This type of dilution is associated with excessive overbreak due to sub-optimal operational practices related to drilling and blasting procedures.

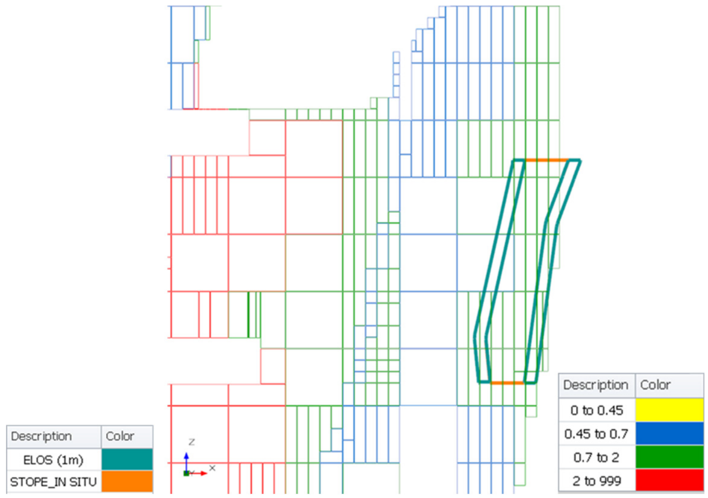


Figure 15-35: Cross section shows 1m in the hanging wall and footwall in Pilar UG Mine (Ero Brasil, 2022)

For Vermelhos UG Mine and underground portion of the Surubim Mine, SOS, the mining method currently in use at Vermelhos, was considered. Application of the method is based upon considerations of dip, plunge and thickness of the orebodies, RQD and overall competence of the host rock. Variations of this method are in use within the central high-grade area of the Vermelhos UG Mine for the maximum possible recovery via introduction of cemented rockfill matrix filling (“CRF”) which enables the recovery of secondary stopes.

Overbreak occurs during the drilling and blasting stages through the mine operation. This factor can be influenced by geotechnical structures (failures, fractures in the rock mass), drilling deviations, explosive action during blasting or imperfections in the execution in the drill and blast design. Within the overbreak volume there is mass of waste and mass of mineralized material. The portion of waste material included within the overbreak is called the operational dilution. In 2022, a dilution model utilizing a marginal cut-off grade, was developed and incorporated into the mine planning stage of the current mineral reserve estimate and LOM production plan.

Underbreak, also called ore loss, is caused when the blasting efficiency is low, drilling is not accurate (length and deviation) and/or imperfections exist within the drill and blast design. The load-haul-dump machine (LHD) will have difficulty mucking the stope corners and near the walls, particularly under remote control operation. The inverse calculation of the underbreak is called mining recovery (100% - underbreak%). 5% underbreak (95% of mining recovery) was applied for the mineral reserve estimate for the Vermelhos UG Mine and the Surubim Mine while 4% underbreak (96% of mining recovery) for the Pilar UG Mine and Deepening Project was applied based on operational performance. For Project Honeypot and other Upper Areas of the Pilar UG Mine, where the projected stopes will be in direct contact with previously extracted historic stopes, a mining recovery factor of 90% was used. The figure below shows an Example of overbreak and underbreak in Vermelhos UG Mine.

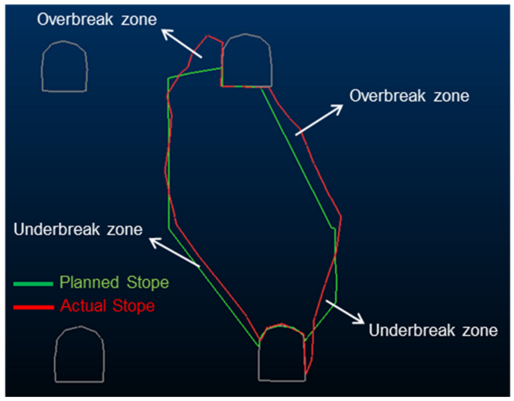


Figure 15-36: Illustrative example of overbreak and underbreak within the Vermelhos UG Mine (Ero Brasil, 2022)

The table below summarizes the dilution and mining recovery modifying factors applied for the Pilar UG Mine, the Deepening Project within the Pilar UG Mine, Project Honeypot and the Upper Areas of the Pilar UG Mine, the Vermelhos UG Mine and the Surubim Mine.

Table 15-14: Dilution and Mining Recovery - UG Mines

Projects	Dilution (%)	Mining Recovery (%)
Pilar UG Mine	27 (avg)	96
Deepening Project - Pilar UG Mine	23	96
Project Honeypot & Upper Areas - Pilar UG Mine	32 (avg)	90
Vermelhos UG Mine	10	95
Surubim Mine	10	95

Metallurgical recovery curves as a function of grade were used to estimate recoveries for underground mines within the Caraíba Operations, as outlined in Table 15-15 and shown graphically in Figure 15-37, consistent with the approach in prior mineral reserve estimates undertaken by the Company. Additional information regarding metallurgical testing and recoveries can be found in Chapter 13 of this Report.

Table 15-15: Metallurgical Recovery by District

CuT (%)	Vermelhos (North) District	Surubim (Center) District	Pilar (South) District	Blended (with Hig Mill)
0.30	85.70	80.14	83.65	84.30
0.40	86.71	81.80	84.82	85.52
0.50	87.50	83.10	85.72	86.46
0.60	88.14	84.18	86.46	87.23
0.70	88.68	85.11	87.09	87.89
0.80	89.15	85.92	87.63	88.45
0.90	89.57	86.64	88.11	88.95
1.00	89.94	87.29	88.53	89.39
1.10	90.27	87.88	88.92	89.80
1.20	90.58	88.42	89.27	90.17
1.30	90.86	88.92	89.60	90.50
1.40	91.12	89.39	89.90	90.82
1.50	91.36	89.83	90.18	91.11
1.60	91.59	90.24	90.44	91.38
1.70	91.80	90.63	90.69	91.64
1.80	92.00	91.00	90.92	91.88

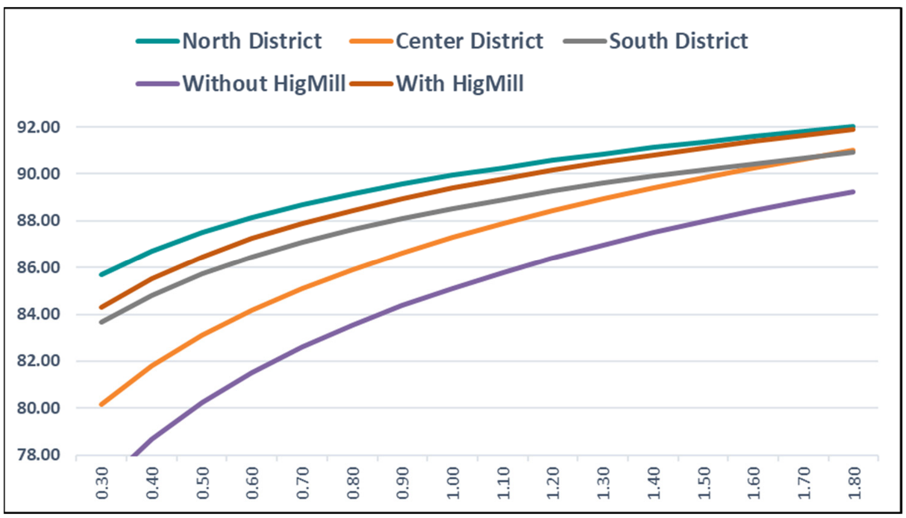


Figure 15-37: Metallurgical recovery curves as a function of grade Cu (%) (Ero Brasil, 2022)

Based on the curves and expected average grade for each underground mine within the Caraíba Operation, the following metallurgical recoveries were applied for the COG calculation.

Table 15-16: Underground Metallurgical Recovery Summary

Project	Grade (%)	Metallurgical Rec (%)
Pilar UG	1.60	90.44
Vermelhos UG	1.30	90.86
Surubim UG	0.90	86.64

The authors of this Report note that the forecast increase in metallurgical recoveries applied in the LOM production plan as a result of the recently commissioned HIG Mill were considered when estimating the current mineral reserves.

Other modifying factors considered in the determination of the mineral reserve estimate include:

- Maximum underground stope dimensions based on geotechnical assessments from previous studies and past operating experience within each mining area, combined with evaluation of induced stresses and the RMR.
- VRM method with cemented paste fill was selected for the Pilar UG Mine, where the method is currently in use.
- Within designed stopes, all contained material was assumed to be mined with no selectivity. Inferred mineral resources, where unavoidably included within a defined mining shape have been included in the mineral reserves estimate at zero grade. Mining dilution resulting from Measured and Indicated blocks was assigned the grade of those blocks captured in the dilution envelope using the current mineral resource estimate.

15.4 QUALIFIED PERSONS OPINION

The QPs responsible for the current mineral reserve estimate are Dr. Beck Nader of BNA, and Alejandro Sepúlveda from NCL SpA.

The QPs have checked the data used to construct the current mineral reserve models and considers the models to be suitable to support advanced mining studies and the current mining operations as currently envisioned.

BNA and NCL SpA supervised and validated the current mineral reserves estimate prepared by Ero Brasil through comparative estimates and validation tools. Comparative estimates were prepared from the open pit and underground stope optimization, and tonnage reports for cross-checks.

The QPs have not identified any metallurgical, infrastructure, permitting, legal, political, environmental, title, taxation, socio-economic, marketing, or other relevant factors that could materially affect the potential development of the stated mineral reserves.

Dr. Beck Nader of BNA and Alejandro Sepúlveda from NCL SpA are of the opinion that the mineral reserve estimation has been performed to industry best practices and conform to the requirements of the CIM Standards and CIM Guidelines.

16 MINING METHODS

This chapter presents the mining methods selected for the determination of mineral reserves and the LOM planning efforts for the Pilar UG Mine, Vermelhos UG Mine, Surubim Mine as well as open pit mines, including N8, N9, N5 (Siriema), C12 and Suçuarana. The geotechnical considerations and parameters, as well as the regional hydrogeological considerations relevant for the extraction of the mineral reserves, are also presented.

Please refer to Chapter 15, Mineral Reserve Estimates, for dilution, mining recovery and other relevant modifying factors applied to each of the mining operations and described in greater detail below.

16.1 PILAR UG MINE

Underground mining operations within the Pilar Mine have been active for approximately 34 years. The mine currently produces an average of 5,600 t/day and approximately 1,400 meters per month of development is expected starting in 2023 (average of 16k m/year) for the next 5 years.

The Pilar UG Mine is divided into eight main zones from a mine planning perspective: Deepening Project (or locally referred to as the Deepening Below L-965), Deepening Above L-965, Baraúna, MSBSouth, P1P2NE/R22UG, P1P2W, MSBW and, for 2022 mine planning, Project Honeypot & the Upper Areas. Figure 16-1 shows a North-South longitudinal section of the Pilar UG Mine.

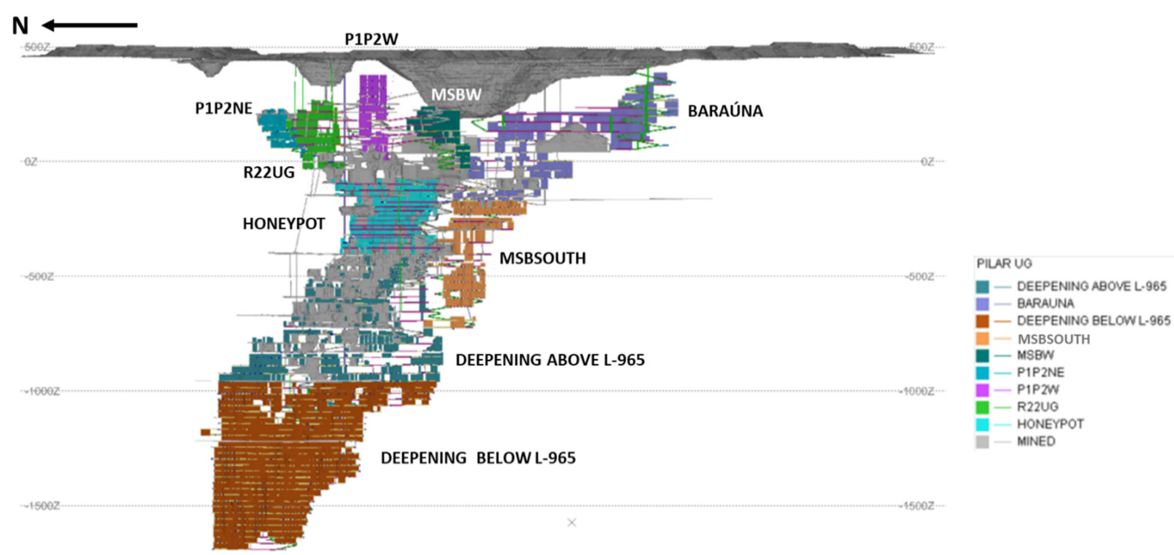


Figure 16-1: Pilar UG Mine long-section showing planned stopes by mining zone (Ero Brasil, 2022)

16.1.1 Mining Methods, Pilar UG Mine

The Pilar UG Mine has previously employed the following mining methods: Sublevel Stoping, VRM and Vertical Crater Retreat ("VCR"). VRM is the method currently employed, whereby ore is removed from the stope after it is blasted, and cemented paste backfill is pumped into the mined stope void to ensure geotechnical stability prior to advancing to adjacent stopes.

The mining method selection is heavily influenced by the deposit type and rock mass characteristics. Other factors influencing the selection process are the proximity of the resource to surface, the nature of the surface topography, the strength of the deposit and host rock, the configuration (i.e., shape, dimensions, and dip) of the deposit, the resource being mined, the required selectivity, productivity and overarching safety considerations.

To determine a safe and economically viable means of mining, several factors are taken into consideration by Ero Brasil. The factors considered for mining each of the deposits within the Caraíba Operations are listed below.

- Deposit shape, continuity, dimensions, and inclination;
- Depth below surface and mine access;
- Topographical features and constraints;
- Rock mass characteristics including groundwater hydrology;
- Mining methods and ground control;
- Production capacity and scheduling;
- Material handling and mechanization;
- Mine ventilation; and,
- Underground services and support infrastructure.

The VRM method currently in use varies in dimensions, with an average stope height of 35m. The majority of production drilling is performed using a Fandrill with 3½" diameter hole. The holes of the free-face are widened to approximately 8" in diameter as shown in the figure below.

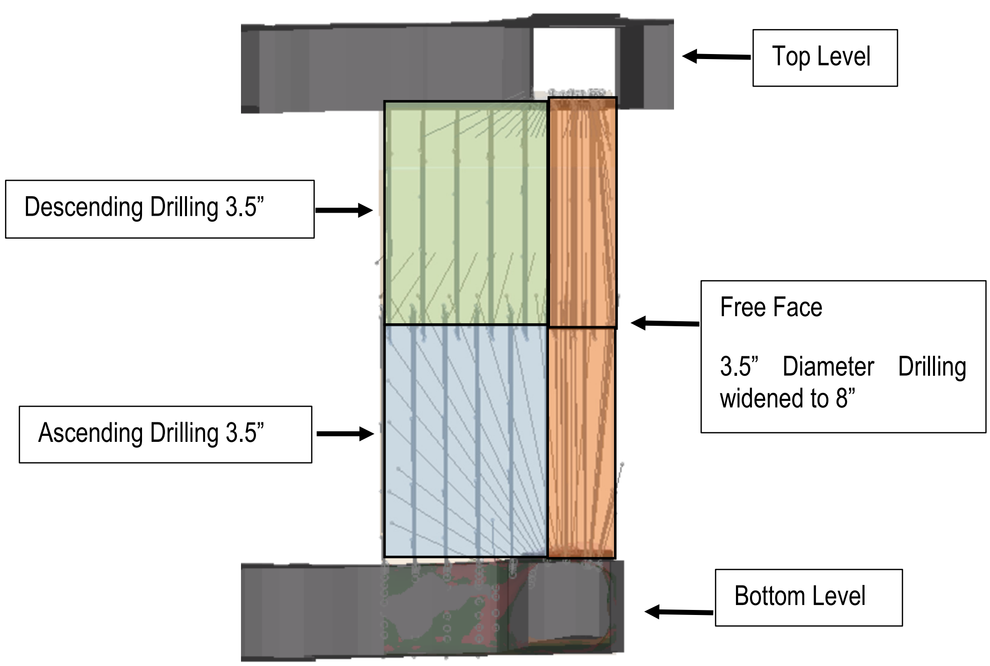


Figure 16-2: VRM variant method schematic (Ero Brasil, 2022)

Design dimensions of each stope vary according to the modeled geotechnical conditions based upon calculated induced stresses and defined rock mass classifications within the areas of development. While locally variable, on average, stope parameters can be described as having the following dimensions:

- In non-faulted zones: 10m width x 20m length x 35m height; and
- In fault zones, the size of stopes is reduced to 10m width x 15m length x 35m height.

For the Deepening Project the same mining method will be employed as the rest of the Pilar UG Mine. A panel height reduction from 35m to 26m will be applied to improve mining recovery and reduce dilution. The mining sequence will be divided based upon the presence of both narrow and thick stopes within the mine design. Longitudinal will be applied to narrow stopes (shown in blue below) and transverse will be applied to thick stopes (shown in red below). The planned modifications to the mining sequence and stope design for the Deepening Project is expected to provide less overbreak and dilution, enhance the stability of the operation and improve mining recovery.

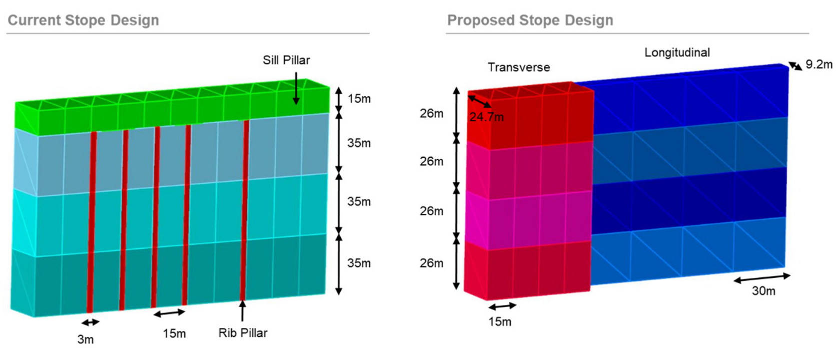


Figure 16-3: Proposed Mine Design for the Deepening Project (Ero Brasil, 2022)

The Pilar UG Mine ramp development utilizes a maximum design grade of 15% and 25m radius on center. Ramp design targets an average distance of 20m from the ramp to ore gallery access to limit access development requirements.

Gallery access design dimensions of 5.0m x 5.5m are employed due to the size of the equipment operated by the Caraíba Operations and the infrastructure necessary for further development of the galleries (ventilation ducts and production equipment access). Production gallery design dimensions are 4.5m x 4.8m. Transport cross- cuts are located at an average distance of 30m to 35m from the orebody and are made parallel to the mineralized zone.

Currently, all ore extracted in the underground mine area (except ore from the near-surface production levels, which are hauled to surface) is directed to the -78 level where it is discharged into an ore pass. After crushing in one of the two primary jaw crushers, the crushed material is transported by conveyor to an intermediate ore silo connected to the shaft hoisting system.

The material (ore and waste) produced from the Deepening Project will be directed to a new external vertical shaft, that will connect the underground mine at the level -1,075 to the surface. The new transportation shaft will be commissioned in 2026. Please refer to Chapter 18 of this Report for additional details on the installed infrastructure and new external shaft construction.

A center-out mining sequence and a pyramidal shape from bottom to top has been applied for the Pilar UG Mine Deepening Zone. The sequence leaves no secondary stopes and avoids high stress concentrations, as shown in the figure below.

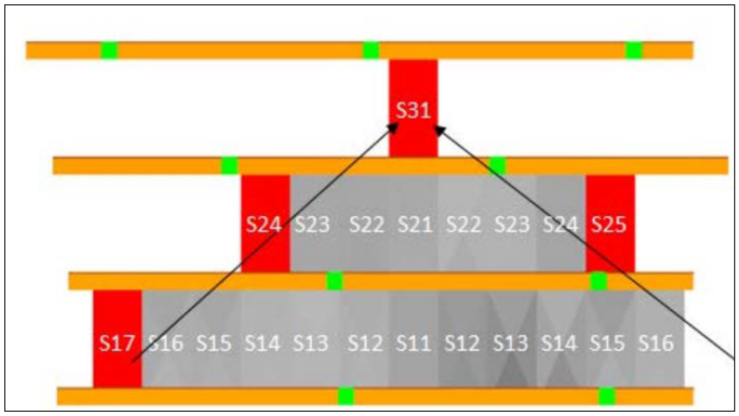


Figure 16-4: Center-out mining sequence (Ero Brasil, 2022)

For the other areas in Pilar UG Mine, a primary-secondary stope sequence is applied. All stope excavations are backfilled with cemented paste or rockfill. With the exception of the planned stopes within P1P2NE that will use waste rock for backfill, all areas are designed to use cemented paste as the main backfill system.

Paste fill uses a combination of flotation tailings and cement, which is used to fill mined out stope volumes to provide additional support, reduce in-situ stresses and increase mining recoveries. Paste comprised of thickened tails and approximately 4% cement by weight and is gravity fed from the paste fill plant to the underground workings as required for in the production sequence.

The waste rock used for backfilling, where required, is generated by the horizontal development from the Pilar UG mine.

16.1.1.1 Pilar UG Mine: Project Honeypot & Upper Areas

Design considerations have applied available models and operational experience across the different sectors within Project Honeypot and the Upper Ares of the Pilar UG Mine. The following summarizes those design considerations:

- Mineralized zone dimensions: The zones generally strikes north-south, with a near vertical dip and plunges towards the west. It is approximately 950 m in length along strike, 5 m to 42 m in width and extends vertically for over 730 m.
- Geotechnical considerations: Rock mass characteristics were considered for mining method selection, excavation sizing and ground stability. Rock mass conditions within the surrounding host rock and designed stopes are qualified as good to very good rock with occasional fault zones qualified as poor rock.
- Mining method considerations: underground mining method selection must be safe and productive. It must also provide flexibility in terms of production capacity and be cost effective. It must provide long term support to the rock mass to maximize resource extraction.
- Production Capacity: A function of the geometry and size of the deposit, mining method and geotechnical constraints.
- Materials Handling: Materials handling and mechanization are related to the depth of the deposit below surface, the productive capacity required, and the degree of labor efficiency needed. The existing materials handling system is composed by a trucking ramp with an underground crusher at -78L and a hoisting shaft from this elevation to surface. A new shaft is being constructed from surface, reaching to the -1,075L and will serve the Deepening Project.

- Ventilation – Mine ventilation requirements are a function of the production capacity, amount of mechanization, mining method and deposit depth. Brazilian regulations have been used to prepare the ventilation design criteria. Additionally, a key design constraint was that Project Honeypot & Upper Area ventilation system must not interfere the Deepening Project ventilation.
- Cooling – 15Mw of Refrigeration has been provided in the mine to ensure working areas can be cooled to levels acceptable by Brazilian Regulations.
- Other Underground Services – Underground services and infrastructure needed to support development and mining activities include provisions for dewatering, power distribution, compressed air distribution, process water distribution, backfill distribution, maintenance facilities, storage, safety facilities and materials handling.

For Project Honeypot and the Upper Areas of the Pilar UG Mine, fully supported and artificially supported mining methods are geomechanically applicable. In general, unsupported or mining methods such as sub-level or blast hole mining, while being more productive than more selective cut-and-fill methods considered, result in lower resource recovery. To ensure stability of the stopes, stope sizes were selected based on the overall strength of the rock mass. Weaker rock masses support smaller excavations than stronger rock masses, while large stope dimensions were considered in order to optimize productivity and economics. Due to the nature of the development cycle in cut and fill mining, the quantity of ore per blast in these headings is far less than that of open stopes.

Other mining methods, such as stope-and-pillar and room-and-pillar in which excavations are left open after mining, were excluded from further consideration due to the thickness of the mineralized zones within the Pilar UG Mine. Stopes must be backfilled to ensure long-term stability of the mine, safe extraction and to maximize recovery of the mineral reserve.

The recommended mining method for the good to very good ground conditions within the Pilar UG Mine, and Project Honeypot specifically, is open stope blast hole stoping, with delayed fill. In practice, this mining method is applied either transverse or longitudinal to the deposit.

The mine layout considered that Sector 1 and Sector 2, the two primary production areas, already have primary accesses via the main ramp of the Pialr UG Mine, new development will be necessary for haulage drifts and to replace some ventilation connections and raises. While in practice, development into many of the areas has previously been completed, all LOM planning by Ero Brasil assumes that new development will be required to access mining stopes, as demonstrated in the following figures.

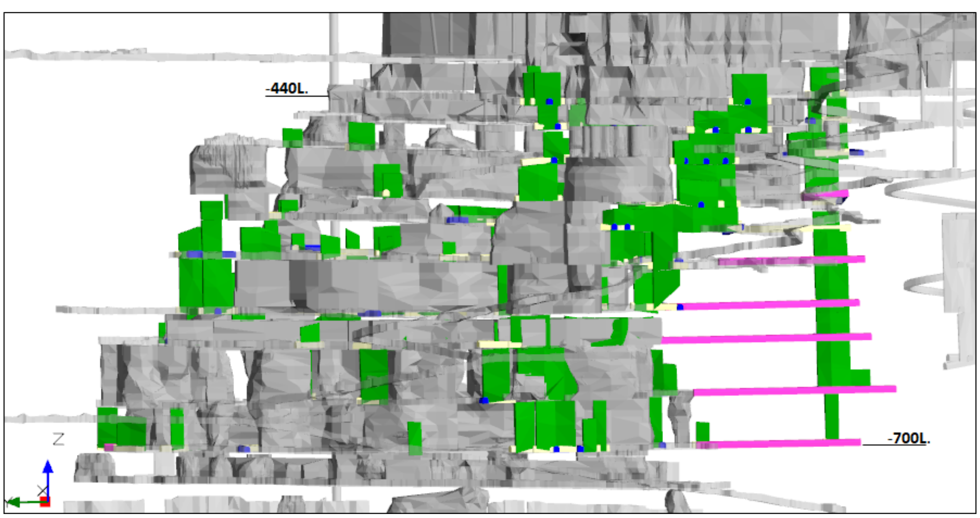


Figure 16-5: Honeypot & Upper Areas Sector 1 - General Layout (Ero Brasil, 2022)

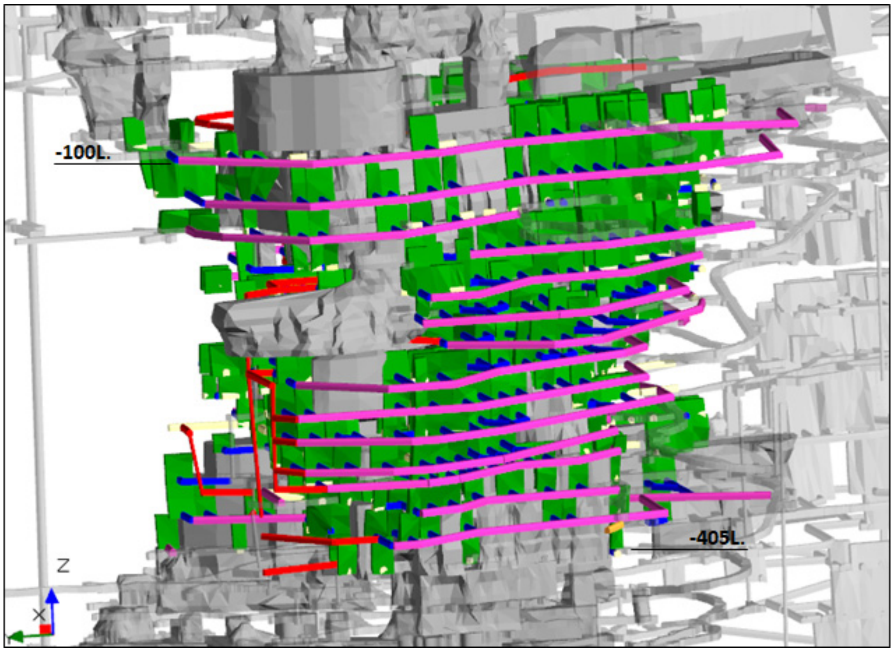


Figure 16-6: Honeypot & Upper Areas Sector 2 - General Layout (Ero Brasil, 2022)

The Baraúna zone will have an independent access through a new ramp from surface with about 2.3 km length. An internal ramp will connect the production levels. Independent exhaust ventilation raises will also be built. The layout for Baraúna is presented in Figure 16-7.

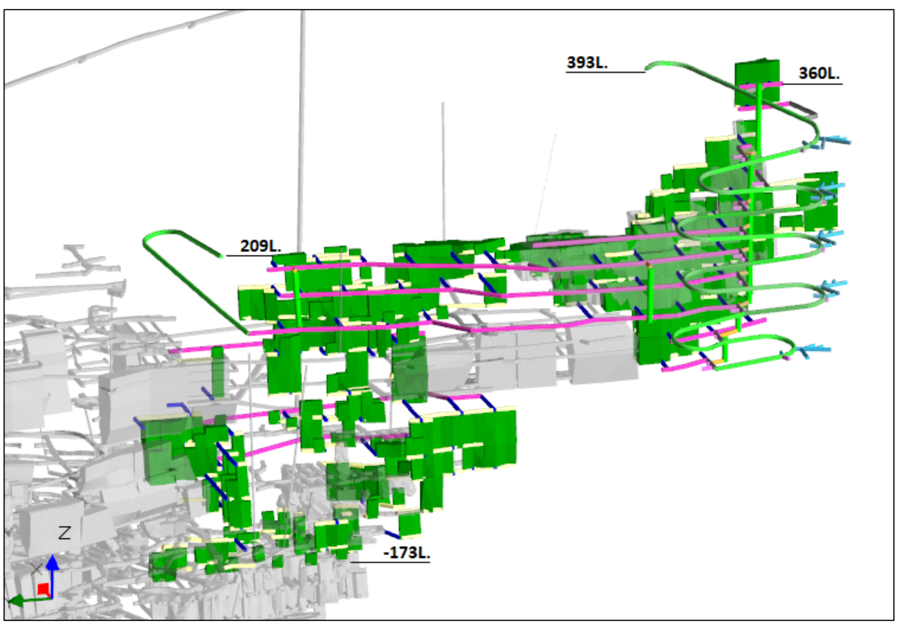


Figure 16-7: Honeypot & Upper Areas Baraúna Layout (Ero Brasil, 2022)

R22 and P1P2 areas within the Pilar UG Mine will use old accesses to get to the production area. Internal ramps will be constructed to access the different production levels. This is shown in Figure 16-8.

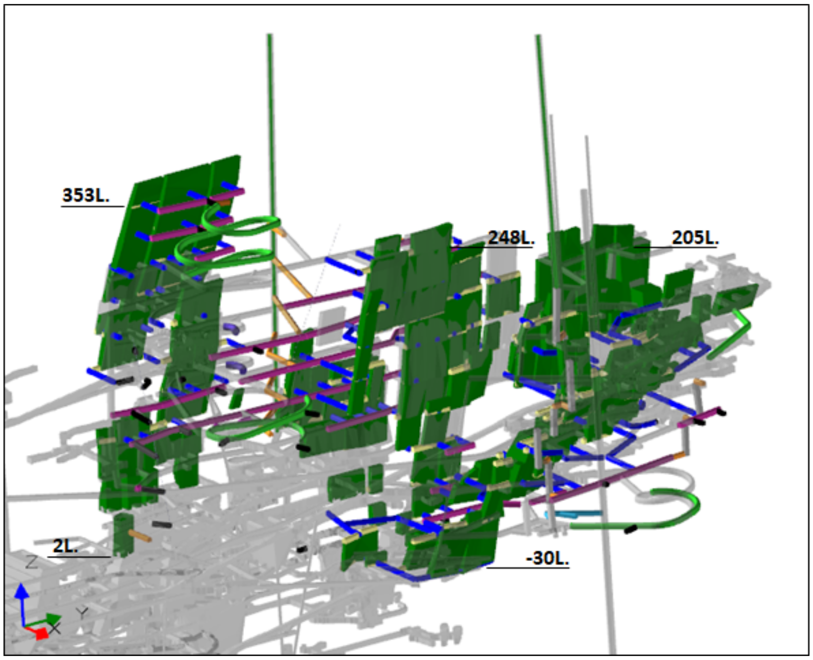


Figure 16-8: Honeypot & Upper Areas P1P2 and R22 Layout (Ero Brasil, 2022)

The MSBW mining area will use the existing decline for access. A connection ramp between production levels will be constructed. The layout for this mining area is presented in Figure 16-9.

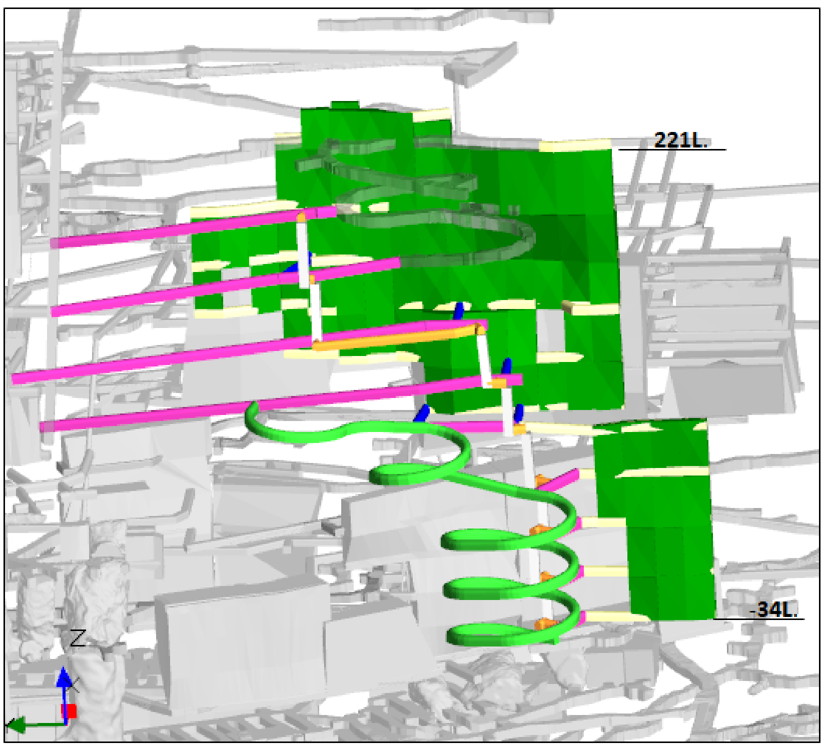


Figure 16-9: Honeypot & Upper Areas: MSBW Layout (Ero Brasil, 2022)

The proposed materials handling system for Honeypot & each of the Upper Areas will use three main different systems (Figure 16-10):

- Existing crushers and shaft system at -78L will be used by Sector 1, Sector 2 and P1P2N. New ore and waste silos will be constructed to support an increase in mine production. There is enough capacity at this system to crush and hoist material as envisioned in LOM planning.
- The new external shaft at -1075L will be used by Sector 1 once completed.
- Ramps to surface will be used by Baraúna, MSBW, P1P2N.

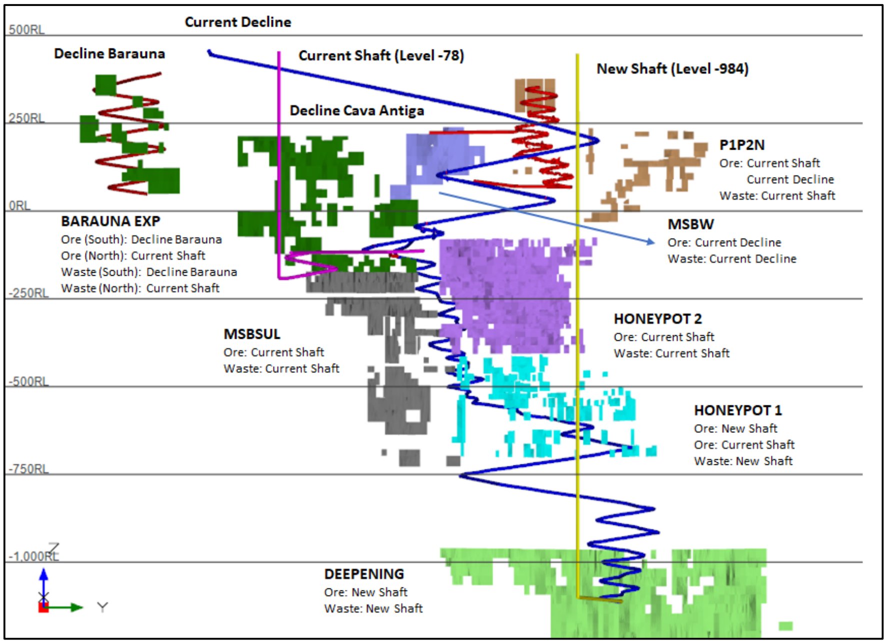


Figure 16-10: Proposed Materials Handling System for Honeypot & Upper Areas (Ero Brasil, 2022)

The mine ventilation system for the mine was designed for maximum global airflow requirements for the mine (excluding the upper part of Baraúna) at a peak of 1,096 m^3/s for 2030. Maximum ventilation air requirement for Baraúna is 172 m^3/s in 2031. The ventilation system for LOM will consist of the following. A complete schematic of the ventilation infrastructure of the Pilar UG Mine can be referenced in Chapter 18 of this Report.

- The reopening of levels to allow mining at Sector 1 and Sector 2 within the Pilar UG Mine has the potential to cause airflow short circuits affecting the Deepening Project ventilation system. A bypass of the Deepening exhaust circuit through the old pit was selected as the best option to avoid impacting the Ventilation and Cooling system of the Deepening Zone.
- Sector 1 will exhaust air by existing vent raises: P1, P2 and P3.
- The existing ventilation system at Sector 2 will be affected by mining of new stopes. Fresh air will enter via ramp and the existing shaft, a new exhaust air system will be constructed to exhaust air to surface via the historic open pit.
- Baraúna extension will require new exhaust raises to Poço Central and connections to P5. Fresh air for the new areas will enter via the Baraúna ramp and a new access ramp from the historic open pit.
- Fresh air will enter into P1P2 via a new intake raise and air will be exhausted via a new ventilation raise.
- Fresh air will enter to P1P2W/R22 area through the ramp. Exhaust air will be via P4 and a new raise to be built. A by-pass connecting P1P2NE with P1P2W will be constructed.

- The intake connection system for Sector 5 will use the P1P2W fresh air through horizontal connections. The exhaust air will be discharged via P4.
- The proposed solution for ventilation within the MSBSUL mining area contemplates fresh air entering via the ramp and exhausting via Poço Central and Sector 3 exhaust system.
- New main fans need to be installed to satisfy the LOM mine ventilation requirements. Please refer to Chapter 18 for detail on sizing and upgrades.

16.1.2 Mine Development & Pastefill Schedule, Pilar UG Mine

To meet the production plan targets, the following development rates are planned from 2023 to 2039 for the Pilar UG Mine. In total, the production plan calls for approximately 201,150m of development, including ramp, horizontal access development and vertical development. Horizontal development, vertical development and pastefill requirements are presented in the subsequent tables.

Table 16-1: Pilar UG - Horizontal development schedule

Year	Horizontal Development (m)
2023	15,772
2024	16,633
2025	15,966
2026	15,881
2027	17,808
2028	17,714
2029	17,747
2030	18,086
2031	17,654
2032	10,455
2033	10,320
2034	8,835
2035	5,686
2036	324
2037	79
TOTAL	**189,560**

Table 16-2: Pilar UG Mine - Vertical Development

Vertical Development (m)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	Total
Exhaust Raises	856	598	571	287	202	450	372	350	584	168	48	36	4,522
Ventilation Raise Borer - Pilot	2,473	796	91	365	109	-	103	108	75	-	-	-	4,120
Ventilation Raise Borer - Enlarged	1,651	1,041	96	330	144	-	103	108	75	-	-	-	3,548
TOTAL	**4,980**	**2,435**	**758**	**982**	**455**	**450**	**578**	**566**	**734**	**168**	**48**	**36**	**12,190**

Table 16-3: Pilar UG - Pastefill Schedule

Year	Total Pastefill (tonnes)
2023	512,328
2024	1,537,018
2025	1,345,586
2026	1,248,366
2027	1,595,236
2028	1,513,869
2029	1,647,280
2030	1,737,274
2031	1,352,521
2032	1,450,908
2033	1,435,548
2034	1,658,399
2035	1,538,612
2036	1,506,776
2037	1,264,380
2038	696,274
2039	107,408
Total	**22,147,783**

16.1.3 Mine Fleet, Pilar UG Mine

The equipment of the mining fleet that will be used in support of mining activities within the Pilar UG Mine are listed below. The Baraúna mining fleet will be operated in parallel with that of the Pilar UG Mine given the satellite nature of the mining area. Replacement of equipment at the end of each equipment's useful life and increases to the existing fleet in support of the LOM production plan are captured in the capital expenditure totals included in this Report.

Table 16-4: Pilar UG Mine (excluding Baraúna) - Mine Equipment

Equipment	Primary Function	Quantity
Jumbo	Horizontal Drilling	6
Cubex	Vertical drilling	3
Cabolt	Cable bolting	3
Fandrill	General drilling	5
Rockbolt	Rock support	8
Scaler	Scaling	7
Shotcrete Launcher	Shotcrete transport	4
Shotcrete Mixer	Shotcrete application	7
LHD	Loading material	14
High Tonnage Trucks	Transport material	8
Road Truck Fleet	Transport material	25
Slot Borer	Vertical drilling	1
Total		**92**

Table 16-5: Baraúna UG - Mine Equipment

Equipment	Primary Function	Quantity
Jumbo	Horizontal Drilling	1
Cubex	Vertical drilling	0
Cabolt	Cable bolting	1
Fandrill	General drilling	2
Rockbolt	Rock support	1
Scaler	Scaling	1
Shotcrete Launcher	Shotcrete transport	1
Shotcrete Mixer	Shotcrete application	1
LHD	Loading material	2
High Tonnage Trucks	Transport material	0
Road Truck Fleet	Transport material	6
Slot Borer	Vertical drilling	0
Total		**16**

All development for the Deepening Project will be performed utilizing Ero Brasil's own equipment and personnel. Production activities will be performed using radial long-hole drills for blast holes, while the drop raises will be constructed mechanically with Slot Borer Machine. Loading (mucking) will be performed using long haul dump trucks ("LHDs") and 27 tonne conventional trucks will be used for ore haulage. Production crews will share emulsion loading vehicles for blasting of the stopes.

Loading and transportation will be done with 10 cubic yard LHDs between stopes in the production levels and stockpiles. From the stockpiles the material will be directly loaded to trucks with 10 cubic yard LHDs. Transportation to the underground crusher will be done using 27 tonne conventional trucks.

The proposed mucking/haulage fleet was selected to accommodate excavations 5.0m wide by 5.5m high. For the purposes of this Report, the existing loader and truck combination fleet type was selected for operational synergies. For waste haulage, the same trucks will be used as are currently in operation.

16.2 VERMELHOS UG MINE

The Vermelhos UG Mine is located approximately 80 km north of the Pilar UG Mine and the Caraíba Mill, and it has been in operation since 2018. The main Vermelhos UG Mine deposit remains open along strike and at depth, and Ero Brasil is actively exploring extensions of the deposit to depth, and to the south of the main Vermelhos UG Mine in an area known as the Southern Vermelhos Corridor.

16.2.1 Mining Method, Vermelhos UG Mine

The SOS method was chosen as the mining method at Vermelhos UG Mine considering the dip, plunge and thickness of the orebodies as well as the rock quality designation and overall competence of the host rock. Variations of this method are planned for the central area for maximum possible recovery using the CRF technique.

The mine design is based on current mining practice and entails mining panels of 15m to 35m, on average, in the vertical dimension without the need for rib pillars to support the open excavations. In the central and western high-grade areas (known as Toboggan and Sombrero) mining occurs using sub-horizontal stopes. In these areas, the panel size has been reduced to 25m and is filled using CRF to maximize mining recoveries and limit in-situ stresses. Panel size and thickness has been constrained by the geotechnical design parameters as determined by 2D and 3D geotechnical modeling of the stresses induced by panel excavation. The geotechnical analysis was performed by Ero Brasil's geotechnical engineering team and reviewed by the authors of this Report.

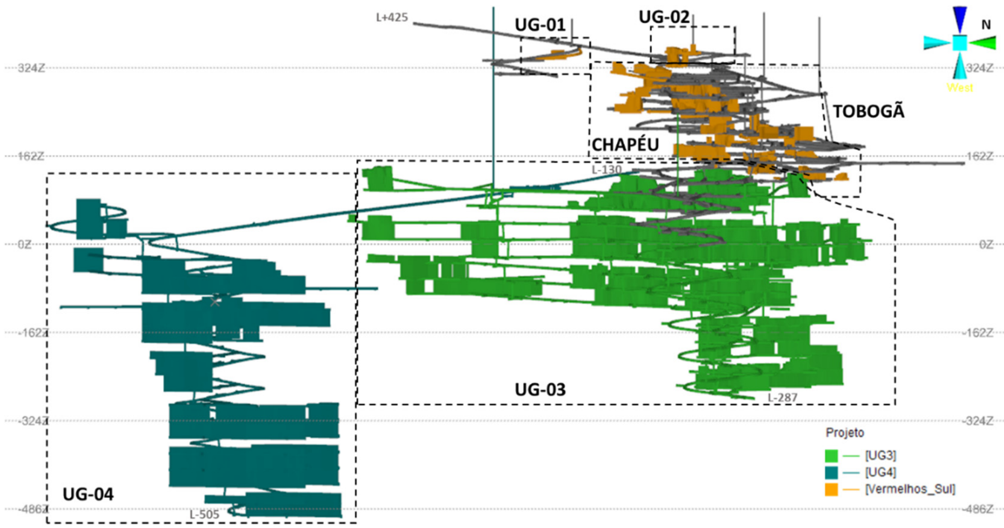


Figure 16-11: North-South schematic profile of the Vermelhos UG Mine. Colors denote mining areas (Ero Brasil, 2022)

Within the Vermelhos UG Mine, the vertical sections of the deposit typically range from 2.5m to 8.0m wide, with strike dimensions of up to 80.0m. Within the sub-horizontal high-grade portion of the deposit the dimensions are approximately 195m in length, 75m in thickness and 23m to 27m in height.

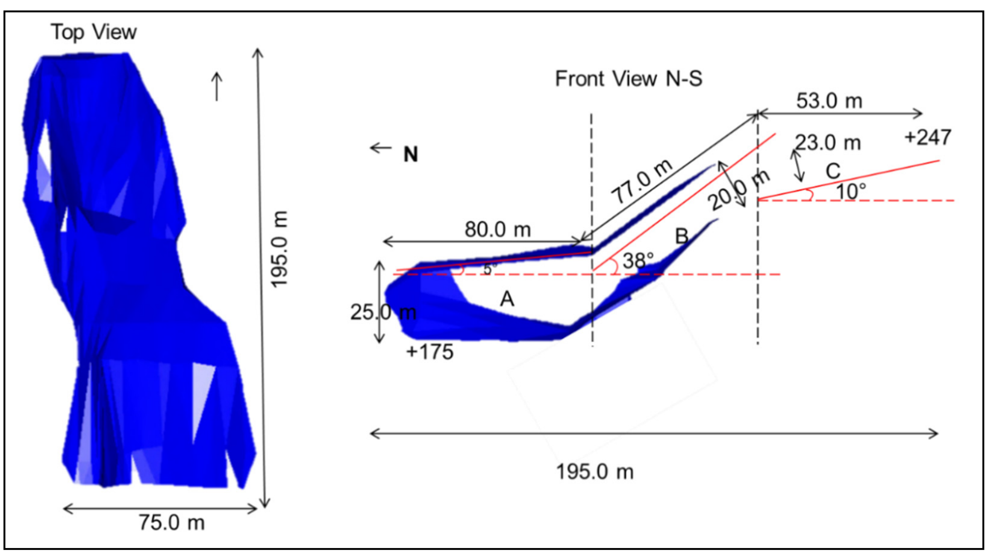


Figure 16-12: Tobogã orebody, Vermelhos UG Mine – Dimensions (Ero Brasil, 2022)

The typical dimensions of stopes within the Toboggan central zone are 15m in width in average by 25m to 30m in height by maximum of 90m in length. Stopes of the east and west vertical areas have average dimensions of 10m in width by 30m in height by 50 m in length.

The top and bottom levels are drilled within each mining panel. Drilling will be performed ascending (from the base level) 15m and descending (from the top level) 15m, with a 3” diameter radial fan pattern within the sub-horizontal stopes of the Toboggan zone. The figure below shows drilling, development and proposed mining sequence for the vertical and sub-horizontal stopes.

To enable maximum recovery of the geological resource of the Vermelhos UG Mine, CRF technique is used, whereby after primary stopes are mined, secondary stopes are mined after the CRF within the primary stope has cured. The secondary is filled on one side ensuring 2/3 of the span is closed by waste filling. An illustrative sequence is shown in the figure below.

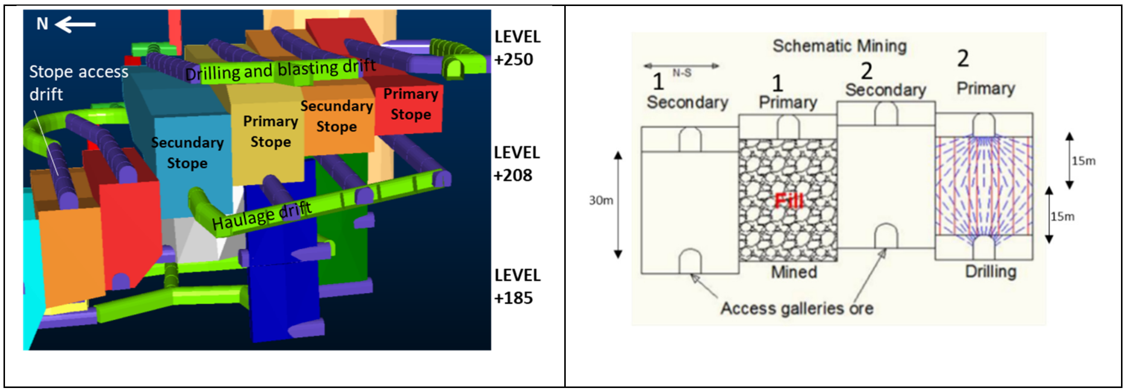


Figure 16-13: Tobogã orebody, Vermelhos South area – Dimensions (Ero Brasil, 2022)

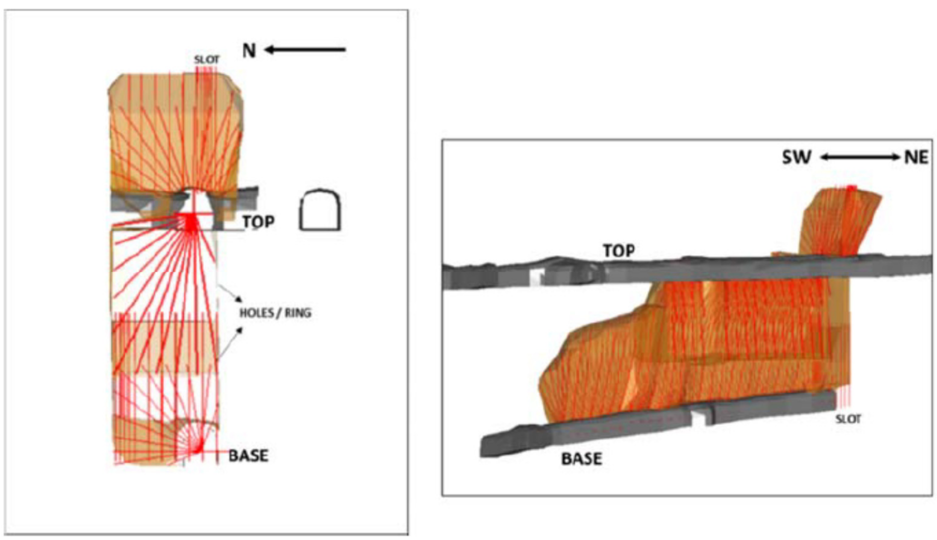


Figure 16-14: Vertical stopes - drilling design schematic in the Vermelhos UG Mine (Ero Brasil, 2022)

Similar to Pilar UG mine, the Vermelhos UG Mine ramp development utilizes the same maximum design gradiant of 15% and 25m radius on center. Ramp design targets an average distance of 30m from the ramp to ore access via galleries to limit access development meterage.

Gallery access design dimensions of 4.5m x 5.0m are employed due to the size of the equipment operated by Ero Brasil and the infrastructure necessary for further development of the galleries including ventilation ducts and production equipment access. Production galleries design dimensions are 4.5m x 5.0m. Transport crosscuts are located at an average distance of 35m from the ore body and parallel to the mineralized zone.

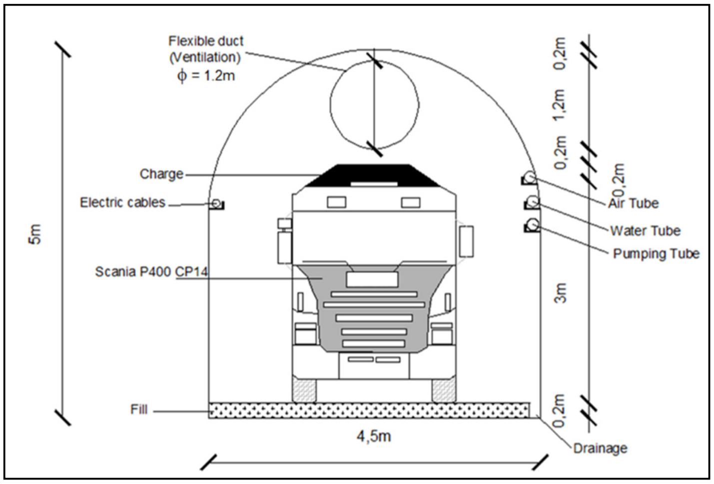


Figure 16-15: Vermelhos UG development size (Ero Brasil, 2022)

The ore production of Vermelhos UG includes two handling phases: mine-to-pile and pile-to-plant handling.

- The mine-to-pile production is carried out via the primary ramp utilizing haulage equipment, over a current average haulage distance of 2.5 km to the stockpile area on surface. The average loaded tonnage of the articulated trucks that transport ore to the surface is 25 tonnes.
- For the pile-to-plant production, 50 tonne excavators and bi-train haul trucks contracted through a third-party materials handling company are used, with an average loaded tonnage of 72 tonnes per bi-train. The distance traveled from the pile to the plant is approximately 70 km.

Rock-fill for CRF is prepared on a surface plant by crushing and mixing the waste with water and cement, and then moved from the surface to the previously mined stopes via the primary ramp by 25 tonne trucks.

The waste generated during gallery development is transported by trucks via the primary ramp to surface and disposed in the waste pile, which has a capacity of approximately 417,000 cubic meters. Most of the waste is used for the generation of gravel for the composition of CRF to fill previously mined stopes. The waste stockpile is strategically located close to the main ramp entrance, to minimize haulage distance on surface (figure below).

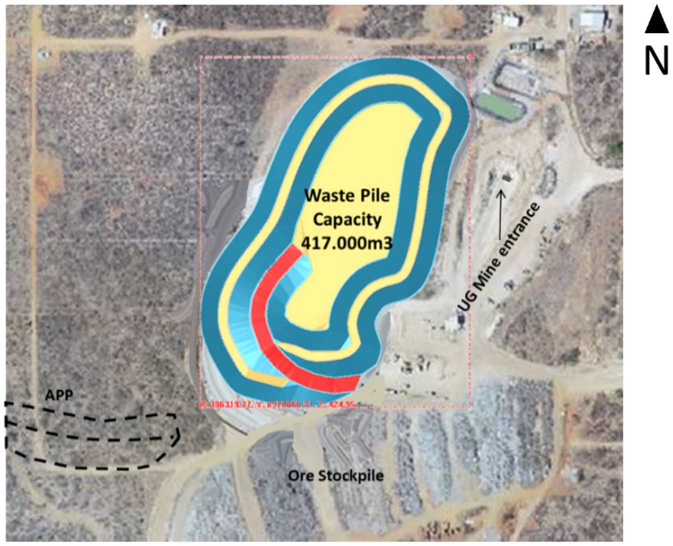


Figure 16-16: Vermelhos UG Mine Waste Pile (Ero Brasil, 2022)

16.2.2 Mine Development and Backfill Schedules, Vermelhos UG Mine

To meet the production plan targets, the following development rates are planned from 2023 to 2027 for the Vermelhos UG Mine (Table 16-6). In total, the production plan calls for approximately 50,000m of development, including ramp, horizontal access development and vertical development. Horizontal development, vertical development and CRF requirements are presented in the subsequent tables.

Table 16-6: Vermelhos UG Mine horizontal development schedule

Year	Horizontal Development (m)
2023	4,610
2024	4,553
2025	4,451
2026	4,962
2027	5,009
2028	5,035
2029	4,933
2030	4,185
2031	2,054
2032	3,909
2033	2,749
TOTAL	**46,450**

Table 16-7: Vermelhos UG Mine vertical development schedule

Vertical Development (m)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	Total
Exhaust Raises	265	107	220	120	92	295	94	115	90	91	57	1,547
Ventilation Raise Borer	92	859	413	318	332	64	0	0	0	0	0	2,078
TOTAL	**357**	**966**	**633**	**437**	**424**	**359**	**94**	**115**	**90**	**91**	**57**	**3,625**

Table 16-8: Vermelhos CRF schedule

Year	Total CRF (tonnes)
2023	578,492
2024	608,933
2025	387,139
2026	487,299
2027	370,204
2028	387,135
2029	378,992
2030	379,625
2031	378,134
2032	167,661
2033	368,674
2034	256,295
2035	110,346
Total	**4,858,929**

16.2.3 Mine Fleet, Vermelhos UG Mine

The Vermelhos UG Mine equipment fleet has been determined based on actual operating experience since commissioning of the mine in 2018 as well as achieved availabilities and useful life of the equipment within the Pilar UG Mine.

Table 16-9: Vermelhos Equipment Fleet

Equipment	Primary Function	Quantity
Jumbo	Horizontal Drilling	2
Cubex	Vertical drilling	1
Fandrill	General drilling	1
Rockbolt	Rock support	1
Scaler	Scaling	2
Shotcrete Mixer	Shotcrete application	1
LHD	Loading material	4
High Tonnage Trucks	Transport material	1
Road Truck Fleet	Transport material	11
Slot Borer	Vertical drilling	1
Total		**25**

16.3 SURUBIM MINE, UNDERGROUND PRODUCTION

Underground mining operation within the Surubim Mine reflects an opportunity to produce approximately 820 tonnes of metal in just a single operating panel and 305m of horizontal development for which strip ratios would be prohibitive to access via an open pit push-back. Underground development commenced in late 2022 and mining is expected to be completed by 2023. The Figure 16-17 shows a North-South longitudinal section of the Surubim UG Project.

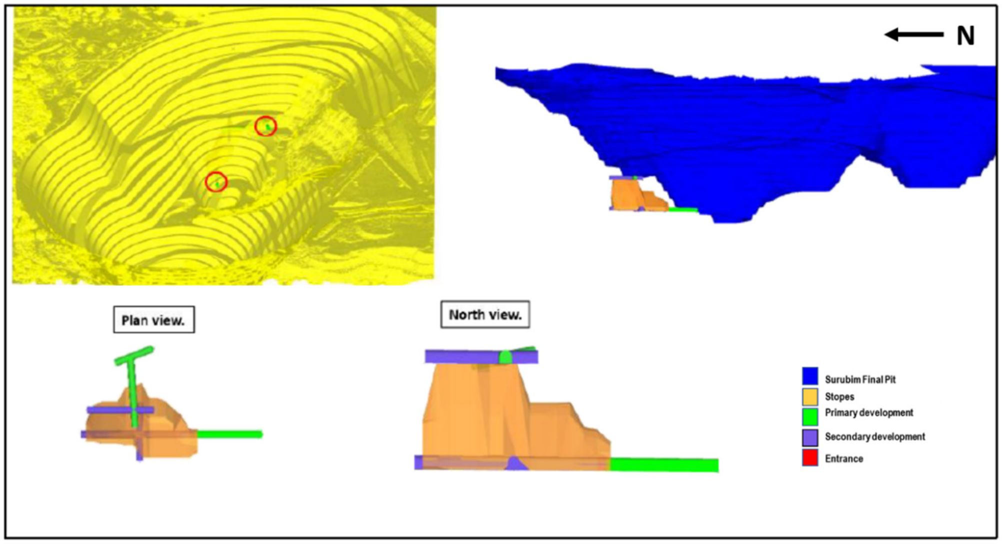


Figure 16-17: Surubim Mine long-section showing planned stopes (Ero Brasil, 2022)

16.3.1 Mining Methods, Surubim Mine

The SOS mining method was chosen to be used for Surubim underground mining. The method was based on the dip and thickness of the ore body were, as well as the rock quality and the general competence of the host rock.

The mine design provides for a single panel with an average height of 35 m without the need for rib pillars. Panel size and thickness were constrained by geotechnical design parameters determined by 2D geotechnical modeling of stresses generated by panel excavation. The analyzes were performed by Ero Brasil's geotechnical engineering team.

The upper and lower levels will be used as drilling levels. Drilling will be carried out ascending from the base level with a limited height of 15 m and descending from the top level, reaching up to 20 m of drilling. Holes with a diameter of 3.5" will be drilled in a radial pattern and the next figures show the drilling, development and mining sequence proposed for the stopes.

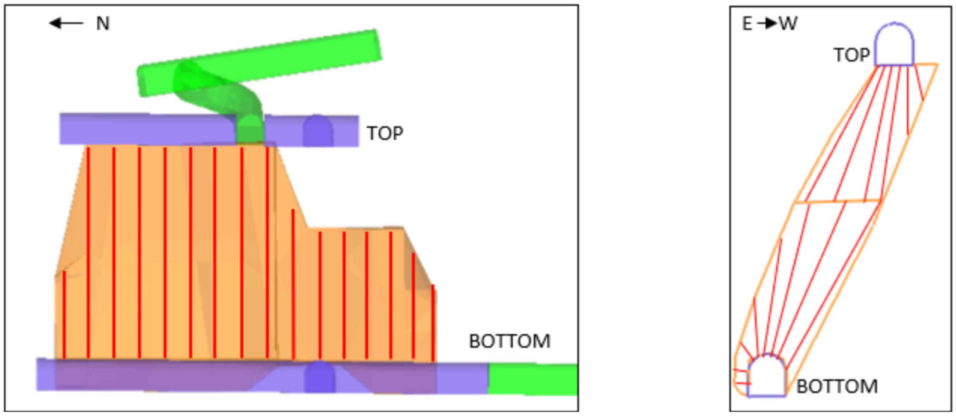


Figure 16-18: Surubim Mine underground panel in perspective and cross section (Ero Brasil, 2022)

The mine ventilation design is based on the published requirements of Brazilian regulation NR 22.24 regarding underground mining activities and necessary airflow. The ventilation designed for the development and mining of Surubim Mine was modelled based on the expected number of operators at the service front and the volume of air needed for the most restrictive activity in the cycle, which is cleaning the using diesel equipment. The dimensioned secondary fans have been specified with 200cv of power, static pressure of 3,640 Pa and flow rate of 26m³/s with a reach of 350m via ducts of 1000mm diameter. Ductwork will be responsible for conducting airflow during development of the ramp and galleries, and when mining activities.

16.3.2 Mine Development & Pastefill Schedule, Surubim UG Mine

The underground development of the Surubim Mine includes a total of 305 meters of galleries divided into two levels. The ramp design considered a maximum gradient of 15% with a radius of curvature of 25m. The dimensions of the galleries of 4.5 m x 5.0 m were selected due to the size of the equipment operated by Ero Brasil and the infrastructure necessary for the development of the galleries (ventilation ducts and access to production equipment). The dimensions of the production galleries are 4.5m x 5.0m and have been designed considering the following activities: Rock drilling; Front Loading/Detonation; Removal (Cleaning) and transport of ore / waste.

16.3.3 Mine Fleet, Surubim Mine

Due to the low planned production from underground, and short mine life, equipment requirements will be met through allocating equipment from the open pit and the Vermelhos UG Mine, as required.

16.4 ERO BRASIL OPEN PIT MINES (N8, N9, N5 - SIRIEMA, SURUBIM, C12 AND SUÇUARANA)

There are six open pit projects in Curaçá Valley, the N8/N9 OP Mines and the N5 OP Mine, within the Vermelhos District; the Suçuarana OP Mine, in Pilar District; and the Surubim and C12 OP Mines in the Surubim District. In total, approximately 26% of the total copper metal produced in the LOM plan is expected to come from open pit operations within the Curaçá Valley.

16.4.1 Mining Methods, Open Pit

The open pit operations of Curaçá Valley utilize conventional open pit mining, implementing proven drilling, blasting and loading / haulage equipment and technologies used in prior open pit operations within the Curaçá Valley by the Company.

To prepare ore for mining, the waste material located in the upper portion of the deposits (mostly comprised of waste rock and oxidized mineralization) is stripped mechanically by a bulldozer. While variable, the weathered profile is, on average, 15m to 20m in thickness throughout the Curaçá Valley. Waste material generated during stripping is stacked outside of the pit area, following the technical and environmental recommendations for each open pit mine.

After pre-stripping, hard rock mining of both barren waste and ore comprising the mineral reserves will be carried out by blasting with explosives. Primary rock drilling will be performed using hydraulic drills rigs with 127mm diameter blast holes, and a 2.40m x 4.80m staged mesh. The explosives, blasting agents and blasting accessories are supplied by a licensed explosive supplier, readily available in the region as demonstrated by the Company's existing operations.

Ore and waste will be loaded by hydraulic backhoes with bucket capacities of 4.5 tonnes and transported from the open pit to the coarse ore stockpile using trucks with a capacity of 35 tonnes each.

Ore will be classified by grade in a near-mine stockpile then transported via dual-train haul trucks with a capacity of 70 tonnes each to the Caraíba Mill for processing, as is currently performed at the Vermelhos UG Mine.

16.4.2 Mine Equipment

The current mining fleet to be used in support of planned mining activities at the peak of Ero Brasil's open pit operations are listed in the table below. Given the synergy of Vermelhos District open pit mines (N8/N9 and Siriema), the total fleet shown represents the fleet requirements for the operation of all three open pit operations within the Vermelhos District.

As the main loading, haul, dump and blasting operations will be carried out by contractors, consistent with Company's prior open pit operations, the investment needed for equipment is limited to drill machines and operational support fleet.

Table 16-10: Curaçá Valley's Open Pit Fleet

Equipment	Primary Function	Vermelhos District	Surubim/C12	Suçuarana
Drill Machine	Primary Drilling	6	4	3
Backhoes	Loading	3	6	4
Loaders	Loading	16	0	0
35-t Trucks	Transportation	77	20	15
70-t Trucks	Transportation	38	8	6
Bulldozer	Operational support	1	1	1
Water truck	Operational support	1	1	1
Fuel truck	Operational support	1	1	1
Total		**143**	**41**	**31**

16.5 GEOTECHNICAL CONSIDERATIONS

The geotechnical characterization of the Caraíba Operations continues to be based on the RMR classification system developed by Bieniawski (1989), which allows classifying the rock mass based on geotechnical quality. Main parameters of RMR include intact rock strength ("IS"), RQD, fracture spacing, fracture condition (persistence, roughness, filling and modification) and ground water.

Geotechnical conditions at Caraíba are divided into six geotechnical domains that correspond to six litho-domains; they are: Basalt, Gabbro, Gneiss, Granite, HDR, veins and faults (see table below). Based on geotechnical logging and lab tests results, most of the domains are classified under this system as 'good to very good' rocks, Fault zones, where locally encountered, are characterized as being 'poor.' In summary, the quality of the host rock throughout the Caraíba Operations is 'good to very good'. Locally, poor ground conditions are expected in the vicinity of faults and intersections with shear zones, as can be observed in practice within the mining operations.

The rock mass of the Caraíba Operations is classified as good geomechanical quality, composed of mostly competent rocks with a high resistance to uniaxial compression varying in average between 160 and 240 MPa. However, some extremely elastic characteristics of certain lithologies exhibit brittle failure, without deforming, breaking abruptly when reaching the limit of the resistance. The system of discontinuities provides the formation of blocks, wedges that must be properly identified and controlled with good practice during mining operations.

All the mineral deposits throughout the Curaçá Valley have very similar geomechanical features containing more specific features as further described in this section. The table below presents the statistical analysis of values of Bieniawski´s basic RMR ("RMRB") and RQD distribution.

Table 16-11: RMRB Bieniawski values without adjustments

Lithology	Weighted parameters		Unweighted parameters		33% parameter value according to cumulative distribution	
	RMRB	RQD	RMRB	RQD	RMRB	RQD
Basalt	80.14	92.54	75.42	83.4	79	92.31
Gabbro	81.37	93.19	76.11	84.33	81	94.01
Gneiss	83.45	90.59	77.9	80.37	83	92.33
Granite	79.09	89.23	72.67	78.56	78	92.28
HDR	67.82	79.86	62.11	64.03	65	78.66
STR	68.07	84.04	67.6	82.06	67	75

There is an active geotechnical stress modelling and monitoring program being commissioned in order to enhance safety and productivity of Pilar UG Mine. The on-going numerical model simulation will provide information in order to have a predictability of the stability for the mine due known stress conditions in depth. These studies are going to re-access all the mine areas to investigate the crown pillars, sill pillars, rib pillars and the stope dimensions and the galleries.

16.5.1 **Pilar District**

16.5.1.1 Pilar UG Mine

The Pilar District, located in the central part of the Curaçá Valley, is the best-known area from a geotechnical perspective as a result of accumulated data since mining activities commenced in the 1970s. The rock mass is predominantly classified as Class II and III, with some occurrence of Class IV in the mineralized areas. Five RMR groups identified in the rock mass have been mapped from the Pilar UG Mine separated by vertical structural planes – generally characterized by fault zones. Main faults at Pilar Mine correspond to two primary structures that can be observed on surface (see Figure 16-19) and in the existing underground mine.

A fault zone previously identified in the geotechnical model (2016) can be mapped to the Deepening Project area, as can be evidenced in the inspection of drill core. The extension of the fault zones below level N-400 shows two different behaviors: a highly fractured fault on the west side and a slightly fractured fault on the east side (figure below). The east fault lies within the hanging wall approximately 60 m away from the mineralized zone, which is different from the upper levels. Within the Deepening Project, all planned mine development has been designed within the footwall of the orebody, such that there is no anticipated intersection with the known extent of the east fault structure.

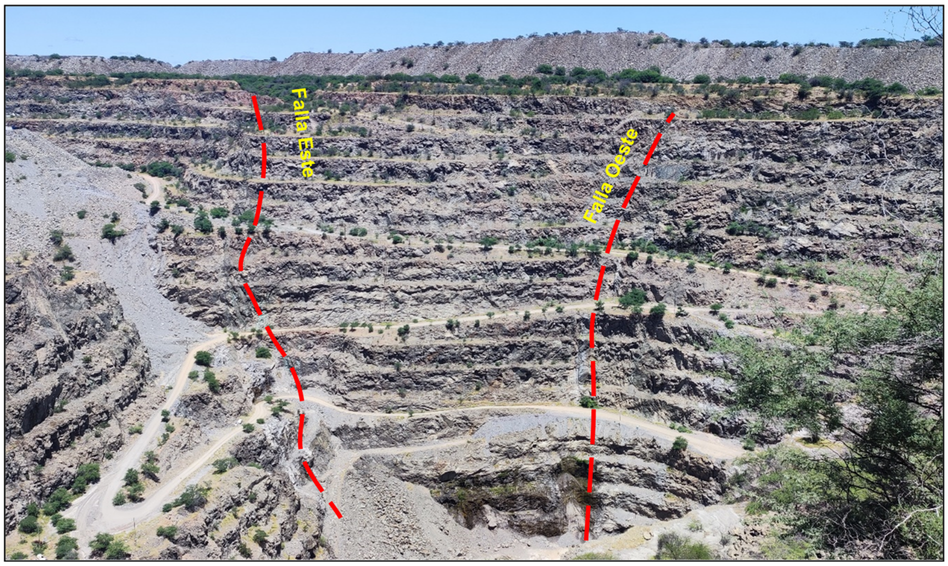


Figure 16-19: East and West Main Faults (Ero Brasil, 2022)

In support of the geotechnical design and geomechanical monitoring, the Caraíba Operations incorporate a Micro-Seismic Monitoring System ("MMS") to map micro-seismic events within the Pilar UG Mine. MMS has been shown to accurately determine the location of natural and/or induced seismic events, their magnitude and as a tool to predict potential interference with mine operations (figure below). Induced seismic events occur during production blasting. The system consists of sensors installed throughout the mine which send signals to a database real-time. The geomechanical behavior of the rock mass is monitored by Ero Brasil personnel in real-time using the installed MMS sensors.

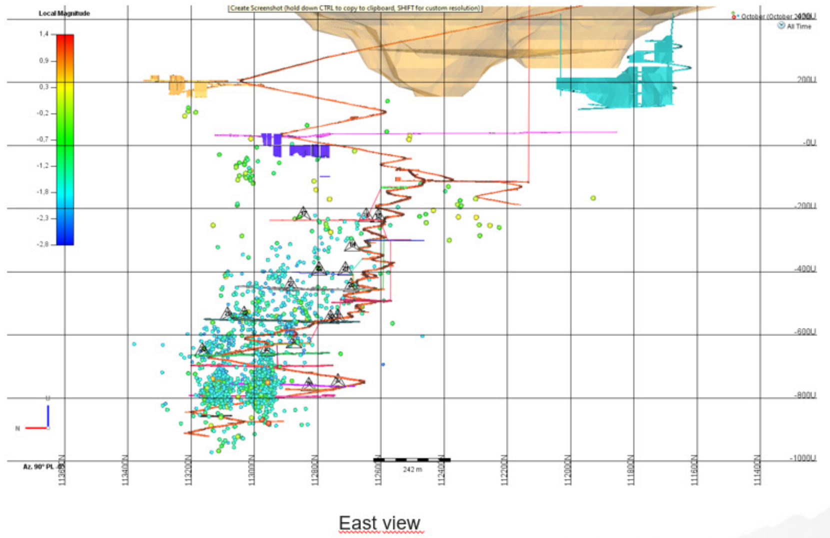


Figure 16-20: Seismic Monitoring System (Ero Brasil, 2022)

Using existing geotechnical logging information, assessment of open stope stability was undertaken using an empirical method based on Mining Rock Mass Rating ("MRMR"), (after Laubscher[2], 1990) and the Empirical Modified Stability Graph method (after Potvin et al., 1988). Several scenarios have been analyzed to evaluate the likely stability of hanging wall and stope backs in respect to stope inclination (65° to 90º), orebody thickness (5m to 30m), heights of stopes and rock mass classification for the proposed stope dimensions. Back dimensions were estimated using the MRMR system, and Potvin method was used to evaluate hanging wall and footwall stability.

The table below summarizes stope dimensions for each mining method. These dimensions are proposed for stopes throughout the Pilar UG Mine.

Table 16-12: Stope dimensions

Mining Method	Stope Width (m)	Stope Height (m)	Stope Length (m)
Transverse Stope	15	26	Orebody Width
Longitudinal Stope	<15	26	30

2 Laubscher, D.H., 1990, A Geomechanics classification system for the rating of rock mass in mine design.
3 Distance from bench to fill.

16.5.1.2 Pilar UG: Project Honeypot & Upper Areas

The assessment of geotechnical design parameters and the rock mass classification for Project Honeypot and the Upper Areas has been based on core logging data provided by Ero Brasil and geotechnical logging also performed by Ero Brasil. RMR estimates were obtained from drilling. Where there was no geotechnical information available, data was extrapolated from neighboring areas believed to have similar geotechnical characteristics.

The structural condition for the different sectors of Honeypot & Upper Areas is presented for each mining area in the following sequence of figures, from Figure 16-21 to Figure 16-24.

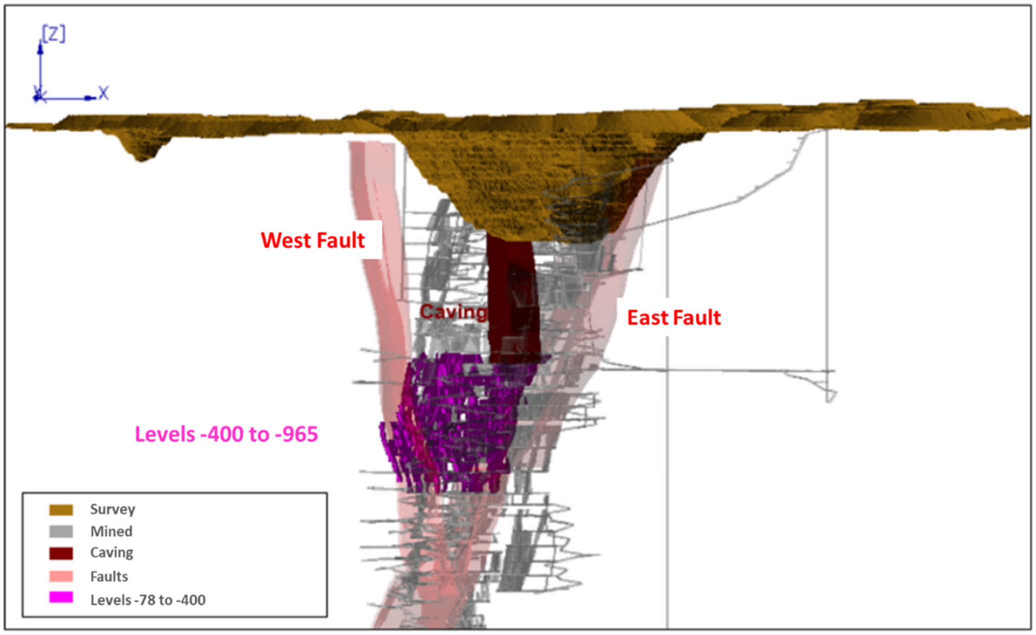


Figure 16-21: Main Faults and existing Excavations for levels -78 to -400, Project Honeypot (Ero Brasil, 2022)

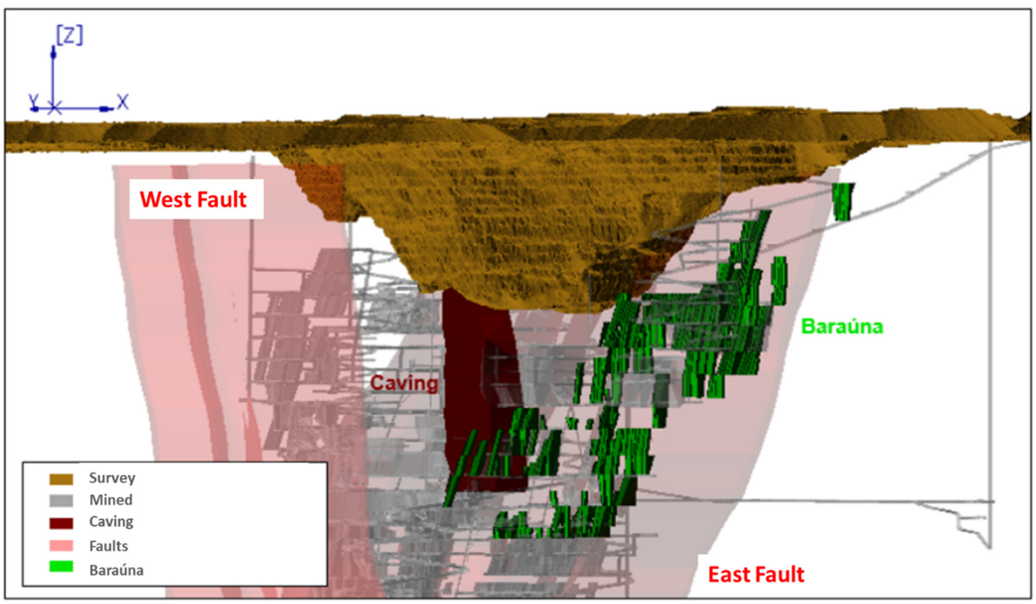


Figure 16-22: Main Faults and existing Excavations for Baraúna (Ero Brasil, 2022)

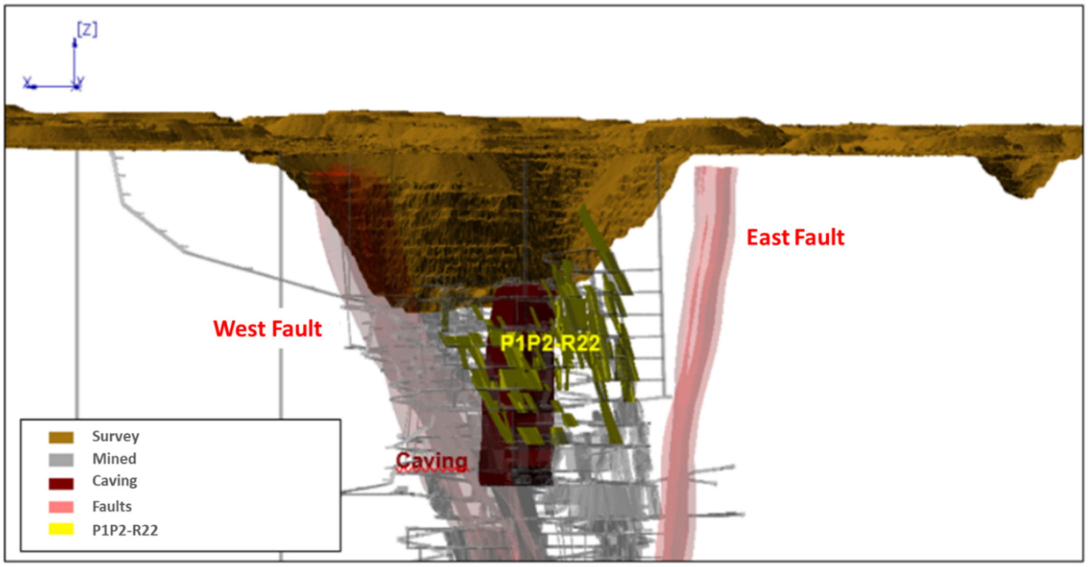


Figure 16-23: Main Faults and existing Excavations for P1P2-R22 (Ero Brasil, 2022)

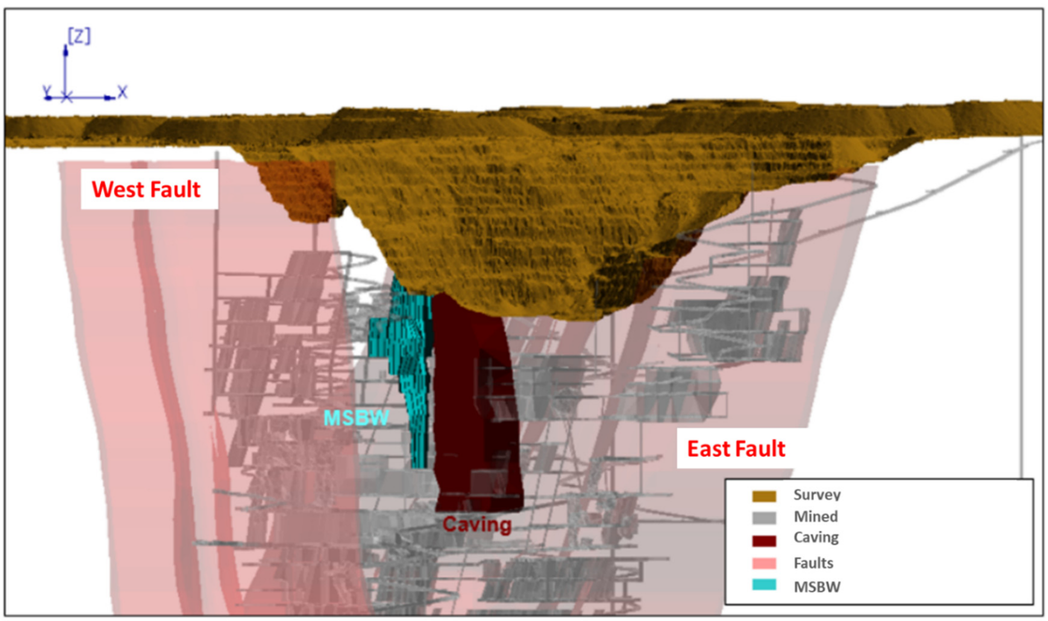


Figure 16-24: Main Faults and existing Excavations for MSBW (Ero Brasil, 2022)

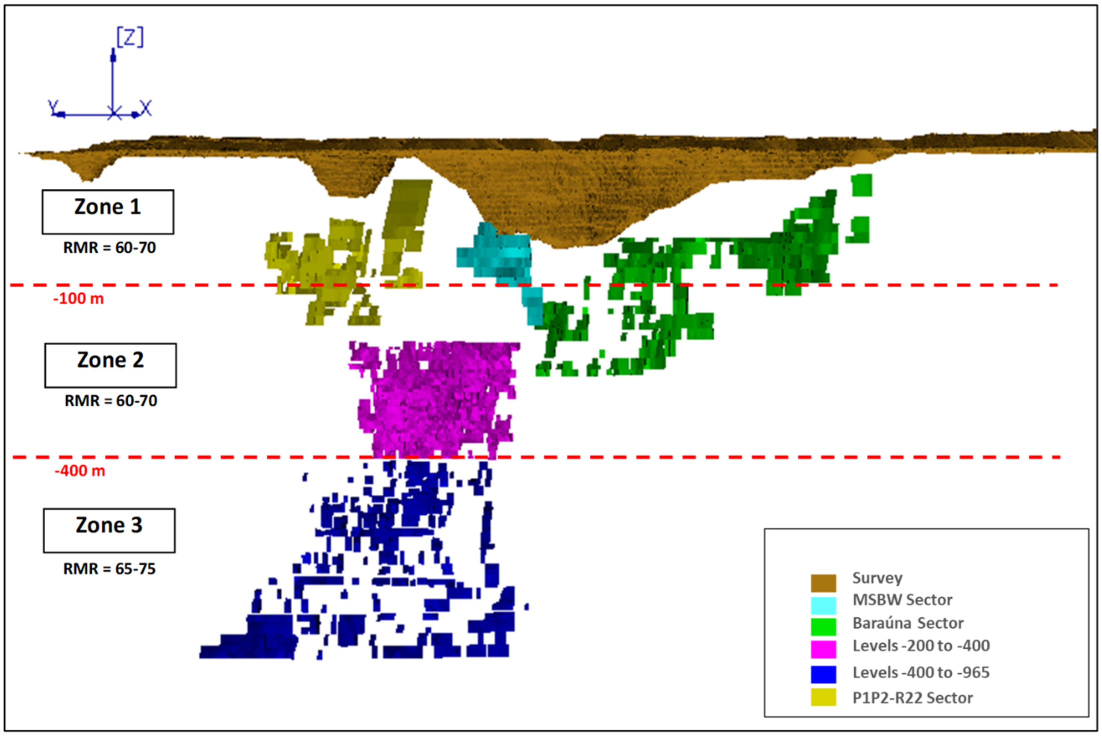


Figure 16-25: Rock Mass Ratings for Project Honeypot & Upper Areas (Ero Brasil, 2022)

A structural characterization and mapping program was performed by Ero Brasil. Figure 16-26 shows the structural diagrams produced from this initiative, based on a dataset of 584 mapped joints and faults:

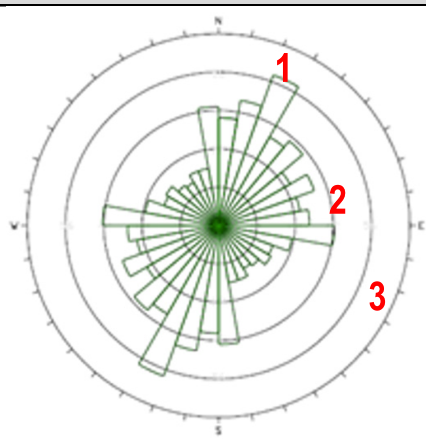
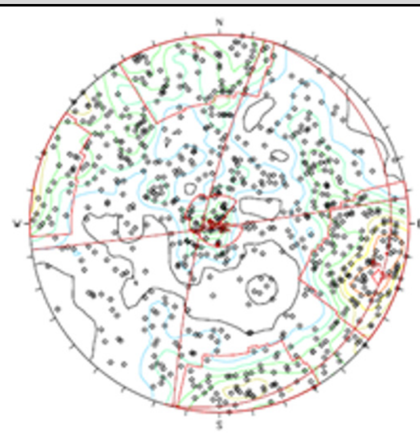
Structure Type	Rosetta Diagram	Contour Diagram
JOINTS AND FAULTS N° of data = 584		

Figure 16-26: Discontinuities and Contour Diagrams, Pilar UG Mine

Table 16-13: Structural Systems at Pilar

Structural System	Structural Attitude		Comments
	DIP (°)	DIPDIR (°)	
1	80	284	Associated to Major Faults
2	88	172	Joints system orthogonal to Major Fault strike
3	6	107	Sub-horizontals persistent structures producing slags

Conclusions from the geotechnical analysis for Project Honeypot and the Upper Areas of the Pilar UG Mine include:

- Geotechnical rock classification for all the sectors at Honeypot & Upper Areas are from Good to Very Good.
- Stability and joint-set evaluations for roof and walls have been incorporated in the stope stability analysis.
- A primary/secondary configuration has been recommended to use for mining Honeypot & Upper Areas.
- Recommended stopes dimensions for Honeypot & Upper Areas are:
    - In non-faulted zones: 10 m width x 20 m length x 35 m height (maximum); and
    - In fault zones, the size of stopes is reduced to 10 m width x 15 m length x 35 m height (maximum).
- No sill pillars and rib pillars are recommended.

16.5.1.3 Suçuarana OP Mine

The definition of the geotechnical parameters were based on the actual operating performance of the operation., which was last mined in 2017. The rock mass of the Suçuarana OP Mine is mainly composed of Class II rocks, as shown in the RMR histogram and modeled evaluation of the safety factor observed in the historic open pit (Figure 16-27 and Figure 16-28).

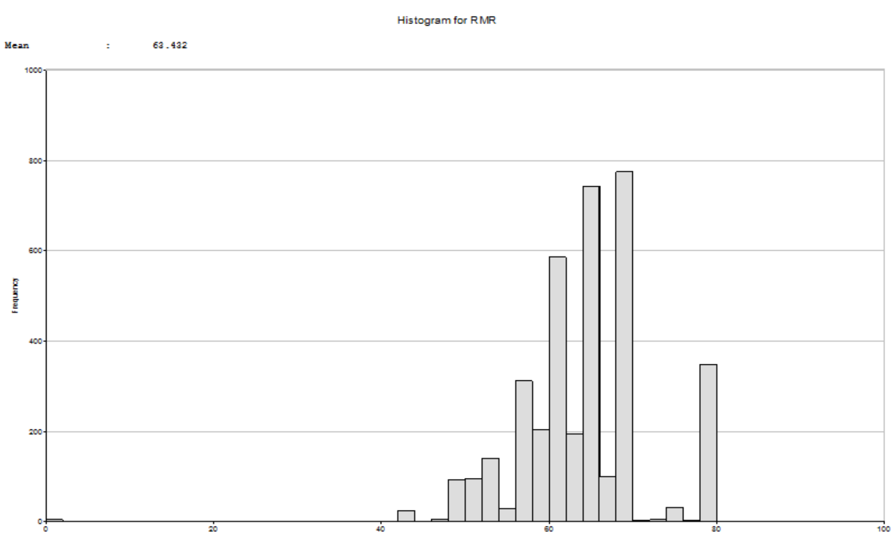


Figure 16-27: Historic RMR Histogram for the Suçuarana OP Mine (Ero Brasil, 2022)

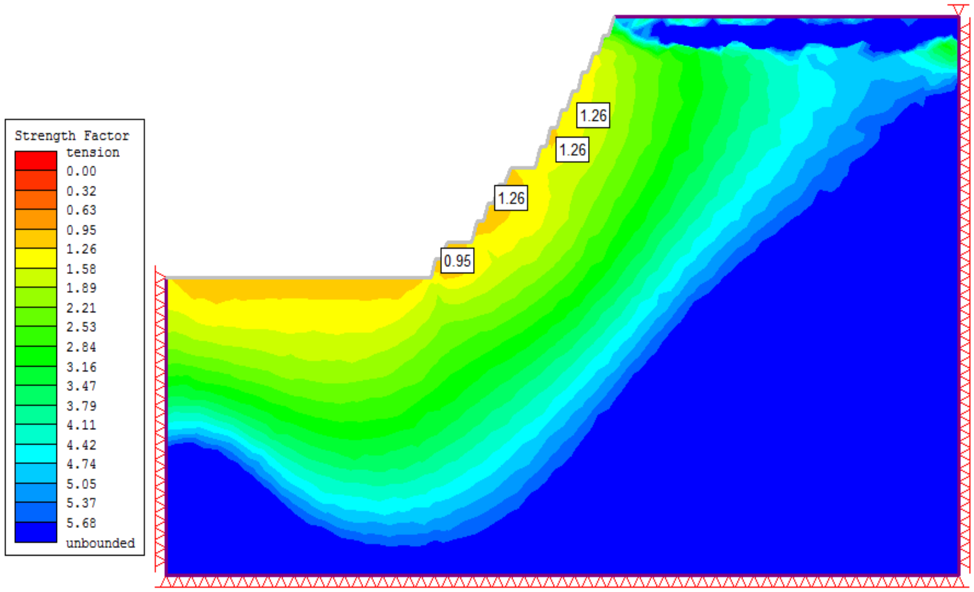


Figure 16-28: Histogram and safety factor for the Suçuarana OP Mine (Ero Brasil, 2022)

Within the Suçuarana OP Mine, structural controls occur with discontinuities oriented preferentially N-S; however, there is a large family of discontinuities with a NW-SE orientation as demonstrated in Figure 16-29. The predominate fault and rock fabric orientations, identified through field mapping campaigns, were analyzed against design pit orientations to calculate planar and wedge failure possibilities for each expanded sector of the pit. The results of this analysis were factored into the final open pit design for the current mineral reserve.

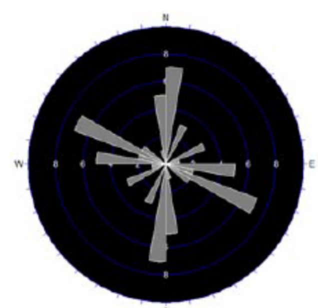


Figure 16-29: Discontinuities in Suçuarana OP Mine (Ero Brasil, 2022)

Based upon geotechnical evaluation and the possibilities for wedge and planar failures, the following slope angle recommendations have been incorporated into the current Mineral Reserve for the Suçuarana OP Mine.

Table 16-14: Geotechnical Parameters of the Suçuarana OP Mine Design

Pit Geometry	Suçuarana
Overall Slope Angle (º)	55.0
Bench Face angle (º)	75
Bench Height (m)	10.0
Berm Width (m)	4.0
Ramp Gradient (%)	12.0
Ramp Width (m)	12.0

16.5.2 **Surubim District**

16.5.2.1 Surubim Mine

With the resumption of operations at the Surubim Mine, the geotechnical engineering team at Ero Brasil carried out further investigations including geotechnical inspections and structural mapping programs. These newly compiled surveys provided important information in terms of slope stability. The families of discontinuities identified during field mapping were analyzed together with the slope guidelines and failure possibilities for each pit sector for detailed mine design. Three main fault zones are located in the eastern and southern portion of the mine.

The quality of the rock mass of the Surubim Mine is considered, generally, medium to good, although areas of prior planer failures inside the pit are evident. The main structures found during field mapping indicate discontinuities from smooth to subvertical angles, a combination that provides instability in some sectors of the mine. The overall angle in the southern portion of the Surubim Mine expansion project, has been planned to be below 50º, due to the discontinuities in the sector, with benches of 4m and a bench angle reaching 65º. The design was based upon analysis of the quality of the mass, field mapping, operational experience, stereographic interpretations and analysis of numerical models.

The general safety factor of the slope in the original design was considered acceptable for mining, according to computational models, which sought to assess breaks controlled by the resistance of the rock mass. However, following additional analysis considering the influences of mapped discontinuity orientation, a conclusion was reached that the designed pit angles should intersect the main discontinuities obliquely to (ideally) perpendicular. A rotation in the design orientation of the benches approximately 30°, clockwise, was made so that the pit wall angle would intersect the primary fault planes obliquely, reducing the geotechnical risk of wall failure.

The pit was classified in three sectors for the definition of the geotechnical parameters, in order to ensure the stability of the mine according to the geotechnical studies carried out and prior mining activity.

- Sector 1 - west side;
- Sector 2 - east side; and,
- Sector 3 - above level 380 north and south.

In Sectors 1 and 2 - it is known that the west side is structurally more stable than the east side, which has a greater number of faults and fractures. This was observed in the quality of blasts carried out on the west side, during the most recent expansion of the pit.

In Sector 3 – above level 380, there is a predominance of friable material, including mud and soil, so the angles have been specified to ensure the stability of this friable material within this sector.

Below is an image of the pit detailing the design sectors.

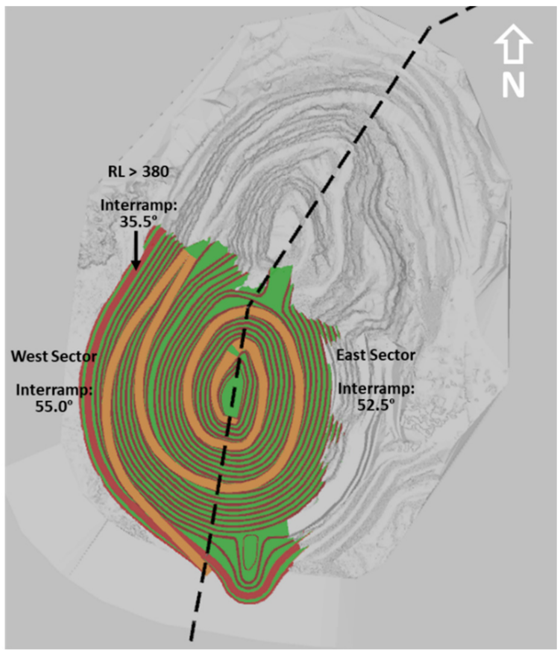


Figure 16-30: Geotechnical sectors of the Surubim OP (Ero Brasil, 2022)

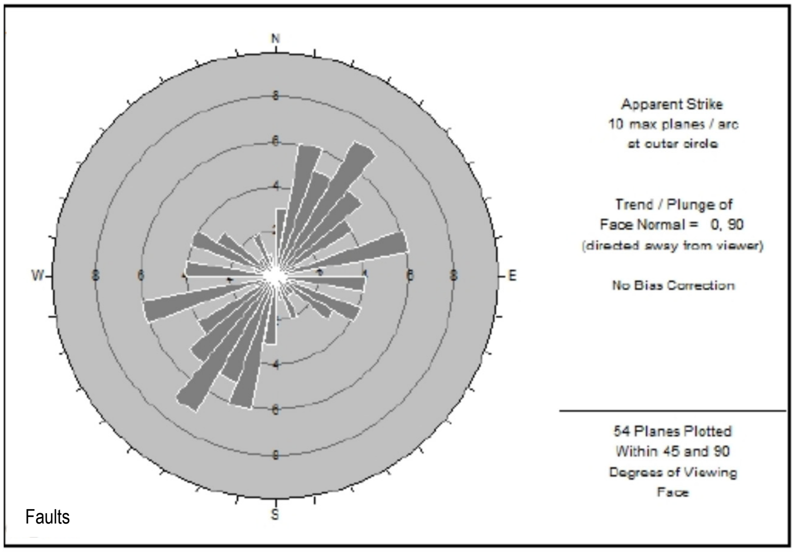
Below is the table with the geotechnical parameters of the pit design.

Table 16-15: Geotechnical Parameters of the Surubim Mine Design

Sector	Description	Overall Slope Angle (°)	Bench Face Angle (°)	Bench Height (m)	Berm Width (m)
1	West	55.0	70.0	10.0	3.4
2	East	52.5	70.0	10.0	4.0
3	Above 380 North & South	35.5	45.0	10.0	4.0

16.5.2.2 C12 OP Mine

The C12 OP Mine is located close to Surubim Mine and both lie within the same regional geological context. Due to their proximity, similar lithological types and geotechnical qualities (deformation styles and geological structures such as fault and foliations) were considered. Additional mapping on the surface of C12 highlights an intense fracturing pattern with predominant NE-SW and NW-SE directions as well as preferential NE-SW faults as shown in Figure 16-31. The predominate fault and rock fabric orientations, identified in field mapping, were analyzed against design pit orientations to calculate planar and wedge failure possibilities for each expanded sector of the pit. The results of this analysis were considered in the final pit design of the current mineral reserve estimate.



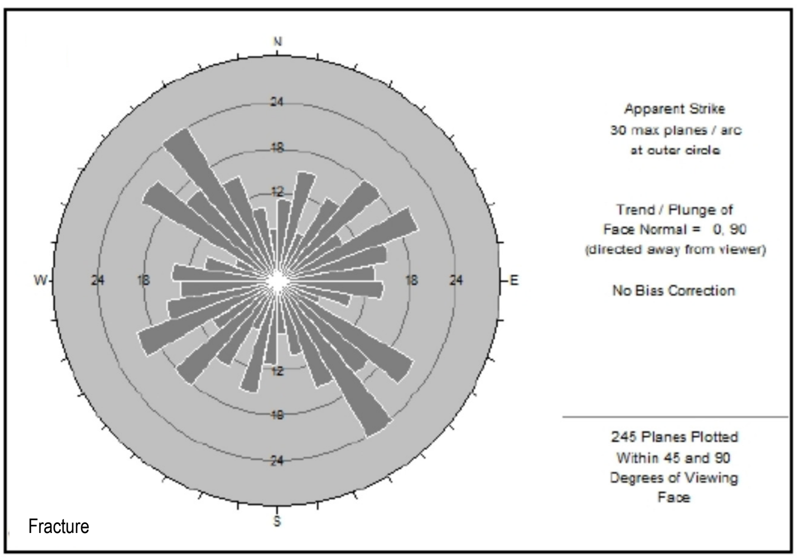


Figure 16-31: Fracture pattern with predominant NE-SW and NW-SE directions and faults preferably NE-SW (Ero Brasil, 2022)

The structural complexity at C12 and Surubim Mine areas is notable, requiring special attention to each geotechnical parameter and ongoing studies to improve geotechnical models. In light of preliminary analysis, operating experience within the Surubim Mine and taking into account specific geotechnical parameters some considerations and recommendations for future pit designs were incorporated into the final geotechnical design parameters, further detailed in the table below.

- Regarding the bench angle, it is recommended that the first two benches have a reduced slope, in both Surubim & C12 OP Mine, due to the presence of weathered rocks. On the west sector, an overall slope angle of 55° should be used. On the east sector, due to the slope dipping in accordance with the weakness planes of the foliations, which dip predominantly to the west, an overall slope angle of 55° should be used;

- 10 m high benches;
- Berms width of 4m and 12m for the ramp. The parameters of the proposed project will be kept until the next studies and field monitoring indicate a different scenario, in which the teams should discuss suitable changes and improvements;
- Ramp gradient of 12%.
- And finally, it is advisable to set the ramp entrances on the west side of the open pits, preferably in the NW quadrant, in order to avoid the greatest risk of instability.

Table 16-16: C12 OP Geotechnical Parameters

Pit Geometry	C12
Overall Slope Angle (º)	55.0
Bench Face angle (º)	75
Bench Height (m)	10.0
Berm Width (m)	4.0
Ramp Gradient (%)	12.0
Ramp Width (m)	12.0

16.5.2.3 Surubim Mine, Underground

Geotechnical characterization work indicates a rock mass of good quality. The underground portion of the Surubim Mine has an average RQD of 75%, being classified as massive type II based on the RMR geomechanical classification system.

The minimum containment recommendations for the project, taking into account the good quality of the rock mass, include:

- Use of shotcrete on the face of the slope where the entrance to the underground mine will be built, and for the first 15 meters of development, the recommended support will be the use of shotcrete, screens and systematic rockbolts in the standard 1.5x1.5 mesh.
- After this interval, the standard support of ramps, transport galleries and ore production galleries, will be used 1.5 x 1.5 mesh rockbolts and screens.

Numerical simulations were carried out to assess the stability conditions of the excavations, as well as to obtain the safety factors for the dimensioning of the mining pillars. Based on the numerical stress and strain simulations performed, the safety factors of the pillars in the Surubim Mine underground development project are expected to be above 1.5 and are considered acceptable for temporary underground excavations.

16.5.3 **Vermelhos District**

16.5.3.1 Vermelhos UG Mine

The quality of the rock mass was determined based on geotechnical drill logging and the resulting RMR geomechanical classification system by Bieniawski (1989). At Vermelhos, RMR values are typically above 60, indicating a rock mass of good quality that can be classified as Type II. Development and production activities to date, have confirmed the quality of the rock mass in underground mapping and production stopes.

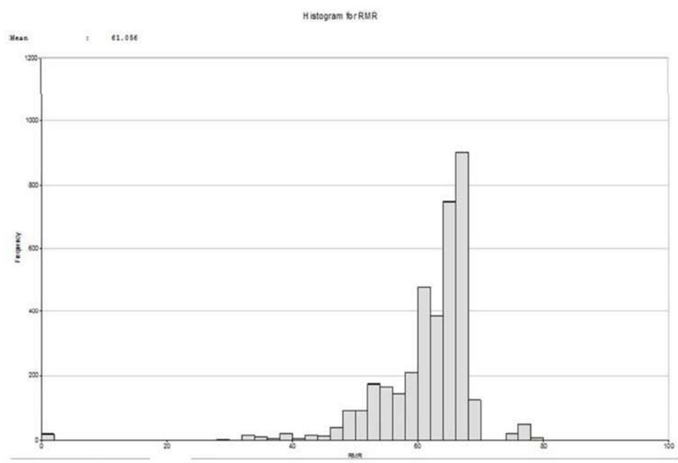


Figure 16-32: Vermelhos RMR histogram (Ero Brasil, 2022)

Throughout the mine, geotechnical mapping is carried out to determine the main structural considerations of the mine. Structural control in Vermelhos indicates a dominant N-S orientation of major discontinuities related to lithology contacts of the mineralized zone and NE-SW fractures and faults. (Figure 16-34 and Figure 16-35).

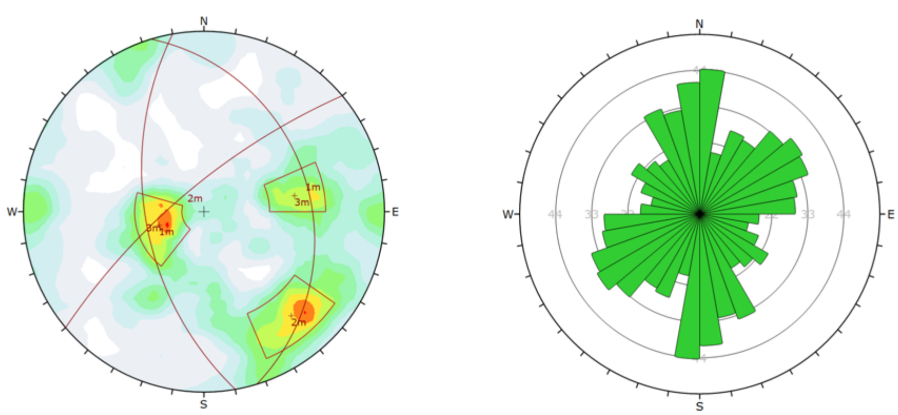


Figure 16-33: Main structures from Vermelhos Mapping (Ero Brasil, 2022)

Figure 16-34: Illustrative structural mapping of Vermelhos Mine (red showing mapped discontinuities and green completed development) (Ero Brasil, 2022)

In addition to underground mapping and ongoing geotechnical evaluation, the size of open stopes at Vermelhos relative to other mines of the Caraíba Operations, requires the additional evaluation using an empirical method for unsupported open stopes as proposed by Mawdesley (2004). The factors consider the classification of the rock mass value (Q'), observed state of fractures, structural orientation of predominant rock fabrics and the hydraulic radius of the openings. The study demonstrates a maximum stable hydraulic radius for stopes of 20.6m.

This work indicates that all excavations of temporary galleries, ramps and main permanent infrastructure must be positioned outside the area of influence of other excavations. This recommendation has been incorporated into the design of the current mineral reserves. Illustrative examples of these parameters are highlighted below:

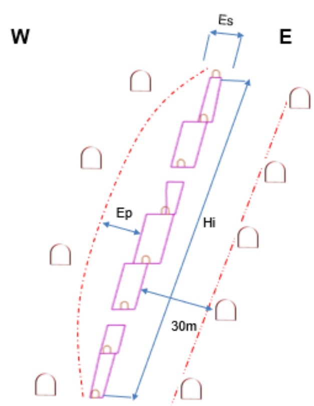


Figure 16-35: Interaction mines/permanent gallery of UG3 mining area, Vermelhos UG Mine (Ero Brasil, 2022)

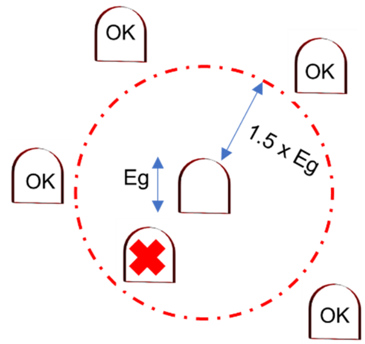


Figure 16-36: Gallery/permanent gallery interaction (Ero Brasil, 2022)

Based on quantitative analysis and operational experience, the long-term geotechnical design parameters for the Vermelhos UG Mine are detailed below:

Table 16-17: Geotechnical Parameters for mining and development, Vermelhos UG Mine

Long-Term Geotechnical Parameters		
Vertical height between levels (m)	**UG 3** 25	**Vermelhos Main** 30
Maximum opening dimension (m)	**UG 3** 60	**Vermelhos Main** 90
Vertical height of Sill Pillar (m)	10	
Width of Rib Pillar (m)	**UG 3** 15	**Vermelhos Main** 10
Minimum distance between two parallel mining areas (m)	7	
Minimum distance between ramp and stope (m)	**Hangingwall** 35	**Footwall** 30
Ramp Pilar - Raise (m)	15	
Pilar GT - Raise (m)	10	

16.5.3.2 N8/N9 & N5 (Siriema) OP Mines

The proximity of the N8/N9 and Siriema OP Mines to the Vermelhos UG Mine, and the observed similarities of the geomechanical parameters based on drill core logging, has demonstrated that the same parameters can be applied with a reasonable degree of confidence. The predominate fault and rock fabric orientations, identified in field mapping, were analyzed against design pit orientations to calculate planar and wedge failure possibilities for each expanded sector of the pits. The results of the analysis have been captured in the final design used for the current mineral reserve estimate.

Table 16-18: Geotechnical and technical parameters of the pit design N8/N9 OP & Siriema OP Mines

Pit Geometry	N5 (Siriema)	N8	N9
Overall Slope Angle (º)	55.0	55.0	55.0
Bench Face angle (º)	75	75	75
Bench Height (m)	15.0	15.0	15.0
Berm Width (m)	6.5	6.5	6.5
Ramp Inclination (%)	12.0	12.0	12.0
Ramp Width (m)	12.0	12.0	12.0

16.6 REGIONAL HYDROGEOLOGICAL CONSIDERATIONS

Annual rainfall within the Curaçá Valley is erratic and has a range of 100mm to 900mm. On average, total annual rainfall is less than 700mm. Most precipitation occurs during the rainy season, from December to March, in isolated high rainfall events associated with thunderstorm activity. The low rainfall, together with limited thickness of residual soils, indicates limited consideration for water pressures within the primary rock mass is required. This is supported by operational experience of the underground mining operations within the Curaçá Valley.

The Curaçá River which sits to the west of the municipality of Curaçá bordering Juazeiro, flows in the north direction. The drainage network of the Curaçá River is composed of rivers and streams that are all intermittent, with their flows oriented mainly to the north and northeast.

In the region there are two aquifers, a porous aquifer, represented by the deposits formed by the weathering of the rocks and / or alluvial deposits; and a fractured aquifer (deep), characterized by the presence of water in the discontinuities (faults and fractures), predominately within the compact gneiss rocks. The porous aquifer has primary (or granular) porosity, whereas the fractured aquifer is characterized by secondary porosity (or fracture) in which water circulates via rock faults or fractures.

Throughout the Curaçá Valley, where the weathering profile can be up to 25m in thickness, observed groundwater to date is present only in the fractured aquifer of the rock mass. The porous aquifer hosted locally within the shallow soils and alluvium has little relevance in understanding the local aquifer environment and is not relevant for mine design parameters.

According to studies and regional surveys in the Brazilian semi-arid region, there is a theory called "Riacho-Fenda", which, through analysis of well data, indicates that fractures filled with water do not exceed 170m of depth. The recharge of the fractured (and to a lesser extent porous) aquifers occurs during peak rain events, concentrated between the months of December to March. Recharge occurs within the alluvial cover and preferentially through fractures within the rock mass.

16.7 INTEGRATED PRODUCTION PLAN

16.7.1 2022 Mineral Reserve LOM Plan

The 2022 Mineral Reserve LOM Plan is summarized in the Table 16-19. Additional notes associated with the LOM production plan include:

- Q4 2022 production outlines the mineral reserve schedule for the three months from the Effective Date to December 31, 2022;
- All figures have been rounded to the relative accuracy of the estimates. Summed amounts may not add up due to rounding.
- The mine production exceeding mill capacity in 2027 will be stockpiled in the ore blending yard.

Table 16-19: 2022 Mineral Reserve LOM Production Plan

RESERVES PLAN	2022*	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	TOTAL
Underground Operations																						
Deepening Extension Zone, Pilar UG Mine (Pilar Mine below Level -965)																						
Tonnes Mined (000s)	6	140	323	304	1,024	1,010	1,103	1,047	766	681	735	579	627	582	326	765	790	168				**10,976**
Grade Mined (% Cu)	1.83	1.70	1.42	1.75	1.57	1.75	1.74	1.87	1.38	1.50	1.76	1.33	1.35	1.60	2.56	2.03	1.92	2.97				**1.71**
Pilar UG Mine Ex-Deepening Extension Zone (Pilar Mine above Level -965)																						
Tonnes Mined (000s)	184	1,389	1,420	1,313	779	1,156	1,075	783	786	535	586	374	354	343	212							**11,289**
Grade Mined (% Cu)	2.28	1.38	1.40	1.25	1.16	1.00	1.04	1.09	1.12	0.99	0.95	0.99	1.05	0.90	1.03							**1.17**
Honeypot & Upper Areas																						
Tonnes Mined (000s)	0	73	211	630	729	756	815	931	886	810	689	1,190	1,551	1,350	996	906	176					**12,697**
Grade Mined (% Cu)	0.00	1.31	1.16	1.64	1.29	1.19	1.54	1.41	1.72	1.65	1.48	1.28	1.27	1.36	1.34	1.42	1.44					**1.41**
Vermelhos UG Mine																						
Tonnes Mined (000s)	305	790	820	695	717	500	312	236	20	106												**4,500**
Grade Mined (% Cu)	2.13	1.85	1.13	1.15	1.24	1.06	0.91	1.05	0.77	0.91												**1.31**
Surubim UG Mine																						
Tonnes Mined (000s)	22	53																				**75**
Grade Mined (% Cu)	1.19	1.19																				**1.19**
Open Pit Operations																						
N8/N9 OP Mine (Vermelhos District)																						
Tonnes Mined (000s)														1,974	2,030	2,983	3,652	3,741	5,205	5,176	4,375	**29,137**
Grade Mined (% Cu)														0.56	0.50	0.47	0.48	0.44	0.43	0.50	0.61	**0.49**
N5 (Siriema) OP Mine (Vermelhos District)																						
Tonnes Mined (000s)										601	432	582	538	553								**2,705**
Grade Mined (% Cu)										0.54	0.64	0.64	0.91	1.31								**0.81**
Surubim District, Open Pit (Surubim & C12)																						
Tonnes Mined (000s)	94	541	488	514	558	1,024		68	287	350	629	721	425									**5,700**
Grade Mined (% Cu)	0.49	0.68	0.55	0.52	0.73	1.07		0.80	0.74	0.63	0.71	0.71	0.90									**0.75**
Suçuarana South OP Mine (Pilar District)																						
Tonnes Mined (000s)																720	1,355	1,678	740	774	422	**5,688**
Grade Mined (% Cu)																0.40	0.39	0.39	0.51	0.50	0.49	**0.43**
Total Mine Plan																						
Tonnes Mined (000s)	612	2,986	3,262	3,455	3,807	4,446	3,304	3,065	2,745	3,082	3,072	3,445	3,495	4,802	3,565	5,374	5,974	5,586	5,945	5,950	4,797	**82,767**
Grade Mined (% Cu)	1.89	1.39	1.19	1.24	1.25	1.23	1.38	1.44	1.34	1.14	1.17	1.03	1.16	1.02	0.95	0.85	0.68	0.50	0.44	0.50	0.60	**0.96**
Ore Sorting Operations																						
N8/N9 OP Mine (Vermelhos District)																						
Tonnes Mined (000s)														938	964	1,417	1,735	1,777	2,472	2,459	2,078	**13,840**
Grade Mined (% Cu)														1.04	0.92	0.88	0.88	0.81	0.78	0.92	1.12	**0.91**
N5 (Siriema) OP Mine (Vermelhos District)																						
Tonnes Mined (000s)										285	205	276	255	263								**1,285**
Grade Mined (% Cu)										0.99	1.17	1.18	1.68	2.41								**1.49**
Vermelhos UG Mine																						
Tonnes Mined (000s)										50	382	626	512	233								**1,803**
Grade Mined (% Cu)										1.67	0.00	0.00	0.00	0.00								**0.05**
Total Ore to Mill																						
Tonnes Mined (000s)	612	2,986	3,262	3,455	3,807	4,446	3,304	3,065	2,745	2,711	3,227	3,766	3,724	3,708	2,499	3,808	4,056	3,622	3,212	3,233	2,500	**67,747**
Grade Mined (% Cu)	1.89	1.39	1.19	1.24	1.25	1.23	1.38	1.44	1.34	1.28	1.10	0.93	1.08	1.26	1.31	1.15	0.94	0.72	0.72	0.82	1.01	**1.14**

*Q4 2022 outlines the mineral reserve schedule for the three months from the Effective Date to December 31, 2022. All figures have been rounded to reflect the accuracy of the estimates. Summed amounts may not add due to rounding.

16.7.2 2022 Strategic LOM Plan

The Strategic LOM Plan presented in Table below expands the ore amounts of the Reserves Plan (Table 16-19), by including the corresponding Inferred Resources of each of the Projects, given the intrinsic synergies associated with the operations.

The Company's 2022 LOM planning process considers recently completed and ongoing investments in mining and milling infrastructure under the Company's Pilar 3.0 initiative. As a result of the integration of Project Honeypot and the nature of the mineralization remaining in the upper levels of the Pilar Mine, and more broadly within the Company's underground operations, effective extraction of the mineral reserve necessitated the consideration of inferred mineral resources in the Company's long-term strategic planning efforts, particularly in the design of stopes that include measured, indicated and some inferred mineral resources - a process that has been utilized at the Pilar Mine since underground operations commenced in 1986. Inferred mineral resources are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. Mineral resources which are not mineral reserves do not have demonstrated economic viability.

Table 16-20: 2022 Strategic LOM Production Plan

SLOM	2022*	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	TOTAL
Underground Operations																						
Deepening Extension Zone, Pilar UG Mine (Pilar Mine below Level -965)																						
Tonnes Mined (000s)	6	154	332	335	1,200	1,201	1,212	1,215	1,202	1,191	1,201	1,200	1,209	1,192	1,216	1,186	1,205	225				**16,683**
Grade Mined (% Cu)	1.83	2.13	1.42	1.73	1.60	1.78	1.74	1.83	1.57	1.76	1.93	1.88	1.56	1.75	2.28	2.08	2.04	2.34				**1.83**
Pilar UG Mine Ex-Deepening Extension Zone (Pilar Mine above Level -965)																						
Tonnes Mined (000s)	490	1,774	1,748	1,467	822	1,156	1,179	835	782	519	591	414	350	325	234							**12,686**
Grade Mined (% Cu)	1.60	1.46	1.56	1.33	1.16	1.00	1.02	1.07	0.91	0.96	0.91	0.94	1.02	0.96	1.05							**1.21**
Honeypot & Upper Areas																						
Tonnes Mined (000s)	0	80	387	941	915	756	815	1,052	1,111	1,246	1,185	1,459	1,560	1,540	1,055	914	189					**15,205**
Grade Mined (% Cu)	0.00	1.29	1.16	1.52	1.28	1.19	1.54	1.35	1.60	1.38	1.24	1.21	1.27	1.32	1.33	1.41	1.40					**1.35**
Vermelhos UG Mine																						
Tonnes Mined (000s)	233	891	867	832	828	832	763	772	793	694	382	626	512	233								**9,255**
Grade Mined (% Cu)	2.13	1.74	1.12	1.08	1.22	1.11	0.90	1.09	0.96	1.23	0.82	0.94	1.03	0.77								**1.15**
Surubim UG Mine																						
Tonnes Mined (000s)	22	53																				**75**
Grade Mined (% Cu)	1.19	1.19																				**1.19**
Open Pit Operations																						
N8/N9 OP Mine (Vermelhos District)																						
Tonnes Mined (000s)														1,979	2,170	3,187	3,734	3,856	5,406	5,302	4,408	**30,042**
Grade Mined (% Cu)														0.56	0.50	0.47	0.48	0.44	0.43	0.50	0.61	**0.49**
N5 (Siriema) OP Mine (Vermelhos District)																						
Tonnes Mined (000s)										666	450	600	600	597								**2,914**
Grade Mined (% Cu)										0.55	0.66	0.66	0.92	1.25								**0.81**
Surubim District, Open Pit (Surubim & C12)																						
Tonnes Mined (000s)	55	610	623	534	599	1,036		77	298	381	728	842	429									**6,213**
Grade Mined (% Cu)	0.72	0.66	0.58	0.52	0.70	1.08		0.78	0.73	0.61	0.69	0.68	0.91									**0.74**
Suçuarana South OP Mine (Pilar District)																						
Tonnes Mined (000s)																720	1,355	1,678	740	774	422	**5,688**
Grade Mined (% Cu)																0.40	0.39	0.39	0.51	0.50	0.49	**0.43**
Total Mine Plan																						
Tonnes Mined (000s)	806	3,561	3,957	4,109	4,364	4,982	3,969	3,950	4,186	4,696	4,536	5,142	4,660	5,867	4,675	6,007	6,483	5,759	6,145	6,077	4,829	**98,761**
Grade Mined (% Cu)	1.68	1.42	1.26	1.25	1.26	1.25	1.32	1.38	1.28	1.23	1.20	1.16	1.22	1.10	1.18	0.92	0.78	0.50	0.44	0.50	0.60	**1.02**
Ore Sorting Operations																						
N8/N9 OP Mine (Vermelhos District)																						
Tonnes Mined (000s)														940	1,031	1,514	1,774	1,832	2,568	2,519	2,094	**14,270**
Grade Mined (% Cu)														1.03	0.91	0.86	0.88	0.81	0.79	0.92	1.12	**0.91**
N5 (Siriema) OP Mine (Vermelhos District)																						
Tonnes Mined (000s)										316	214	285	285	284								**1,384**
Grade Mined (% Cu)										1.02	1.21	1.21	1.70	2.31								**1.49**
Vermelhos UG Mine																						
Tonnes Mined (000s)										330	382	626	512	233								**2,082**
Grade Mined (% Cu)										2.27	1.51	1.73	1.91	1.43								**1.79**
Total Ore to Mill																						
Tonnes Mined (000s)	806	3,561	3,957	4,109	4,364	4,982	3,969	3,950	4,186	3,982	4,300	4,827	4,345	4,514	3,535	4,333	4,523	3,734	3,307	3,293	2,515	**81,095**
Grade Mined (% Cu)	1.68	1.42	1.26	1.25	1.26	1.25	1.32	1.38	1.28	1.41	1.32	1.33	1.40	1.42	1.52	1.24	1.06	0.71	0.73	0.82	1.01	**1.24**
Processed																						
Tonnes Mined (000s)	761	3,467	3,900	4,197	4,080	4,200	4,213	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,200	4,080	3,375	2,997	**81,470**
Grade Mined (% Cu)	1.73	1.43	1.29	1.24	1.28	1.25	1.29	1.34	1.31	1.36	1.33	1.32	1.32	1.40	1.52	1.22	1.05	0.77	0.65	0.78	0.96	**1.22**
Recovery (%)	92.54	91.57	92.29	92.08	92.26	92.15	92.31	92.48	92.37	92.58	92.43	92.41	92.41	92.71	93.13	92.00	91.21	89.65	88.75	89.70	90.79	**0.92**
Copper tonnes in concentrate (000s)	**12.2**	**45.3**	**46.3**	**47.8**	**48.3**	**48.5**	**50.3**	**52.0**	**50.9**	**53.1**	**51.5**	**51.2**	**51.2**	**54.6**	**59.4**	**47.1**	**40.0**	**28.8**	**23.4**	**23.6**	**26.2**	**911.8**

*Q4 2022 outlines the mineral reserve schedule for the three months from the Effective Date to December 31, 2022. All figures have been rounded to reflect the accuracy of the estimates. Summed amounts may not add due to rounding. The Company's 2022 Strategic LOM Plan is preliminary in nature and includes inferred mineral resources which are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. As such, there is no certainty that the 2022 Strategic LOM Plan will be realized. The Company has an active drill program in place to continuously infill and upgrade inferred mineral resources once underground drill stations have been developed. However, until this work is completed, and the inferred resources have been upgraded to mineral reserves, there is no certainty this material will be converted into mineral reserves. Modified inferred mineral resources are not mineral reserves. Mineral resources that are not mineral reserves do not have a demonstrated economic viability.

17 RECOVERY METHODS

17.1 CARAÍBA MILL FLOWSHEET AND PROCESS DESCRIPTION

The Caraíba Mill was designed and built by Milder Kaiser, a Canadian engineering, design and construction company. Processing operations commenced in 1979 and the plant has since had the benefit of decades of process optimization work performed by the Caraíba's process engineering team with the support of third-party consultants as needed. The concentrator is operated 24 hours per day, seven days per week with monthly scheduled downtime to perform routine maintenance. In its current configuration, the plant has capacity to treat a nominal 3.2 million tonnes of copper bearing ore per annum, assuming 91% total availability.

The Caraíba concentrator plant is composed of a three-stage crushing, two-stage milling and flotation design. Three-stage crushing is used to prepare a nominal 12.5mm top size crushed feed for the ball milling circuit that also feeds the regrind mill circuit prior to being sent to flotation for the recovery of copper-bearing minerals. Final flotation concentrate is filtered to a design target of 7.5% moisture and is transported via highway for smelting and refining either (i) locally at Paranapanema Company, located in Dias D'Ávila, or (ii) sold via international export markets from Salvador's port, both approximately 475km from the Caraíba Mill.

Installed equipment of the Caraíba Mill are detailed in Table 17-7. A process flowsheet showing major unit operations is further detailed in Appendix C to the Report.

17.2 CRUSHING

There are two primary crushing operations. Ore from other mining sites is delivered to the surface primary gyro crusher, featuring a nominal capacity of 1,600t/h. Ore from underground mining is crushed underground by one of two primary jaw crushers with a nominal capacity of 400t/h each. Feed enters the primary crushing operations with maximum size of 48" and is discharged with maximum size of 10".

The blended product of the primary crushing operations is transported via conveyors to a feeder stockpile with a capacity of 12,000 tonnes. The stockpile feeds two primary double deck screens, configured with 100mm aperture on the top and 40mm aperture on the bottom decks. The material over 40mm feeds one of two secondary cone crushers (seven-feet ("ft.") standard Symons; 1,400t/h of capacity each) set to 28mm aperture. Screen undersize and secondary crushers products discharge onto one conveyor in an open circuit configuration. The Symons Cone crushers will be replaced by Metso HP500 Cone crusher during the execution of the planned mill expansion project, scheduled for completion in 2023.

Secondary cone crusher discharge and primary screen fines are blended with tertiary crusher discharge and are conveyed to the seven secondary double screen decks, configured with 25mm aperture on the top and 16mm aperture on the bottom decks. Tertiary crushing is performed with four standard CH660 Sandvik cone crushers (capacity of 350t/h each) set to 20mm aperture. Oversize material passes to the tertiary crushers operating in a closed-circuit configuration. Final product from the combined crushing and screening operations is 88% passing 1/2". The technical specifications of the crushing circuit are included below in Table 17-1.

Table 17-1: Caraíba Crushing Circuit Technical Specifications (Ero Brasil, 2022)

Parameter	Units	Value		
Primary Crusher		**Underground (UG)**		**Open Pit**
Make		Metso (Old)	Metso (New)	Dedini-Kawasaki
Model		C12090	C120	Gyro 54"x74"
Feed Opening	mm x mm	1,200 x 870	1,200 x 870	
Feed Top Size, F100	mm	746	746	-
Product Top Size, P100	mm	178	178	-
Closed Side Setting	mm	100 (CSS)	100 (CSS)	
Open Side Setting, Ave (Min – Max)	mm	-	-	152.4 (137.6 – 254)
Stroke	mm	N/A	N/A	28
Motor	kW	160	160	403
Secondary Crusher				
Make		Nordberg		
Model		Symons 7ft		
Number of Units	qty	2		
Cavity		Coarse		
Closed Side Setting	mm	32		
Motor	kW	224		
Tertiary Crusher				
Make		Sandvik		
Model		CH660		
Number of Units	qty	4		
Cavity		Fine		
Closed Side Setting	mm	9.5		
Motor	kW	298		
Primary Screen				
Make		FMC		
Number of Units	qty	2		
Screen Size (W x L)	m x m	2.4 x 6.1		
Screen Aperture (Top / Bottom Deck)	mm / mm	100 / 40		
Secondary Screen				
Make				
Number of Units	qty	7		
Screen Size (W x L)	m x m	2.4 x 6.1		
Screen Aperture (Top / Bottom Deck)	mm / mm	25 / 16		
Coarse Ore Stockpile Live Capacity	m^3	12,000		
Fine Ore Silos - Max Capacity	t	2 x 3,000		
- Operating Capacity	t	2 x 1,750		

17.3 ORE BLENDING

Crushed ore is conveyed to the stacker-reclaimer system to further homogenize the ore for feeding the plant. The stacker-reclaimer system is comprised of a two-armed stacker and a 16 bucket-wheel reclaimer with capacities of 1,600t/h and 1,200t/h, respectively. Crushed ore capacity of the stacker-reclaim system is currently 140,000 tonnes.

17.4 GRINDING

The grinding circuit consists of two identical lines operating with a primary ball mill operating in closed circuit with a dedicated battery of 26" hydro-cyclones. Each ball mill is 5.0 m by 7.6 m, charged with 90 mm in diameter high chrome cast steel balls. The nominal grinding capacity of each mill is 200 t/h each. Typical ball consumption is 340 g/t.

Blended ore from the stacker reclaimer is withdrawn through belt feeders below one of the 3,000 tonne ore silos that are interconnected. Ore is delivered to the ball mill over a belt weightometer to control and measure the mass of ore sent to each mill for metallurgical accounting purposes.

The coarse fraction from the cyclone underflow recycles to the ball mill feed chute for further grinding. Overflow from both grinding lines combines as feed to the high frequency screeners and regrinding circuit.

Table 17-2: Caraíba Ball Mill Specifications (Ero Brasil, 2022)

Parameter	Units	Ball Mill 3	Ball Mill 4
Diameter – Inside Shell	**m**	**5.03**	**5.03**
Effective Grinding Length	**m**	**7.62**	**7.62**
Imperial Measurements	ft x ft	16.5 x 25.0	16.5 x 25.0
L : D Ratio		1.51	1.51
Discharge Arrangement		Overflow	Overflow
Speed	rpm	13.8	13.8
	% Nc	71.6	71.6
Liner Thickness – New	mm	100	100
Ball Addition Size	mm	100	100
Ball Addition Rates	kg/t	0.355	0.355
Operating Ball Charge	% Vol	32	32
Maximum Ball Charge	% Vol	40	40
Operating Power	kW	2,900	2,900
Installed Power	**kW**	**3,100**	**3,100**

17.5 HIGH FREQUENCY SCREENS AND REGRINDING CIRCUIT

The cyclone oversize is pumped to high frequency screening operations comprised of eight screens with five decks each of 210+ micron aperture. The high frequency screening coarse fraction is gravity fed to the vertical mill (STM HIG Mill HIG2300/23000) for regrinding, operating in an open circuit.

Table 17-3: Caraíba Derrick Screen Techincal Specifications (Ero Brasil, 2022)

Parameter	Units	Design
Number of Units	qty	8
Number of Decks per Unit	No	5
Aperture	micron	210
Estimated Capacity Unit	t/h	**70 – 95**
Estimated Total Capacity	t/h	**550-750**

The HIG Mill was commission in September 2020. The screening operation fines combine with the regrind mill product and are pumped to the flotation circuit. Technical specifications for the HIG Mill circuit are shown below in Table 17-4.

Table 17-4: Caraíba HIG Mill Technical Specifications (Ero Brasil, 2022)

Parameter	Units	HIG2300
Inside Diameter Mill Chamber	**m**	**1.7**
Height Mill Chamber	**m**	**6.8**
Net Volume	m^3	13.3
Gross Design Volume	m^3	15.0
Number of Discs	No.	16
Operating Power	kW	1,700
Installed Power	**kW**	**2,300**

17.6 FLOTATION AND DEWATERING

The flotation circuit at Caraíba consists of a conventional rougher-cleaner-scavenger flotation process. The rougher circuit consists of three rougher banks divided into two stages of flotation with four cells in each unit operation. The first four cells of each bank produce a rougher concentrate that passes to the four cleaner cells. In practice, the concentrate of second rougher stage is returned to the head of the circuit to increase total rougher mass pull and retention time. Rougher concentrate is fed to the cleaner circuit and rougher tails are fed to the rougher scavenger circuit.

Rougher concentrate, combined with recleaner circuit tails and cleaner-scavenger concentrate, is sent to the cleaning circuit which consists of four cell banks. Each bank contains one recleaner cell, three cleaner cells and four cleaner-scavenger cells. Operated in a continuous process, the recleaner cell concentrate becomes the final product grading approximately 33%-35% copper with minimal impurity elements. Notably, all concentrate assays fell below detection limits of 100 ppm for Arsenic. By-product gold and silver averaged 2.5 g/t and 42.0 g/t, respectively. Assays of copper concentrate, performed on concentrate shipments from 2021 resulted in the following average composition:

Table 17-5: Copper Concentrate Assay Average for 2021 (Ero Brasil, 2022)

Cu	S	Fe	SiO_2	MgO	Al_2O_3	CaO	TiO_2	K_2O	Ni	Cr_2O_3	Zn	MnO	P_2O_5	V_2O_5	CoO	Others
34.02	25.4	18.67	11.26	3.10	2.33	1.83	0.27	0.24	0.40	0.20	0.02	0.06	0.05	0.004	0.02	2.12

Note: All elements determined using ICP-MS, except Cu (Volumetric technique). Recent assay results provided are illustrative for reference only and not intended to be representative of total concentrate production.

The composition of the Company's concentrate can be characterized in the table below:

Table 17-6: Concentrate Production Blend (Ero Brasil, 2022)

Oxides / Elements	Tenor
Cu	33.50%
MgO	3.00%
SiO_2	11.00%
Al_2O_3	2.00%
CaO	1.0%
Fe	20.00%
S	25.00%
Ni	0.40%
Na	0.23%
Au	2.50g/t
Ag	42.0g/t
Cr	150 ppm
Co	200ppm
Pb	60ppm
Zn	250ppm
Cd	<10ppm
Bi	<50ppm
Sb	<50ppm
Mo	<100ppm
As	<100ppm
Se	200ppm
Te	150ppm
Cl	150ppm
V	<100ppm

Note: All elements determined using ICP-MS, except Cu (Volumetric technique). Recent assay results provided are illustrative for reference only and not intended to be representative of total concentrate production

The scavenger concentrate from the cleaner-scavenger cells is recycled back to the cleaner circuit. Tailings from the cleaner-scavenger cells are recycled to the rougher circuit.

Throughout the flotation circuit samples of new feed, final concentrate, rougher tailings and final tailings are sampled by an automatic sampling device. A fraction of the slurry is sent to an online XRF analyzer to determine the copper grades. The balance of each sample is accumulated during the duration of each operating shift for further laboratory assay and analysis performed by Ero Brasil's laboratory and process engineering teams.

The final copper flotation concentrate is sent to one of two thickeners for dewatering prior to the filter press. Both concentrate thickeners are 24m in diameter and configured such that one is operating and one is on standby or undergoing routine maintenance. Overflow from the concentrate thickeners is recycled for plant process water. The thickener underflow is transferred to holding tanks that feed the filter press. The concentrate filtration capacity is expected to increase to adequately meet LOM concentrate filtration requirements as part of the mill expansion project, expected to be completed in 2023.

The thickened concentrate is filtered by a Diemme (GHT1500) plate filter press configured with 49 plates, producing a final dry concentrate of 7% to 8% moisture. Dry concentrate is stored in the Caraíba concentrate shed until it is loaded, weighed and transported via highway to local or international markets.

Final tailings from flotation operations are pumped to one of two tailings thickeners for dewatering. Both thickeners are 90m in diameter and configured such that one is operating and the other is on standby or undergoing routine maintenance. Water from the thickeners is recycled for plant process water. The thickened tails are pumped to the waste stockpiles for co-disposal and a fraction of the tailings to the paste fill plant for backfilling operations.

Table 17-7: Installed Equipment of the Caraíba Mill, 2022

Equipment	Size / Model	Qty
Primary gyro crusher	1.4m by 1.9m	1
Primary Screen	2.4m by 6.1m	2
Secondary crusher	7 ft	2
Secondary Screen	2.4m by 6.1m	7, each with 2 decks
Tertiary crusher	CH660	4
Stacker	1,600t/h	1
Reclaimer	1,200t/h	1
Ore bin	3,000t	2
Belt Feeders	various	20
Weightometers	2,5t; 0,5t	1;3
Ball mill	5.0m by 7.6m	2
Cyclone battery	6x 26”	2
Regrind mill	HIG2300/23000	1
Rougher cells	14.2m^3	24
Rougher-Scavenger cells	14.2m^3	24
Cleaner cells	8.5m^3	12
Scavenger cleaner cells	8.5m^3	16
Recleaner cells	8.5m^3	4
High frequency screens	1.0m by 1.5m	8, each with 5 decks
Tailing thickener	90.0m	2
Concentrate thickener	24m	2
Press filter	186.0m^2	1
Flash Float Cell	18.0m^3	1

17.7 LOADING AND TRANSPORTATION OF CONCENTRATE FOR SALE

The Caraíba Mill’s primary concentrate shed, located adjacent to the filter press, has storage capacity for approximately 8,000 tonnes of final concentrate. The building has a concrete floor, steel siding and dimensions of 50m in length, 36m in width and an average height of 11m (peak height of 13m). A secondary, uncovered cemented floor storage area adjacent to the primary shed has capacity for an additional 6,000 tonnes of final concentrate (covered with canvas tarps). The dimensions of the uncovered storage area are 60m by 36m.

Figure 17-1: Exterior and Interior of the Primary Concentrate Shed at the Caraíba Mill (Ero Brasil, 2020)

Ero Brasil ships final concentrate for sale to both the domestic market, via the Paranapanema Smelter located in Dias D'Ávila, Bahia State, and to international markets via Salvador´s port located in Salvador city, Bahia State. All concentrate is transported by road using standard highway trucks loaded with 32 tonnes of concentrate.

Trucks are loaded to specified weight using a loader configured with a scale-coupled bucket. After loading, the truck is directed to Ero Brasil's 100 tonne truck scale (+/- 10 kg), which is calibrated annually and certified by National Institute for Metrology, Quality and Technology (Inmetro). After final weight is recorded, the trucks are sampled for final assay. The samples obtained are hermetically packaged for moisture determination and copper and nickel. Analyses of final concentrates are performed by Ero Brasil's laboratory. The invoice is issued for transport of concentrate and shipped to Paranapanema or Salvador´s port.

17.7.1 **Concentrate Shipment for Export Market**

After site weight and sampling, concentrate trucks leave the Caraíba Operations via state highways number BA314, traveling 54km to BR407 that goes to the town of Capim Grosso, then follow on federal highway number BR324 to Salvador City and the city's port, the second largest in Brazil's northeast. The total route is approximately 472.7km from the concentrate shed. Caraíba also has the option of exporting the concentrate via the other Salvador's port (Aratu) or the Aracaju port (TMIB).

On delivery, the concentrate is discharged into a secure warehouse contracted. Containers are loaded with bobcats. During loading, samples are taken from each loaded bucket for moisture and metal assay. Assay results are composited to determine final metal and moisture content.

Figure 17-2: Salvador's Port, where Caraíba Concentrate Departs for International Markets (Ero Brasil, 2017)

17.7.2 Delivery of Concentrate for Domestic Market

After site weight and sampling, concentrate trucks leave the Caraíba Operations via state highway BA314, traveling 54km to BR407 that goes to the town of Capim Grosso, then federal highways BR324 and BA512 to Dias D'Ávila town and the Paranapanema Smelter. The total route is approximately 475.2km from the concentrate shed.

The copper concentrate delivered at Paranapanema is weighed to determine the final weight, unloaded and then transported via conveyor to the smelting facilities. Conveyor samples are taken during unloading for moisture and metal assay. Assay results are composited to determine final metal and moisture content.

17.8 CARAÍBA MILL PERFORMANCE

Through the end of 2021, the Caraíba Mill has produced a over 3.0 million tonnes of concentrate containing over 1.0 million tonnes of copper.

Summarized processing results of concentrate flotation operations between 1998 and 2021 are provided in Table 17-8 and from January to September 30th of 2022 in Table 17-9.

Table 17-8: Caraíba Mill Processing Results, 1998 to 2021

	Caraíba Mill Feed		Copper Production	
Year	Tonnes	Grade (% Cu)	Tonnes	Recovery (%)
1998	2,665,700	1.49	34,325	89.6
1999	1,248,720	2.88	31,371	90.9
2000	1,173,452	3.11	31,786	89.0
2001	1,185,834	2.92	30,111	89.4
2002	1,195,136	2.97	30,642	88.7
2003	1,109,396	2.87	27,237	88.0
2004	1,557,261	1.93	25,748	88.1
2005	2,553,803	1.11	23,991	86.9
2006	3,093,042	0.99	22,720	82.0
2007	2,882,542	1.00	25,191	81.3
2008	3,340,765	0.80	22,911	85.3
2009	2,932,262	0.97	25,873	85.4
2010	2,044,002	1.32	23,313	86.4
2011	2,749,812	1.09	25,096	83.7
2012	2,717,980	1.07	24,827	85.4
2013	2,940,566	0.91	22,494	84.3
2014	3,014,269	1.01	25,717	84.7
2015	2,836,528	1.11	27,046	86.0
2016	826,759	0.71	4,895	83.5
2017	1,771,209	1.31	20,133	86.8
2018	2,257,917	1.56	30,426	86.3
2019	2,424,592	1.93	42,318	90.5
2020	2,271,625	2.08	42,814	90.5
2021	2,370,571	2.08	45,511	92.4

Table 17-9: January 2022 to September 2022 Processing Results

	Caraíba Mill Feed		Copper Production	
Year	Tonnes	Grade (%Cu)	Tonnes	Recovery (%)
2022 (Jan-Sep)	2,118,380	1.73	33,707	91.8

The reagent scheme utilized by the Caraíba Mill is determined by Ero Brasil's process engineering team for each source of ore and verified through daily metallurgical composite bench testing as well as online process monitoring via an online XRF unit. The typical dosage of reagents for the copper circuit flotation is provided below in the table below.

Table 17-10: Typical Caraíba Mill Process Reagent Dosages

	Collector (g/t)	CMC (g/t)	Frother (g/t)	Depressor (g/t)	Xanthate (g/t)	pH Rougher	pH Cleaner
Average 2022 (Jan-Sep)	48.1	248.8	23.4	60.5	1.2	9.6	11.5
Standard deviation	7.8	51.7	3.0	8.2	1.7	0.7	0.7

Power for the Caraíba Mill is supplied from CHESF. Average power consumption, for total Caraíba Mill operations is currently 29kWh/t to 35 kWh/t of ore processed. Water usage averages approximately 4.2 to 5.5 m3 per tonne of ore processed, of which approximately 70% is obtained from recycled process water. When including all water sources, including surface run-off water collection, recycled water represents approximately 90% of water usage.

Total forecast power and water usage (including recycled process water) are 31kWh and 3.0m3 per tonne of ore processed, respectively. These projections are in line with current and prior plant performance.

Table 17-11: Caraíba Power and Raw Water Use (Ero Brasil, 2022)

		2017	2018	2019	2020	2021	2022f
Tonnes Treated	t	1,771,209	2,257,917	2,424,592	2,271,625	2,370,571	2,861,843
Electricity Use	MWh/t	34.2	32.7	32.2	33.7	35.6	29.3
Raw Water Use	m^3/t	6.9	5.0	4.9	4.9	5.5	4.2

17.9 CARAÍBA MILL OPTIMIZATION & 4.2 MTPA EXPANSION

A multi-phased and discretionary plan has been set forth to increase the mill capacity to 4.2Mtpa from current levels in support of the LOM plan. The authors of this report have not identified any metallurgical, infrastructure, permitting, legal, political, environmental, title, taxation, socio-economic, marketing or other relevant factors that could materially affect the potential development of the stated Mineral Reserves.

Several trade-off flowsheets were evaluated during 2020 and 2021 and a number techno-economic trade-offs completed. The main process options were:

- adding an HPGR to the current flowsheet, keeping the 2 operating Ball mills
- adding a third Ball Mill to the flowsheet

Based on a capital costs, operating costs and operational risk trade-off studies, the third ball mill option was selected as the preferred route and is currently under construction. The mill expansion is expected to be completed by year-end 2023.

17.9.1 Current Operations (3.2Mtpa)

Depending on availability of mill feed, the Caraíba Mill operates at a maximum rated tonnage of approximately 9,600 tpd, or approximately 3.2Mtpa. A number of optimization projects were completed related to both improving metallurgical recoveries and providing the foundation for continued mill expansion. Those projects are:

- Installation of a single, variable speed drive, HIG Mill (23000F/2300) handed over to operations in first quarter of 2021 in order to improve copper recoveries through increased particle liberation (see Section 13.2 for additional information).

- Installation of an expanded CMC circuit to increase the actual dosage from 200 g/t to 500 g/t dosage capability scheduled to be completed and commissioned during the last quarter of 2022 in order to suppress hydrophobic materials in the mill feed (primarily talc).

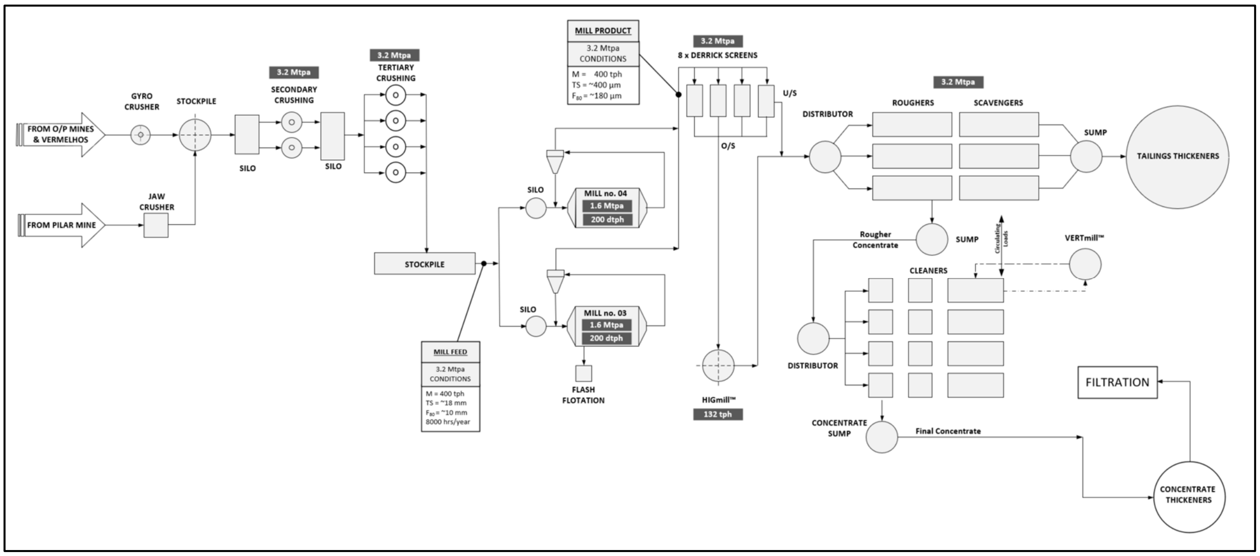


Figure 17-3: Simplified Process Flow-Sheet (Ero Brasil, 2022)

17.9.2 Third Ball Mill and Flotation Upgrades

The expansion to increase capacity to 4.2Mtpa of annual mill throughput requires the upgrade of the Secondary Crusher system due to obsolescence, installation of a third Ball Mill, and upgrades to the flotation circuit to ensure residence time is not impacted, alongside an increase in concentrate filtration capacity. A simplified process flowsheet highlighting new equipment and upgrade requirements is shown in the figure below.

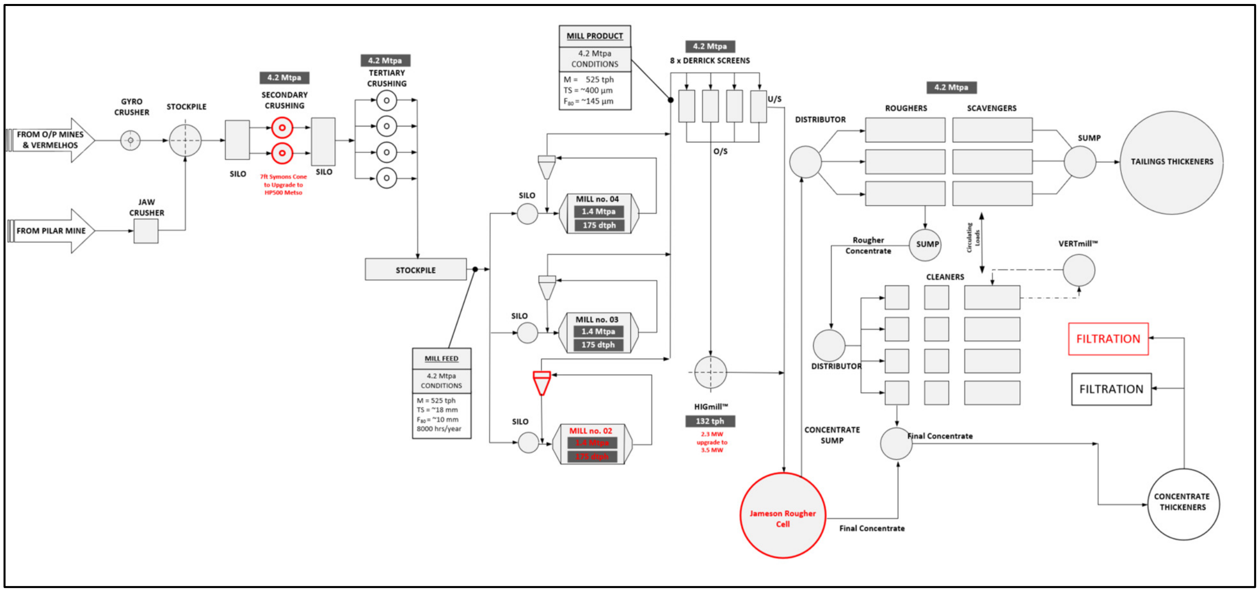


Figure 17-4: Simplified Process Flowsheet, 4.2Mtpa (Ero Brasil, 2022)

Based on current power consumption, the installed HIG Mill power is adequate for the 3.2 Mtpa production level based on the specific grinding energy ("SGE") of 14-16 kwh/t measured. Power upgrades are needed for the expansion of the mill to 4.2 Mtpa. An increase to 3.5 MW from 2.3 MW of installed power has been included as part of the ongoing mill expansion project, expected to be completed by the end of 2023.

The modeled power draw for 4.2Mtpa was simulated as shown in Table 17-12. The total operating work index was simulated at approximately 22 kwh/t for flotation feed of 92 microns. Studies show that the capability of the expanded mill will have the capacity to process approximately 4.8 Mtpa at an increased flotation feed P80 of 102 microns by the end of 2023. The third ball mill option adds flexibility to the Caraíba Operations processing circuit providing increased capacities without complicating the circuit relative to alternative configurations evaluated.

Table 17-12: Modeled Plant Data for 4.2 and 4.8 Mtpa (Ero Brasil, 2022)

Parameter	Units	Option 1
4.2 Mtpa		
Total Mill Feed Rate, t/h	t/h	525
Ball Mill 1 Power Draw	kW	3,070
Ball Mill 2 Power Draw	kW	3,070
Ball Mill 3 Power Draw	kW	3,070
HIG Mill Power Draw	kW	2,722
Total Mill Power Draw	kW	11,932
Derrick Screen US P_{80}	mm	0.100
HIG Mill Product P_{80}	mm	0.074
Screen US & HIG Mill Product P_{80}	mm	0.092
New BM Screen US P_{80}	mm	-
Flotation Feed P_{80}	**mm**	**0.092**
Operating Work Index, Wio	**kWh/t**	**21.7**
4.8 Mtpa		
Total Mill Feed Rate, t/h	t/h	600
Ball Mill 1 Power Draw	kW	3,200
Ball Mill 2 Power Draw	kW	3,200
Ball Mill 3 Power Draw	kW	3,200
HIG Mill Power Draw	kW	3,226
Total Mill Power Draw	kW	12,826
Derrick Screen US P_{80}	mm	0.110
HIG Mill Product P_{80}	mm	0.085
Screen US & HIG Mill Product P_{80}	mm	0.102
New BM Screen US P_{80}	mm	-
Flotation Feed P_{80}	**mm**	**0.102**
Operating Work Index, Wio	**kWh/t**	**21.6**

For the selection of expanded flotation residence times, a Jameson cell was selected to be installed ahead of the existing flotation circuit. The design calls for approximately 74% of the copper contained in feed to be pulled from the Jameson cell as final concentrate while the tailings from the Jameson cell, containing the remaining 26% copper, will flow to the existing flotation circuit. Figure 17-5 shows the future layout of the Caraíba Mill with the Jameson cell and new conveyor addition.

Table 17-12 shows the main design parameters based on test work concluded at Ero Brasil, simulating the Jameson Cell operation in the laboratory. The test work data was used as basis for the process design and installation, expected to be completed by the end of 2023.

Table 17-12: Jameson Cell design parameters for 4.2 and 4.8 Mtpa (Ero Brasil 2022)

Parameters	Units	4.2 Mtpa		4.8 Mtpa	
Jameson Cell Model		B6500/24		B6500/24	
Number of Cells		1		1	
Slurry Lens Orifice Size	mm	44		44	
Feed Pressure	kPa	170		170	
Wash water Ratio		2.0		2.0	
Feed Pulp Density	% Solids	30.0	35.0	30.0	35.0
Fresh Feed Solids Rate	t/h	525	525	600	600
Feed Grade	Cu%	1.23	1.23	1.23	1.23
Mass Recovery	%	2.6	2.6	2.6	2.6
Cu Metal Recovery	%	74.0	74.0	74.0	74.0
Concentrate Grade	Cu%	34.5	34.5	34.5	34.5
Concentrate Pulp Density	% Solids	30.0	30.0	30.0	30.0
Upgrade Ratio		28.0	28.0	28.0	28.0
Tailings Recycle	**%**	**33.8**	**44.5**	**24.4**	**36.5**
Tailings Grade	Cu%	0.33	0.33	0.33	0.33

Figure 17-5 shows the layout of the primary modifications in support of the plant expansion. The first feed silo will be re-equipped with a new conveyor system to feed the new ball mill, which will be positioned in the old ball mill 2 location. The Jameson cell will be positioned on the side of the building. The flotation rougher feed will be diverted out of the building into a new feed sump to the Jameson Cell. Jameson tails will be pumped back into the existing scavenger and cleaner system. Jameson concentrate will be diverted straight to final concentration.

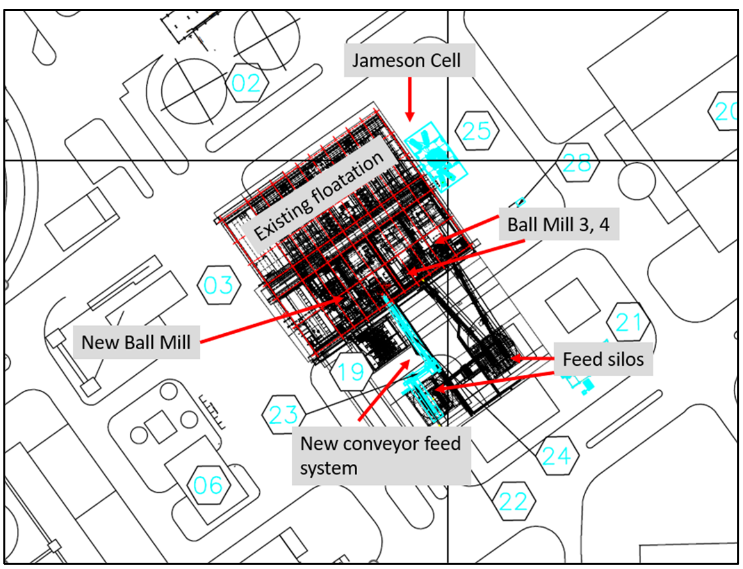


Figure 17-5: Plant Expansion Layout (Ero Brasil, 2022)

17.10 SX/EW PLANT

The SX/EW operations at the Caraíba Mine operated from 2007 until 2014, processing a total of approximately 5.9 million tonnes of oxide ore from open pit operations throughout the Curaçá Valley. Processing operations consisted of crushing, agglomeration / pre-treatment, heap leaching, solvent extraction ("SX") and electrowinning ("EW") producing a copper cathode. The EW unit operation has a maximum installed capacity of 430t of copper cathode per month.

In practice, crushed oxide ore was pre-treated with 98% sulphuric acid and water to agglomerate the material prior to placement on one of 22 heaps used for leaching. Each heap had approximate dimensions of 130m by 12m. Design heap height was initially 4m, but later reduced to 2m in practice. Leaching was performed over a period of 45 to 60 days, producing a pregnant leach solution ("PLS") of 5-7 grams per liter ("g/l") of copper in solution prior to SX/EW unit operations. Recovery of copper from PLS averaged 96%, with global metallurgical recoveries of 70.5%. Historic operating data from the SXEW operations is shown in the table below.

At the time of the Effective Date, there is no copper cathode production included in the production plan, economic projections, nor have oxide Mineral Resources been defined in sufficient quantities to incorporate economic projections. An ongoing analysis to rehabilitate and permanently decommission the existing facility is ongoing.

Table 17-13: Historic SX/EW Plant Performance

	Oxide Ore Treated		Cu Cathode Production		Acid Consumption	
Year	**Tonnes**	**Grade (% Cu)**	**Tonnes**	**Recovery (%)**	**(kg / tonne ore)**	**(kg / kg Cu)**
2007	117,533	0.72	913.0	60.0	28.0	3.6
2008	758,456	0.77	3,807.8	68.6	38.0	7.6
2009	891,934	0.73	4,398.0	74.9	35.7	7.2
2010	895,145	0.66	4,496.8	75.6	34.4	6.9
2011	943,580	0.68	4,549.8	77.4	30.6	6.3
2012	982,055	0.62	4,374.3	76.9	34.2	7.7
2013	1,077,577	0.57	3,999.2	71.2	36.3	9.8
2014	214,946	0.41	685.3	62.4	35.9	11.3
Total	**5,881,231**	**0.66**	**27,224.2**	**70.5**	**34.7**	**7.5**

18 PROJECT INFRASTRUCTURE

18.1 GENERAL INFRASTRUCTURE

The Caraíba Operations consists of fully-integrated mining, processing facilities and supporting infrastructure. The complex has been in near-continuous operation since 1979. In recent years, and in particular following the acquisition of Ero Brasil, several improvement and modernization campaigns have occurred. An overview of the processing facilities and supporting infrastructure is shown in the figure below. Infrastructure maps of the Caraíba Operations are further detailed in Appendix D of the Report.

Figure 18-1: Primary Caraíba Mine Infrastructure and Site Layout (Ero Brasil, 2017)

18.2 PROCESS AND MINE WATER SUPPLY

Water is supplied to the mine via an 86 km permanent steel pipeline (measuring 80 cm in diameter) from the São Francisco River. The primary pumping and water intake system is located 6.5 km upstream of Juazeiro city, in Bahia State. Flow rates of the river are controlled by the Sobradinho Hydroelectric Power Dam, located upstream of the primary pumping and water intake system. The available capacity of Ero Brasil's water source has assured the constant delivery of fresh water for Ero Brasil's mining and processing needs. The reservoir created by the Sobradinho Dam is reported to be the 12th largest man-made reservoir on earth.

Supported by three pumping stations, the maximum capacity of the freshwater intake system is 3,240 m^3/h, equivalent to approximately 2,000,000 m^3/month at 21 hours of operation per day. Current pumped volume of water is approximately 2,287 m^3/h, equivalent to approximately 1,234,980 m^3/month with only 17 hours of operation per day.

Ero Brasil uses only 20% of the total pumped volume of the pipeline. As operator of the pipeline, Ero Brasil provides water to the region's municipalities of Massaroca City, Abobora City and Umburnas City as well as local farmers located along the pipeline.

18.3 SITE POWER

Energy is supplied to the Caraíba Operations by CHESF via an overhead transmission line from the Sobradinho Hydroelectric Power Dam at 230kV. Ero Brasil has a long-term contract with CHESF and the provision of power for the operations is not a relevant risk to the current or future development plans of the Company.

Power from CHESF is fed to the primary substation at Caraíba, which is comprised of two transformers configured with 60MVA/230kV/13.8kV that serve to distribute power to the Caraíba Mine, Caraíba Mill, processing support facilities and administration offices. The figure below shows the primary power substation on the property which was installed and commissioned in 1978.

Mine


Figure 18-2: Main Electrical Substation at the Caraíba Mill (Ero Brasil, 2019)

Currently, Ero Brasil uses less than 25% of its primary substation capacity. Further expansions of the Pilar UG Mine including cooling and ventilation requirements, as well as the increased milling capacity up to 4.2Mtpa currently envisioned, will result in less than 50% of the installed power of the primary substation capacity. No further investments of the power supply infrastructure are anticipated.The Ero Brasil power supply infrastructure features a step-down substation (the “Main Electrical Substation”) containing two 40/50/60 MVA ONAF power transformers (forced ventilation) and 230 / 13.8 kV transformation ratio in order to distribute power to the Pilar UG Mine, the Caraíba Mill, administrative and support offices located on site as well as the local town of Pilar. The distribution of power follows the schematic illustrated below.

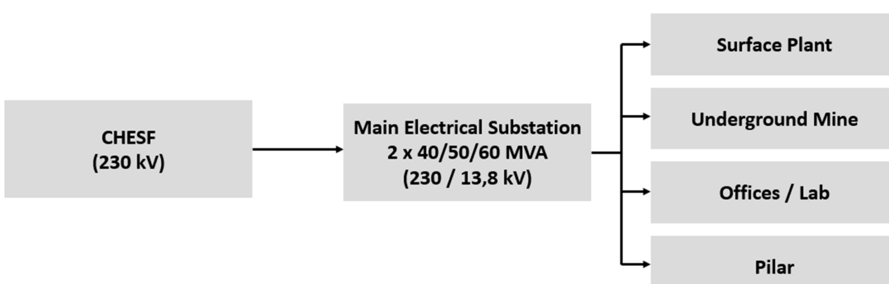


Figure 18-3: Simplified power distribution schematic (Ero Brasil, 2020)

The Electrical reticulation is designed with a ring feed system so that there is 100% redundancy and only one circuit is in operation at any given time, with the second duplicate circuit on stand-by. The circuits are responsible for supplying two buses (“Bus A” and “Bus B”), from which 20 circuits are available for delivery of power with medium voltage cubicles

("QF"). The currently configured load of each QF is listed below, and the disposition of the main equipment in the Main Substation is illustrated in Figure 18-4the figure below.

- QF 2: Paste Fill, Ore Winch, Surface Ventilation;
- QF 4: Underground Mine;
- QF 5: Primary and Secondary Crushing;
- QF 6: Milling and Filtering;
- QF 7: Ball mills;
- QF 8: Dining hall and Offices;
- QF 9: Residential nucleus;
- QF 11: Capacitors bank;
- QF 12: Lab and Pipeline Station;
- QF 13: Ball mills;
- QF 14: Milling and Filtering;
- QF 15: Primary and Secondary Crushing;
- QF 16: Underground Mine;
- QF 18: Paste Fill, Ore Winch and Surface Ventilation.

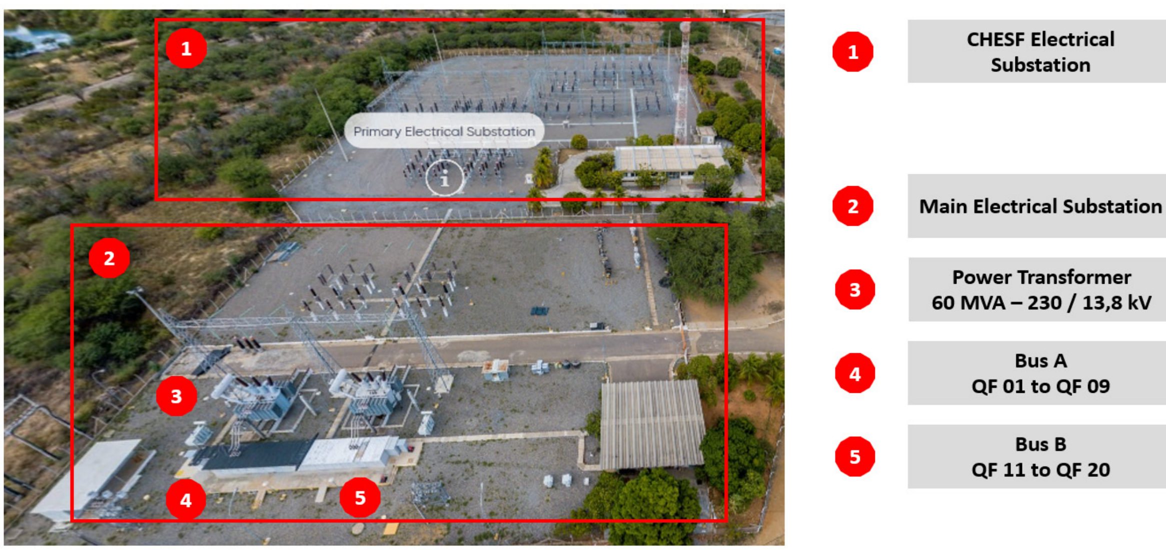


Figure 18-4: Location of equipment in Main Substation (Ero Brasil, 2020)

In addition to the primary power distribution system, there is an installed emergency electrical generation system comprised of two diesel generator sets with individual nominal capacity of 1,200 kVA and supply of 800 kW each when in continuous operation. They operate in parallel and turn on automatically in the event of a main power failure. The emergency power system is designed to ensure power delivery to critical areas of the operation at all times, including: the tailings thickeners, surface lighting, management offices, IT servers, ventilation and key areas of the underground mine including lighting, communication and the personnel hoist of the main underground shaft to ensure availability of secondary escapeways at all times.

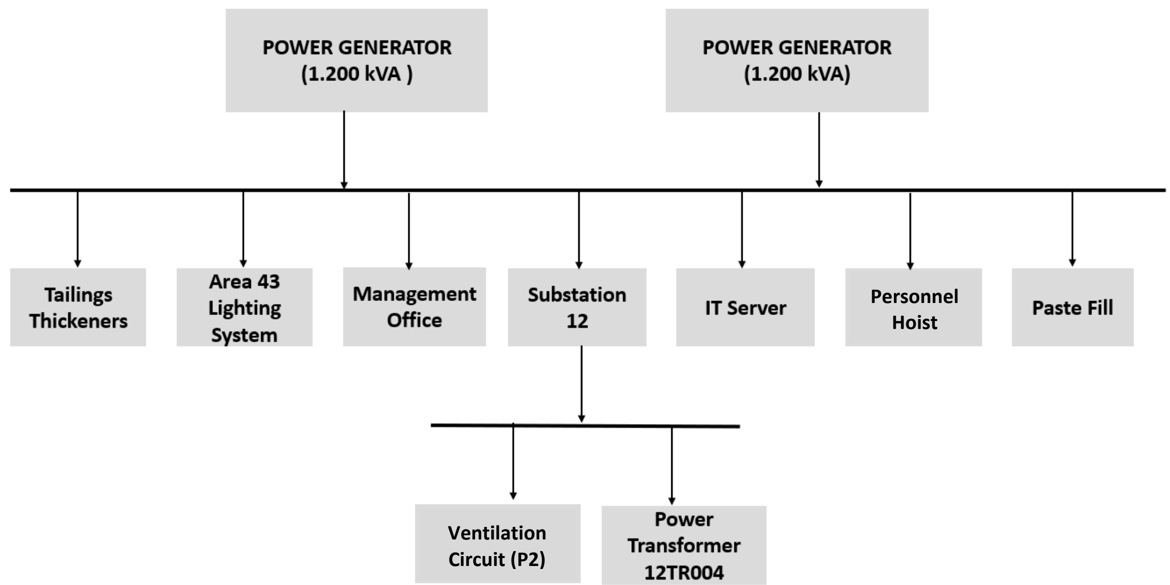


Figure 18-5: Loads served by the emergency generator system (Ero Brasil, 2020)

18.4 CARAÍBA MILL

The fully integrated Caraíba Operations have been producing copper concentrate from the Caraíba Mill since commercial production was achieved in 1979. The individual components of the Caraíba Mill are described in greater detail in Chapter 17 – Recovery Methods and a process flowsheet is shown in Appendix C to the Report. The mill was initially constructed with four ball mills resulting in an installed nameplate design capacity of 800 t/h. In 1999, two of the four ball mills were sold, reducing the nominal capacity of the milling operations to 400 t/h using both mills. The balance of the Caraíba Mill operations, including secondary, tertiary crushing and blending operations remain configured for the original design capacity, which collectively currently serves as built-in redundancy for each process operations. A two-phased optimization and expansion program for increasing the mill capacity beyond its current level is currently planned in two stages. These stages will increase the milling capacity from 400 t/h to 464t/h with the HIG Mill installation (completed in 2020), and to 527 t/h with the installation of a third ball mill, currently scheduled for completion by the end of 2023.

18.5 WASTE AND TAILINGS DISPOSAL, PILAR DISTRICT

The Caraíba Operations are a mature mining and processing operation with more than 40 years of operating history. Throughout the operating history, several methods have been used and continue to be used to dispose of flotation tailings as well as remediate coarse waste-rock stockpiles and historic open pit operations. There are three primary methods in which flotation tailings have been historically and are currently disposed of on site. These include: back-fill of open stopes within the Pilar UG Mine using cemented paste fill as part of production process, co-disposal of tailings into coarse waste rock stockpiles and the disposal of tailings in exhausted open pits. These methods are further detailed in Chapter 20.

Tailings management, reporting and monitoring are among the top priorities of the Company and its stakeholders. Following review of the operational practices in place, including various deposition methods, it is the opinion of the authors of this report that the tailings management system in place at the Company's operations aligns with industry best practices.

18.6 PILAR UG MINE INFRASTRUCTURE

The Pilar UG Mine complex is approximately 1.4 km deep and in total consists of approximately 124 km of gallery development. The underground mine consists of a large network of supporting infrastructure that has been expanded and modernized over the years.

18.6.1 Electrical Supply

The electrical supply for the Pilar UGUG Mine begins at QF 04 or QF 16 of the Main Electrical Substation, depending on which of the redundant circuits is active. Currently, QF circuit 16 (Main B, Busbar B) is responsible for the power supply.

On surface, there is a step-down electrical substation, SE 12, composed of 3 transformers (12TR001, 12TR002, 12TR003) that are collectively responsible for the energy supply of the entire underground mine. SE 12 is currently undergoing an upgrade project in which it will increase its installed power by 5MVA. The project is expected to be completed by the end of 2022.

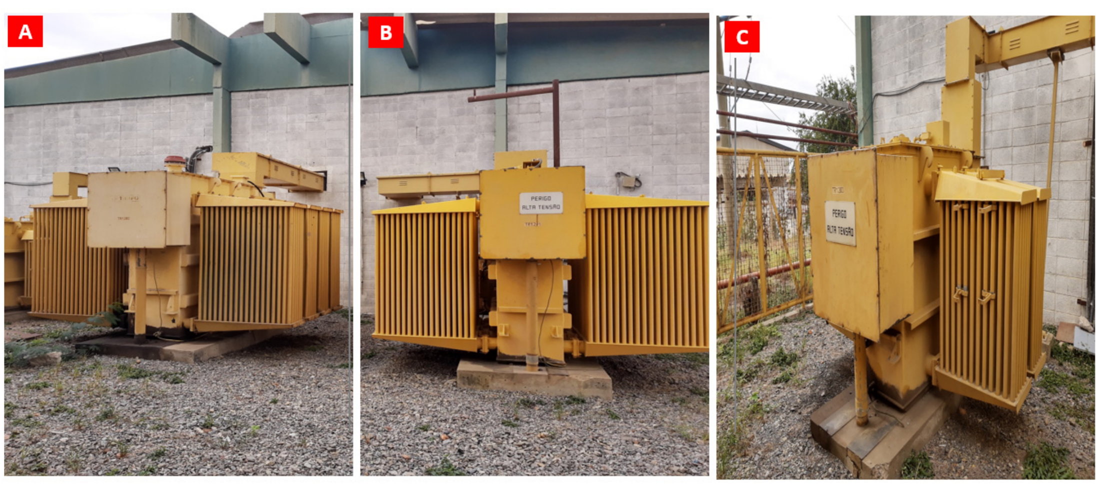


Figure 18-6: A: 12TR001; B: 12TR002; C: 12TR003 (Ero Brasil, 2019)

The existing shaft, completed to approximately 700m below surface, provides the conduit for delivery of power to the underground mine. Four medium voltage cables are wired, originating from the 12TR001 transformer to the substation located on the 21° bypass of the underground mine.

The cables are fixed to the shaft cabling structure and descend together to the bypass as shown in the figure below.

Figure 18-7: A: Existing Shaft; B: Cables running through Shaft (Ero Brasil, 2019)

Within the mine, power cables are laid connecting o the mine's underground substations, where the voltage is lowered to 4.16kV and distributed throughout the mine.

The table below presents the installed capacity of each of the installed transformers relative to current demand. The Analysis considered daily demand from the 12 months prior to the Effective Date for transformers 12TR001, 12TR002 and 12TR003.

Table 18-1: Power capacity vs. demand of the Pilar UG mine (Ero Brasil, 2022)

Transformer	Nominal Power (kVA)	Active demand (kW)	Reactive demand (kvar)	Apparent demand (kVA)	Power Factor	Current load
12TR001 (21º Bypass)	6,000	3,992	3,453	5,278	0.72	88%
12TR002	5,000	1,660	707	1804	0.65	51%
12TR003	1,500	1,300	554	1413	0.92	94%

The Deepening Shaft Project Substation, located on surface, will be fed from the existing 13.8 kV Main Substation through overhead lines and 13.8 kV cables to shaft surface substation connectors. This substation will provide all charges for shaft and deepening mining area and includes the following:

- Large-scale air cooler (BAC)
- Surface utilities i.e. Surface ore box / (Banksman; Control; Emergency; Rescue Brigade Room) / diesel lot system / high mast lights and general lighting

- Personnel winder
- Rock reel
- Underground rock handling system
- Substation of deepening mining area with capacity of approximately 5 MVA

The main power supply will consist of two independent sources of supply. Crosslinking systems have been designed to ensure that, in the event of loss of the power supply, the redundant system can continue to provide power to the winder and critical pumping infrastructure if necessary.

The 13.8 kV underground substation at the -1038m level will provide electricity to the mining area within the Deepening. This substation will be supplied power from the Shaft Surface Substation at 13.8 kV via two cables (one redundant) installed in the shaft barrel. Three substations have been designed to provide power to the rock handling system; a crushing substation and two transport substations.

18.6.2 Water Management

The water management system of the Pilar UG Mine can be divided into 2 main components: water supply (inlet) and the pumping system (outlet).

The requirements for service water used in the mining operations is primarily related to equipment use (drilling equipment and concrete sprayers), as well as stationary facilities (workshops, offices and the underground shotcrete plant).

The average use of service water is currently approximately 50,000m³/month. Supply distribution is managed through an 8-inch HPDE circuit that starts from the main ramp (on surface) and passes through the levels via galleries or down vertical drill holes. The water flows by gravity and surge boxes (built of either steel or concrete) control the flow pressure and serve as buffers for varying water inflow levels throughout the mine.

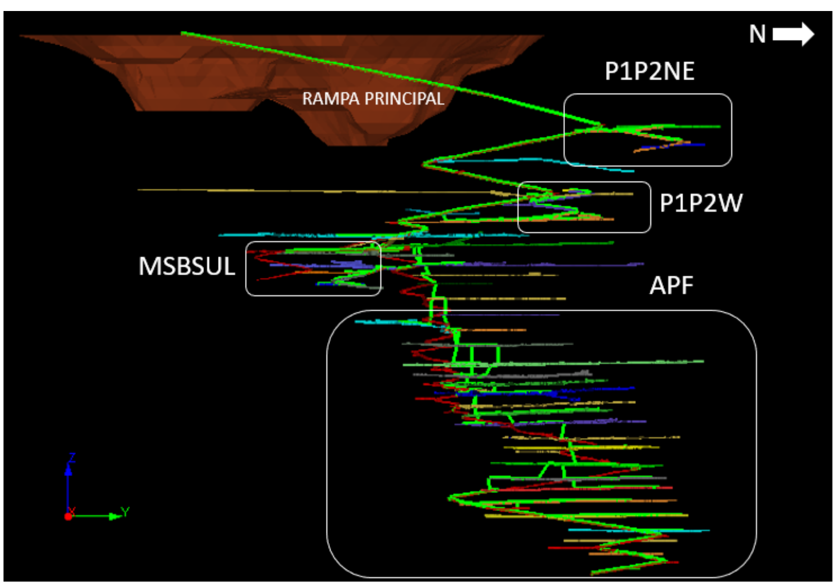


Figure 18-8: Service water schematic (green line) (Ero Brasil, 2020)

After use, secondary water discharged through normal drilling and mining operations is directed for water capture by the main pumping system.

The main dewatering range has a diameter of 8 inches (225 mm). In total, the pumping system consist of approximately 1 km of carbon steel and approximately 5km of HDPE piping. Joints are coupled using both steel and HDPE fittings depending on the pipe installed and area of the mine. All piping for the pumping system is supported by a metallic structure fixed to the either the side of the galleries, or ceiling for permanent installations.

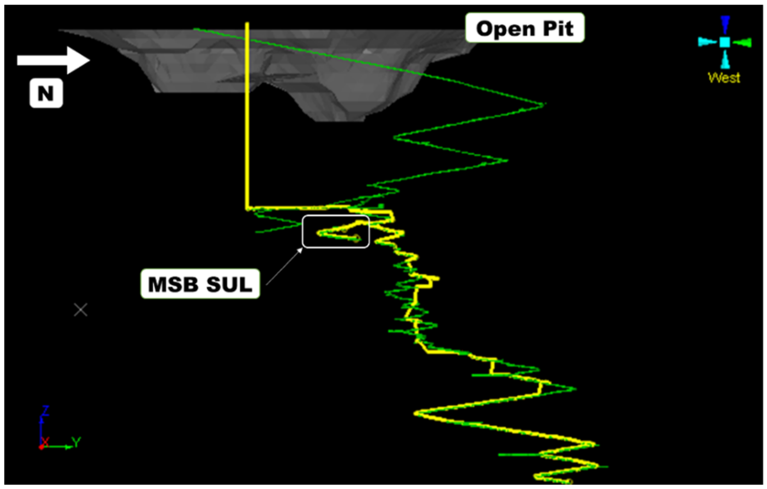


Figure 18-9: Pumping line schematic (Ero Brasil, 2020)

The main stations are built of concrete containing two 4/3 E-HH pumps with a WEG 150 horsepower 4P motor. The decantation galleries contain settlement dams which provide storage and also allow the suspended solids to settle, which have the function of collecting water from the drainage system from the main ramp and retaining contained solids, which are filtered using a Geotextile Blanket before reporting to the suction inlet of the pump stations. The water enters the floodgates through pipes fixed to the gallery ceiling and positioned above the gates.

Currently, Ero Brasil uses approximately 154m³/h of the pumping system, representing approximately 62% of the total installed capacity. While the existing circuit retains available capacity, the expansion the Deepening Project, envisions the installation of a new pump range to reduce the number of intermediate stations. Construction of new pumping stations has been included in the Company's forecast capital expenditures for the current LOM plan.

Figure 18-10: Photo of a Main Pumping Station (Ero Brasil, 2020)

18.6.3 Communication

The current communication, voice and video system installed in the Pilar UG Mine is a leaky feeder system featuring both transmitting and receiving devices. The radio system consists of 4 digital repeaters, which provide the capability of forming 10 simultaneous talk groups. The current topology of the underground mine's communication system is undergoing an upgrade project, in which it is in the transition phase from the flexcom / multicom system to the CENTRIAN system provided by the PBE company.

The existing leaky feeder infrastructure is divided into voice and video systems. The video system has a single exclusive channel for Pastefill monitoring and the voice system has 10 channels, as shown in the table below.

Table 18-2: Communication System Configuration

	Description
Channel 1	Surface to N-78
Channel 2	N-78 to N-732
Channel 3	Below N-732
Channel 4	Fleet Maintenance
Channel 5	Mine Dispatch
Channel 6	Emergency
Channel 7	Paste Fill
Channel 8	Fix Maintenance
Channel 9	Spare
Channel 10	Shaft Maintenance

The components used to transmit the signals of this system include a series of cabinets, amplifiers, splitters and termination units designed to reach all working faces, fixed facilities (maintenance, etc.), and mobile equipment. The system is comprised of two main circuits. One is fixed permanently along the main ramp (Circuit 1) and another is wired through the existing shaft (Circuit 2).

Circuit 1 is responsible for the communication of the upper levels of the Pilar UG Mine, where the system enters through the main portal and connects to the levels below. Along its length there are amplifiers, power supplies, derivations, and terminations. Circuit 2, is directed via the existing shaft to the primary crushing area and the lower levels of the mine. Both circuits feature components to ensure quality distribution of the signal throughout the mine.

Figure 18-11: Leaky Feeder Circuit 1, Main Ramp (Ero Brasil, 2020)

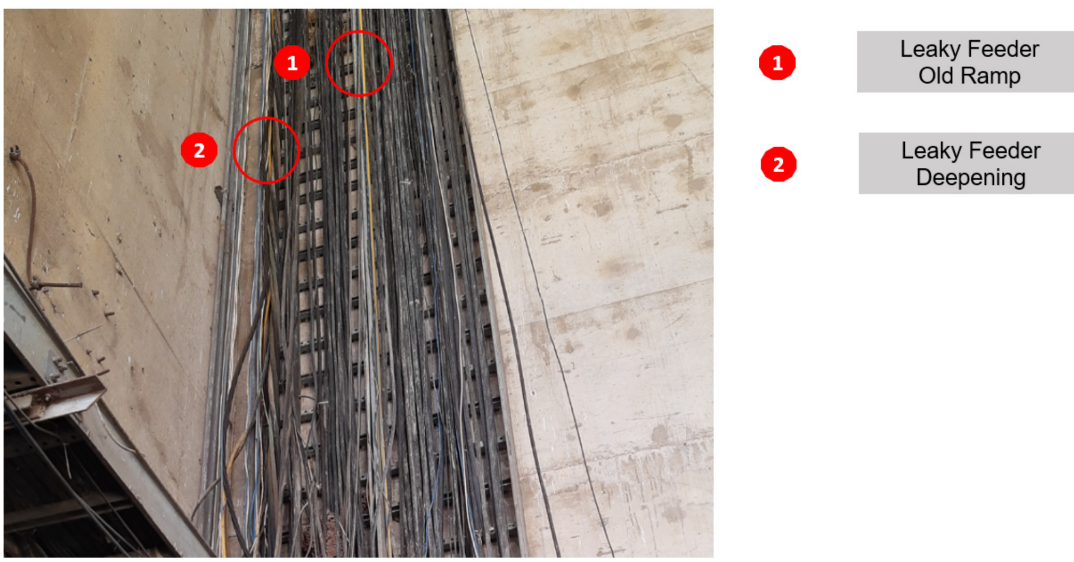


Figure 18-12: Leaky Feeder Circuit 2 via Shaft (Ero Brasil, 2020)

18.6.4 Fleet Maintenance Facilities

Currently, there are four facilities for maintenance activities: a light vehicle workshop and central maintenance facility, both located on the surface; an LHD workshop located on level -137 of the underground mine and fuel supply and lubrication area located on level -732 of the underground mine. There is also a support location for performing truck tire changes on level -200 of the underground mine.

The central maintenance facility, located on the surface, consists of 7 large maintenance bays. One of the bays has been designed for the maintenance of platforms, two are reserved for preventive maintenance of drilling equipment, two for preventive maintenance of LHDs and support equipment and two other bays are designed for various maintenance and repair work. In addition to the maintenance bays, there is a subassembly maintenance area, meeting rooms for maintenance planning and control team, a central supplies warehouse as well as machining and welding areas. Most of the heavy maintenance performed for the operations of the Curaçá Valley is performed at the central maintenance facility.

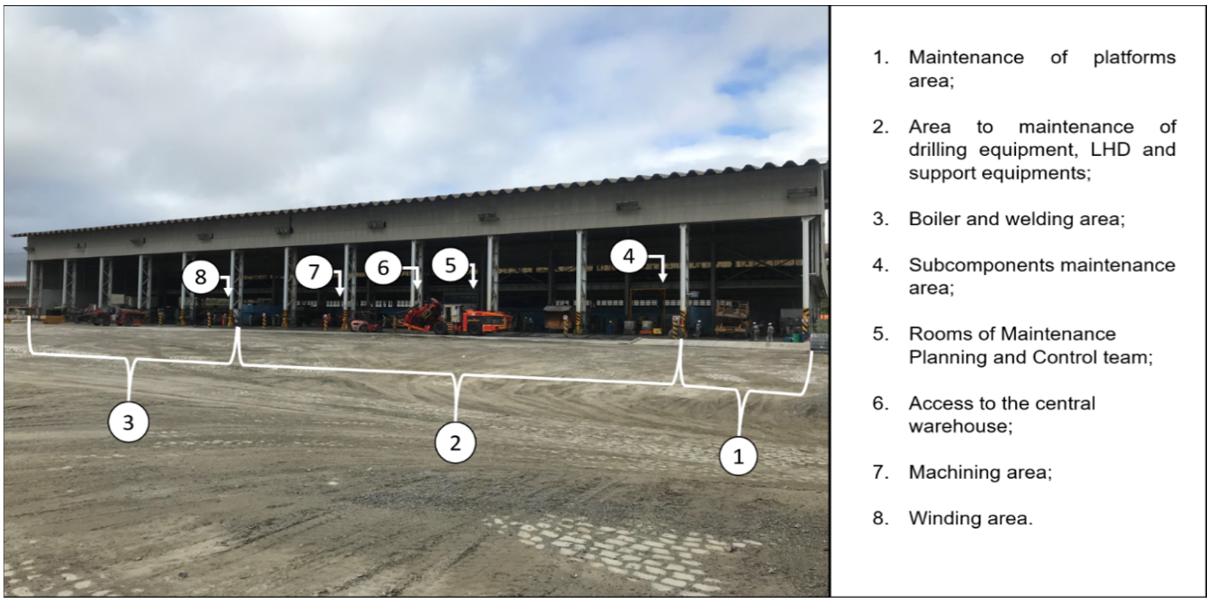


Figure 18-13: Central Maintenance Facility on Surface, Pilar Mine (Ero Brasil, 2020)

The underground LHD workshop, located at L-137 in the underground mine serves as an area for preventive and corrective maintenance of the underground fleet. The workshop also serves as the staging area for the Company's underground ambulance. In addition, one bay is used as storage for spare parts and consumables used in the mining operation and maintenance processes.

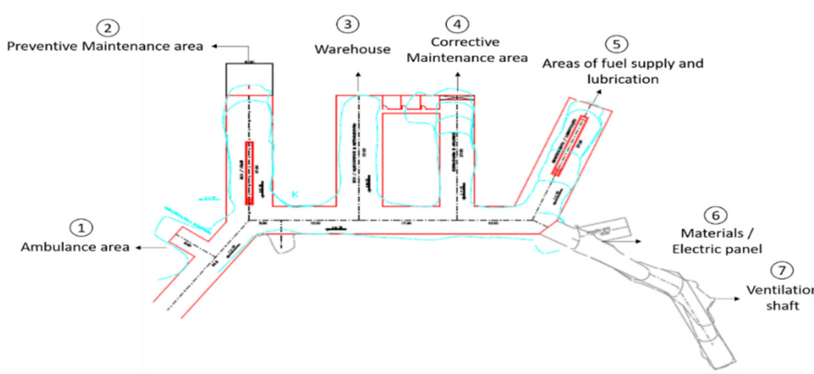


Figure 18-14: Schematic of the LHD Workshop at L-137 (Ero Brasil, 2020)

In addition to the LHD workshop, there is a maintenance facility located at L-732 primarily used for fleet lubrification. The facility on L-137 is currently the deepest fixed facility in Pilar UG mine.

Figure 18-15: and Lubrification facility at L-732 (Ero Brasil, 2020)

18.6.5 Compressed Air

To serve the underground mine, there is a central compressed air station located on the surface featuring six compressors working in parallel that are capable of generating a combined 8,852 m³/h of compressed air.

Compressed air leaving the compressors is stored in two 30m³ pressure vessels. These vessels store and deliver compressed air to the underground mine through compressed air piping and hoses passed through the shaft to meet the various working areas within the Pilar UG Mine.

Figure 18-16: Compressed air central station and pressure vessels at surface (Ero Brasil, 2020)

Table 18-3: Pilar UG Mine compressor capacity

Compressor	Manufacturer	Model	Nominal Capacity (m³/h)	Working pressure (bar)
36CA001	Atlas Copco	GA160	1,677	7.40
36CA002	Atlas Copco	GA160	1,508	9.10
36CA003	Atlas Copco	GA110	1,128	9.10
36CA004	Atlas Copco	GA160	1,517	9.10
36CA005	Atlas Copco	GA160	1,511	9.10
36CA006	Atlas Copco	GA160	1,511	9.10
TOTAL			**8,852**	

Currently, approximately 8,000m³ of the total the air generated by the compressors is used by the primary drilling fleet (80% of total use), concrete production (10% of total use) and other fixed facilities (10% of total use). To ensure that the current installation can fulfill the air requirements of the LOM plan, the replacement of drill machines from air to electro-hydraulic has been implemented as the existing rigs are replaced at the end of their useful life along with improvements to the compressed air system.

18.6.6 **Pastefill Plant**

Ero Brasil implemented the use of pastefill in mined out stopes beginning in 1998. There are three main objectives of the pastefill production and delivery system: (i) increase the structural integrity of mining operations, (ii) reduce the deposition of tailings in the waste piles, pits or tailings dam and (iii) maximize mineral extraction.

Paste is produced on surface in the Company's pastefill plant, where the tailings are conditioned and mixed with a binder (Portland cement) to form suitable paste according to specification for each application and then gravity fed into the stopes of the Pilar UG Mine. Currently, the pastefill plant has a batch capacity of 70m³/h. The capacity of the plant will be increased by an additional 90m³/h in each of Phase 1 and Phase 2 expansions of the facility.

The main components of the existing facility includes: 1 bulk storage tank, 2 disk filters, 1 pulp conditioner, 1 pulp mixer, 5 cement storage silos, conveyor belts, weighing machines and other associated mechanical equipment.

Figure 18-17: Pilar UG Mine Pastefill Plant (Ero Brasil, 2020)

The paste produced by the pastefill plant is delivered underground by gravity, through 8-inch steel pipelines and directed to the top of the stopes being filled. Currently, the installed paste line, including all branches has a total length of approximately 3.5 km. The current plant was refurbished in 2022, replacing major equipment like the plant feed tank, filters, pumps, binder addition system and weighing, plant control system and additional instrumentation. These upgrades have been designed to support the current LOM plan which calls for approximately 20Mt of paste. A block diagram of the upgrades to the plant is shown in

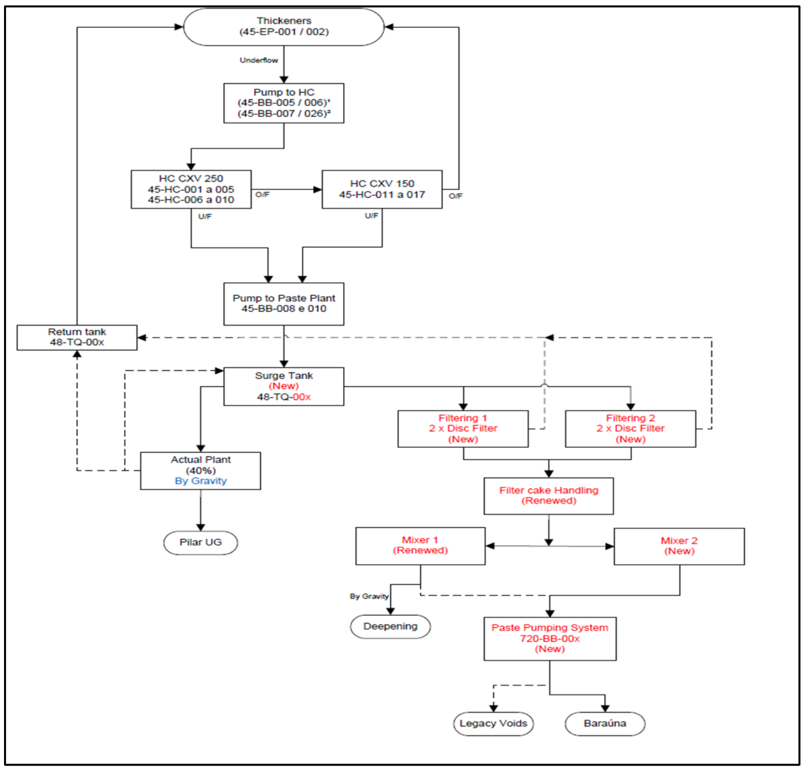


Figure 18-18: Pilar UG Mine Pastefill Plant and Expansion, Block Flow Diagram (Ero Brasil, 2022)

18.6.7 **Ventilation**

The ventilation system of the Pilar UG Mine is performed mechanically by a series of exhaust fans installed on surface and a series of ventilation raises that serve to both expel dust and gases from the various working fronts of the mine, as well as draw fresh-air into the mine. The current ventilation circuit is comprise of four ventilation raises; each primary raise is constructed with a 3.1 m diameter raise-bore connecting the interior of the mine to the surface exhaust fans. To ensure sufficient air flow at each of the working faces in the mine, mechanical auxiliary ventilation and flexible temporary ductwork is used.

The airflow requirements for the Caraíba Operations was estimated for all periods throughout the LOM. Analysis and flow requirements considered Brazilian standard NR 22.24.8 assuming the highest required airflow for mining and development. The highest value for the flow requirement corresponds to the number of active levels (production and development). Based on this criterion, the estimated maximum overall airflow requirement is 976 m3/s in 2024. For the Deepening Project, the maximum requirement for airflow also occurs in 2024, at 445 m3/s.

Current measurements show a total airflow of 631 m3/s, indicating a deficit of 202 m3/s for 2024. Most of the activities needed to meet the increased demands of the Pilar UG Mine airflow were completed in 2022, and others will continue into 2023 / 2024. These actions include:

- development of new ventilation raises,
- incorporation of new booster fans; and
- replacement of ventilation hoods.

Together, these measures are expected to provide a total ventilation capacity of 892 m3/s by the end of 2022 and 1,000 m3/s by 2024, sufficient to meet the LOM requirements of the mine.

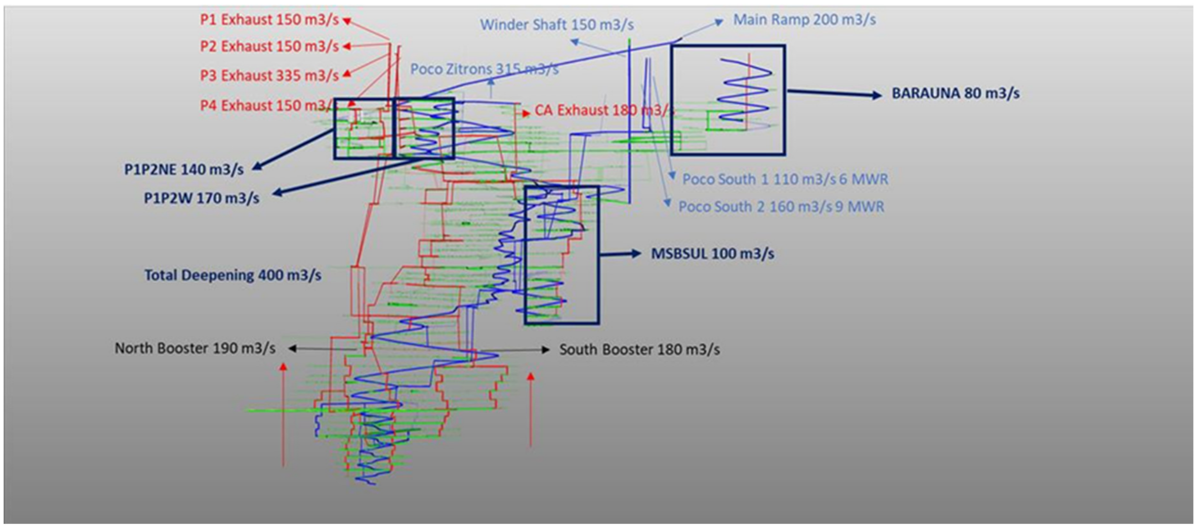


Figure 18-19: Schematic of Ero Brasil's Main Ventilation System (Ero Brasil, 2022)

To generate sufficient airflow, 5 surface exhaust fan systems, equipped with axial fans are placed at surface on top of three primary ventilation raises. The exhaust fans and raises include the P3, P1/P2 circuits and the exhaust fans installed in the historic open pit.

In 2022, several upgrades were made to the ventilation circuit of the Pilar UG Mine to improve airflow throughout the mine. Upgrades include:

- P1 and P2 were retrofitted with 2 x 600 horsepower ("HP") fans in early 2022. The upgraded design increased airflow from 60 m3/s to 75 m3/s (each fan) resulting in total airflow of 150 m3/s for each circuit.

- The P3 System was also upgraded with 2 x 1000 HP fans, contributing 50 m3/s to the mine's ventilation capacity.

- The P4 400 HP Fan instillation was completed, adding an additional 150 m3/s to the mine's ventilation capacity.

- Installation of a 1,100 HP South Booster fan, located in N-732 South sector of the mine, in conjunction with a 63 m raise connecting N-627 and N-670, increased airflow by 24% in the Deepening, reaching 380 m3/s.

In 2024, installation of the 1,100 HP North Booster fan is scheduled. The booster is located on the same level N-732, in the north sector of the mine When paired with a new 326 m vertical ventilation raise, 410 m3/s of airflow to support the Deepening Project is expected.

Figure 18-20: P3 exhaust fans – model SOMAX (Ero Brasil, 2020)

Figure 18-21: P1/P2 exhaust fans – model SOMAX (Ero Brasil, 2020)

Figure 18-22: Old pit exhaust fans – model TECSIS (Ero Brasil, 2020)

18.6.8 Mine Cooling

A cooling system was installed to decrease the temperature in the deeper part of the Pilar UG Mine. The system is comprised of two plants, one on the surface with a capacity of 15 MW of cooling and air flow capacity of 240 m3/s. The completed system delivers cooled air into the N-574 level within the mine. Another "spot cooler" serves specific points to manage temperature as needed. The spot cooler has a condenser spray chamber unit at the N-930 level and a mobile refrigeration machine. The spot cooler is capable of moving around the mine as needed depending on production and development requirements.

18.7 VERMELHOS DISTRICT INFRASTRUCTURE

The installed infrastructure of the Vermelhos District is sufficient to continue providing support for the existing Vermelhos UG Mine as well as support the development and operations of the N8/N9 and Siriema OP mines, with minimum additional expansion required. Current installed infrastructure is comprised of the Vermelhos UG Mine and supporting infrastructure including offices, electrical supply, and mining infrastructure.

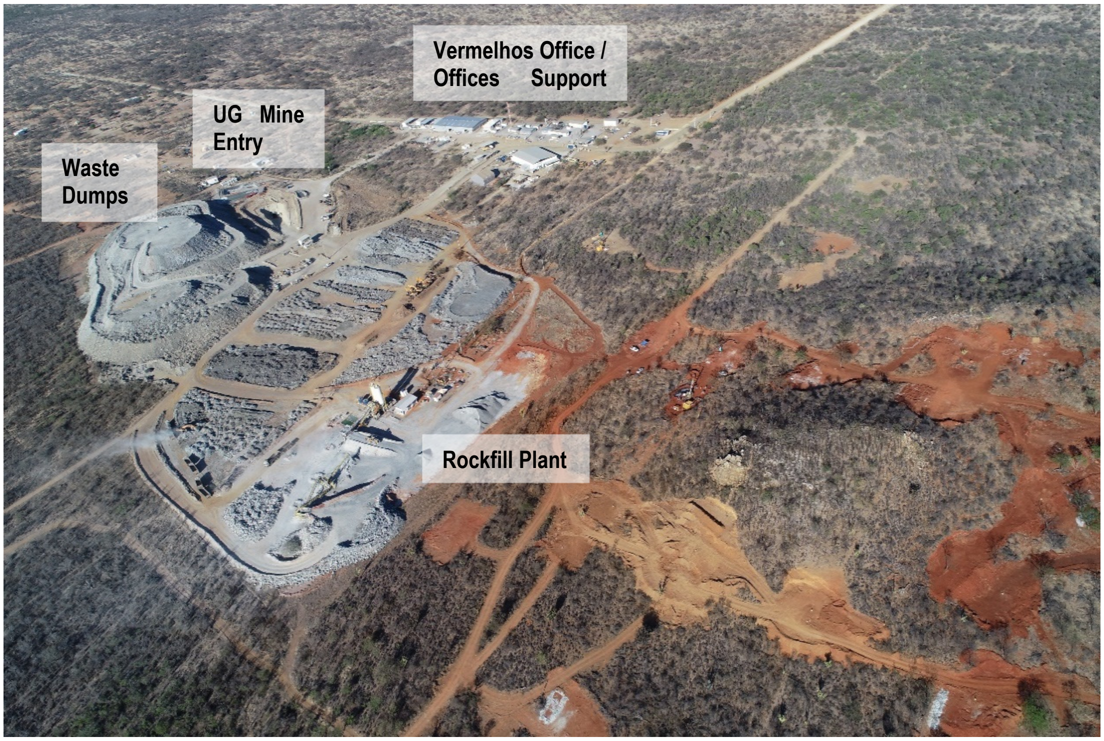


Figure 18-23: Vermelhos Industrial Area (Ero Brasil, 2020)

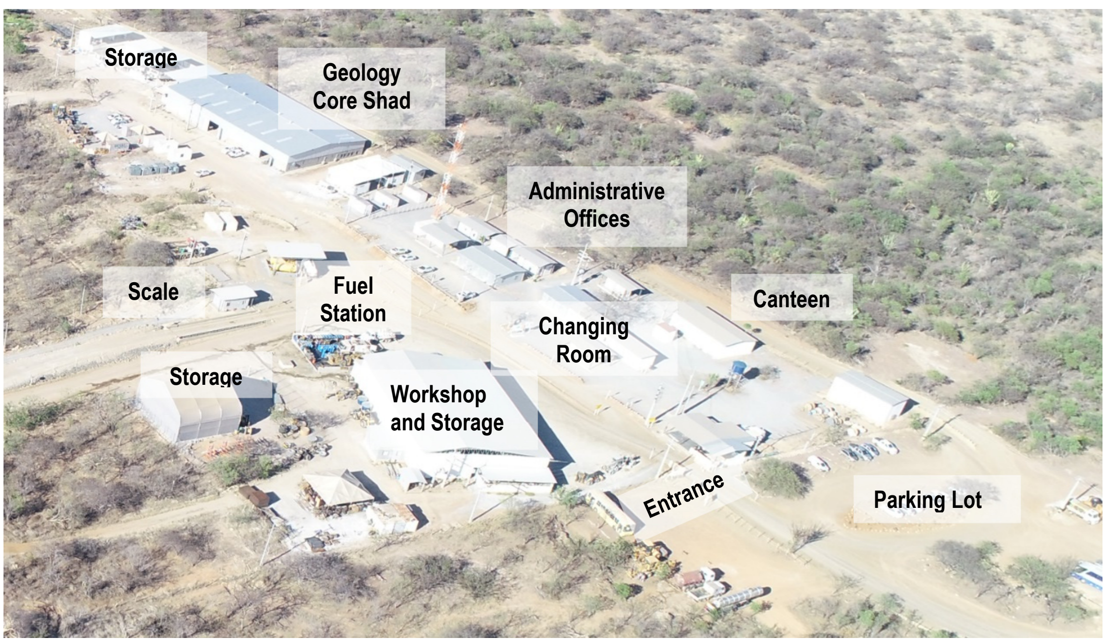


Figure 18-24: Vermelhos Office and Support Facilities (Ero Brasil, 2020)

18.7.1 Electrical Supply

The Vermelhos UG Mine is supplied by the Bahian State power company, COELBA, initially at a voltage of 13.8 KV. A substation at the entrance of the mine provides step-down to 4.16KV, and supply for the site is finally transformed to 440V by a substation located within the Vermelhos UG Mine. The figure below shows the transmission line (orange), comprised of approximately 30km of overhead electric lines from the "Barro Vermelho" community to the Vermelhos UG Mine.

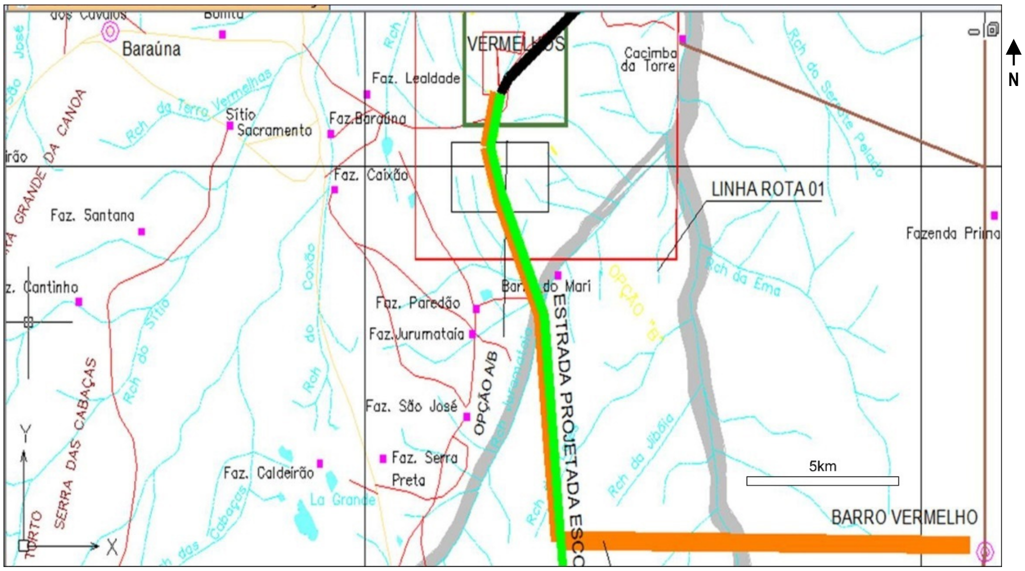


Figure 18-25: Vermelhos Infrastructure, Primary Electrical Supply (Ero Brasil, 2020)

18.7.2 Water management

Water used at the Vermelhos UG Mine, including for production, offices and for the mine dry is pumped from several permitted artesian wells on the property. Fresh water is stored continuously in 4 storage tanks, each with a capacity of 10,000 liters (40,000 liters of total storage). The closed circuit system allows the Company to reuse more than 90% of the required water for the operations. A horizontal decanter with two 25,000 liter tanks and a reservoir is used as a contingency for water supply.

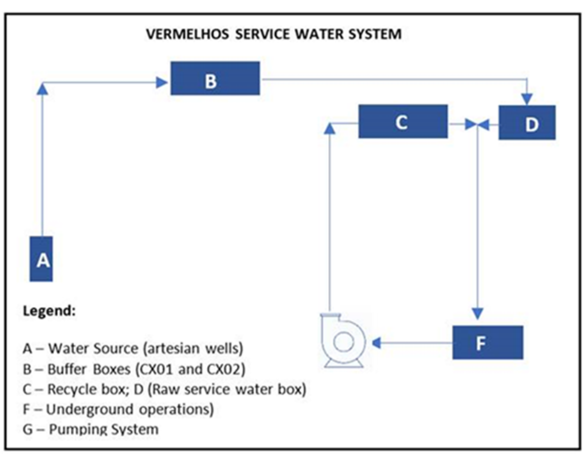


Figure 18-26: Industrial water circuit schematic (Ero Brasil, 2020)

The Vermelhos UG Mine pumping system consists of 9 main pump stations with 130 m³/h capacity. Pump stations are located every 60 vertical meters along the ramp and connected to the closed circuit. Each main pumping station consists of two slurry pumps installed in parallel, whereby one is on standby at all times in case of operating pump failure. The pumping stations utilize a system of sluice gates to aid in the removal of fines prior to pumping.

Each level underground is developed with a 2% ascending grade to direct water back to the main ramp, where the water is collected in steel tanks linked to the main pumping stations. To complete the water balance, the entire industrial area is equipped with a surface water drainage system to collect and store surface run off for use. A water/oil separator is installed on surface to remove any oil and grease from the water.

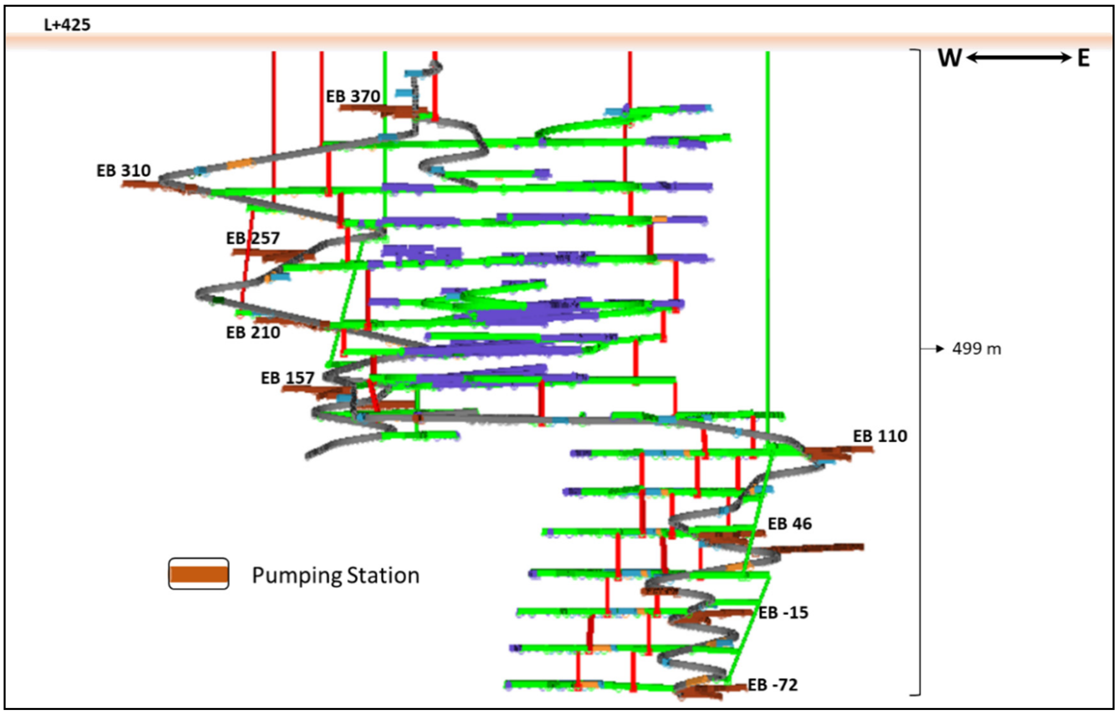


Figure 18-27: Vermelhos UG Mine pumping station locations (Ero Brasil, 2020)

18.7.3 Ventilation Infrastructure

The Vermelhos UG Mine ventilation design is based on the published requirements of Brazil regulation NR 22.24 pertaining to underground mining activities and mandated air flow requirements. Model simulations performed by Ero Brasil ensure adequate air flow is reached during the design phase using VENTSIM software. The ventilation system design of the mine entails the use of 4 fresh air intake points (ramp and raises), and two exhaust points (raises) located at surface. The ventilation raises have a design diameter of 3.0 m and are drilled using a raise-bore machine. Sub-vertical chimneys between levels are opened by blasting as required in the design.

Currently, there are 4 exhaust fans installed on surface (2 at vent raise-02 and 2 at vent raise-05), each with 60m³/s, static pressure of 150 millimetres water gauge, or millimetres column agua in Portuguese ("mmCA") (at the point of operation) and installed power of 200 CV. The fans provide a total flow of 240 m³/s. In 2021, the 5th exhaust fan was installed, increasing the total installed airflow in the mine to 300m³/s. Working faces are supplied with fresh air via mechanical auxiliary ventilation and flexible temporary ductwork as required. The ventilation system is shown schematically in figure below.

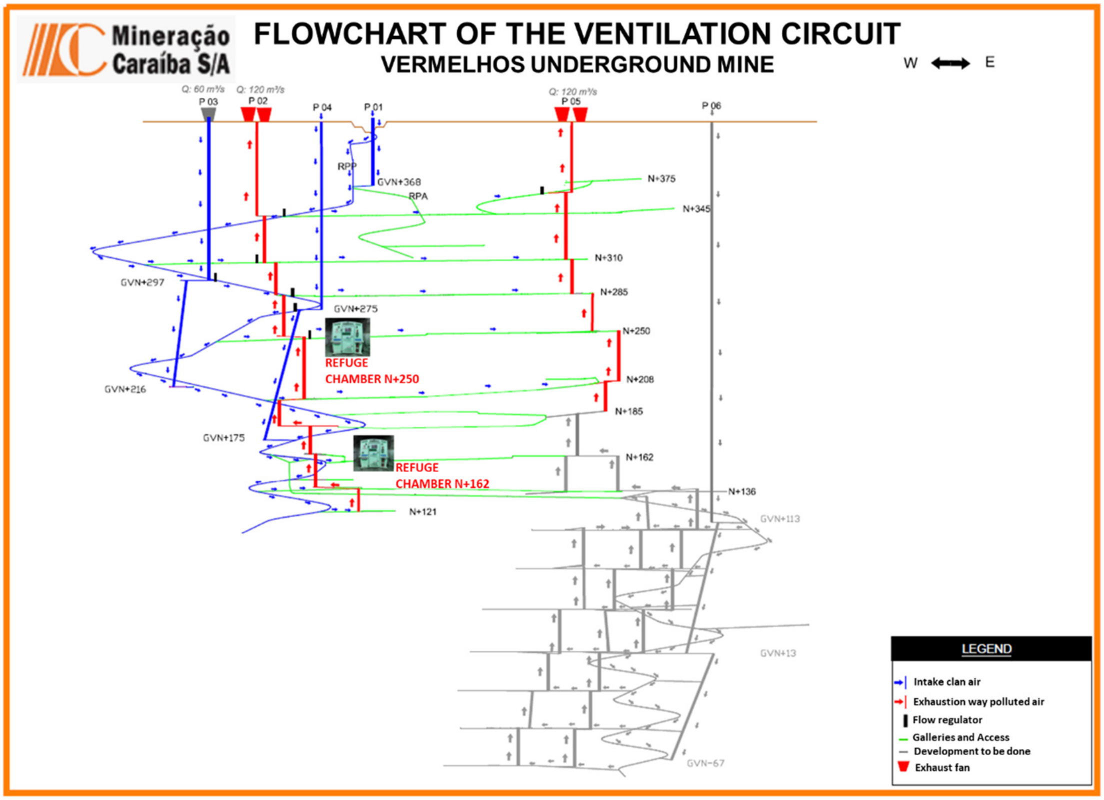


Figure 18-28: Vermelhos UG Mine main ventilation circuit schematic (Ero Brasil, 2020)

18.7.4 Rockfill / CRF

To enable maximum recovery of the high-grade reserve of the Vermelhos UG Mine, CRF is used to fill the voids after primary stopes have been mined, thereby allowing adjacent secondary stopes to be mined after curing. Rock-fill is prepared on surface plant by crushing and mixing the waste with water and cement and transported from the surface to the stopes for filling via ramp by 25 tonne trucks.

In September 2020, an expansion of the rock-fill plant was completed, increasing the capacity from 23kt/month to 38kt/month. The expansion included an installation of a secondary crusher, breaker hammer and mixer.

In its current configuration, the plant consists of a primary jaw crusher (model Metso C80), a secondary cone crusher (Metso HP 100), a breaker hammer, interconnecting conveyor belts for the systems, 2 cement silos and a mixer. The waste pile used for CRF was generated during mine development and is located next to the rock-fill plant. Material from the pile is fed into the primary crusher using a CAT 966 wheel loader. After crushing, the gravel is mixed with cement and water at approximately 5% cement by weight. The material is discharged from the mixer directly into the truck, where it is transported to the primary stope being filled. A photograph of the CRF plant is shown below.

Figure 18-29: CRF Plant at Vermelhos UG Mine (Ero Brasil, 2020)

18.7.5 Tailings and Waste Disposal

All ore mined from the Vermelhos District is transported for treatment at the Caraíba Mill. Waste rock stockpiles generated by the Vermelhos UG Mine are used for CRF and disposed of underground. Waste rock generated from open pit mining activities within the Vermelhos District will be stored for future use in end-of-life reclamation activities.

Please refer to Chapter 20 for additional detail on tailings disposal methods of the Caraíba Mill.

18.8 SURUBIM DISTRICT INFRASTRUCTURE

The mining operations of the Surubim District commenced operations in 2010. The district features a large installed infrastructure base that will support the re-start of the Surubim Mine and the delivery of the C12 Mine.

18.8.1 Electrical Supply

The Surubim Mine is supplied by the Bahia State power company, COELBA, initially at a voltage of 13.8 KV. The industrial area of the Surubim Mine has 3 transformers that reduce the voltage to 380/220V for supply to the main administrative and support facilities and 1 transformer to supply the operation inside the open pit mine with 440V.

18.8.2 Water Supply

The water used in the mining process, administrative and support areas is pumped to surface for storage from permitted ground wells. As at the Effective Date, Surubim had 3 productive wells, each with an average flow of 2-3m³/s.

18.8.3 Fleet Maintenance

The Surubim Mine infrastructure includes 2 permanent metal canopies that provide workspace to support the maintenance and consumable materials storage to support the mining fleet.

Figure 18-30: Surubim maintenance facilities (Ero Brasil, 2020)

18.8.4 Offices and other facilities

Adjacent to the Surubim Mine, additional infrastructure installed to support the operations of the Surubim District includes:

- Offices for operations and administrative support;
- Geology and core storage areas;
- Entrance and security gate;
- Telecommunication Infrastructure;
- Office for health and safety support;
- Cafeteria; and,
- Explosive storage.

Figure 18-31: Surubim security gate and parking lot (Ero Brasil, 2020)

Figure 18-32: Surubim geology core shack and telecom tower (Ero Brasil, 2020)

Figure 18-33: Surubim cafeteria and support offices (Ero Brasil, 2020)

18.8.5 Tailings and Waste Disposal

All ore mined from the Surubim District is transported for treatment at the Caraíba Mill. Waste rock generated from open pit mining activities within the Surubim District will be stored for future use in end-of-life reclamation activities.

Please refer to Chapter 20 for additional detail on tailings disposal methods of the Caraíba Mill.

18.9 PLANNED INFRASTRUCTURE MODIFICATIONS, DEEPENING PROJECT

The delivery of the Pilar UG Mine Deepening Project, requires significant modifications and the expansion of underground infrastructure currently under construction, that is as further described herein.

The design requirements for the Pilar UG Mine new external shaft include:

- Hoisting a maximum of 2.2 million tonnes per annum (Mtpa) from the loading flask level - 1076 m to surface (just below the station level),
- Requirement to raising and lower 840 personnel per day from the station level at -1058 m, over four shifts i.e. average 210 personnel per shift with a crew change-over in a maximum of one hour.

The mine layout considers that the ramp will continue from Level -1010 at 5.0 m wide by 5.5 m high with an arched profile. These dimensions provide enough space for conventional transport trucks with a capacity of 30 t. The ramp is developed at a maximum gradient of 15%. The infrastructure developed through the ramp was maintained per standard practice for the Pilar UG Mine, which includes:

- collection bays,
- dewatering stations,
- electrical substations,
- water boxes and passage bays.

The Deepening Project contains 28 sublevels, starting at -965L through -1693L. The levels are developed to access the extent of the dive direction of the deposit and connect the development to the air return raise ("RAR") in the north and south and a fresh air raise ("FAR") in the middle of the deposit in order to establish direct flow ventilation. The planned mine ventilation system for the Deepening Project consists of the following:

- Two vertical raises injecting fresh air, named South Well 1 and 2.
- Hoisting shaft injecting fresh air.
- Main RAR connecting to the surface where the fans are installed.

The remaining sections of the mine ventilation system include the mine ramp and the connection levels of the internal raises.

Materials handling management will consist of a new external 6.3 m (final dimension with coating) in diameter shaft with a well of 6.9 m (excavation diameter) extending from the surface to the loading station at the bottom of the shaft, which is located at a depth of 1552.75 m below the collar. Access to the Deepening Project mining faces for all personnel will be conducted via the same shaft.

The management of the ore and underground sterile will consist of two ore deposits and two Run-of-Mine ore silos (ROM), a sterile deposit and sterile silo, an ore crushing chamber (with two crushers), a crushed ore silo, transfer from the ore silos and sterile to the well feeder belt and transfer to the loading system. Two jaw crushers will be installed, identical to the existing underground crusher.

The following Mine Services were designed for the Deepening Project

- Water supply
- Materials handling from the mine
- Underground electrical distribution
- Compressed air
- Fuel storage and distribution
- Maintenance of mobile equipment
- Concrete plant
- New electrical substation in the lower part of the mine.

18.9.1 Electrical Supply

A complete review of the forecast power demands of the Pilar UG Mine, including the Deepening Project cooling and ventilation systems was performed as part of the LOM planning efforts.

The Deepening Project Shaft Surface Substation will be fed from the Main Mine Substation (Existing) via 13.8 kV overhead lines and 13.8 kV Cables to the installed electrical supply of the new external shaft. The distribution network of the shaft has been designed as a fully redundant system with two separate supplies to each of the substations in a ring arrangement. Each supply will be adequately sized to cater for the full demand of the Deepening Project power requirements. The Deepening Shaft Surface Substation is fully equipped with 15 kV metal clad switchgear.

The normal power supply for all loads for the mining area for the Deepening Project will be derived from the Deepening Shaft Surface Substation. This facility includes:

- 15 kV single busbar switchboard ,with two Incomers; two Power Factor Correction (PFC); two Metering; one Busbar Coupler and 18 Feeder Panels.
- Metering, Protection, Tele-communications, and Supervisory control and data acquisition (SCADA) equipment.
- An allowance has been made for the installation of smoke and heat detection systems inside the substation building.
- The substation has been designed with a fire detection system.

Key loads that are to be supplied directly from the Deepening Shaft Surface Substation are:

- Bulk Air Cooler Plant (BAC)
- Utilities – Surface ore bin / (Banksman; Control; Emergency; Proto Room) / Diesel batch system / High mast Lights and general lighting
- Personnel and Rock winders
- Underground Ore handling system
- Deepening Project Underground Substation (Deeps Production Stopes) total +/- 5 MVA

Emergency power for the personnel winder has been designed as part of the Winder installation. The man winder and ventilation fans will be supplied via a redundant system. The main power supply will consist of two independent sources of supply. The reticulation systems have been designed to ensure that in the event of the loss of power supply from the main source, the redundant system continues to supply power to the Personnel Winder and critical pumping if required.

The following loads were calculated for the Deepening Project. For the new shaft hoisting system, the project's load has been calculated incorporating the latest mine production estimates based on the LOM Strategic Plan:

- Personnel Winder Mechanical Power required = 840 kW
- Personnel Winder Aux Transformer = 212 kW
- Rock Winder Mechanical Power required = 6083 kW
- Rock Winder Aux Transformer = 297 kW
- Total 7,432 kW

For the Underground Ore Handling (Crushing, conveying) = 879 kW

The Deepening Project Underground Production Total (Booster fans, BAC) = 3,376 kW

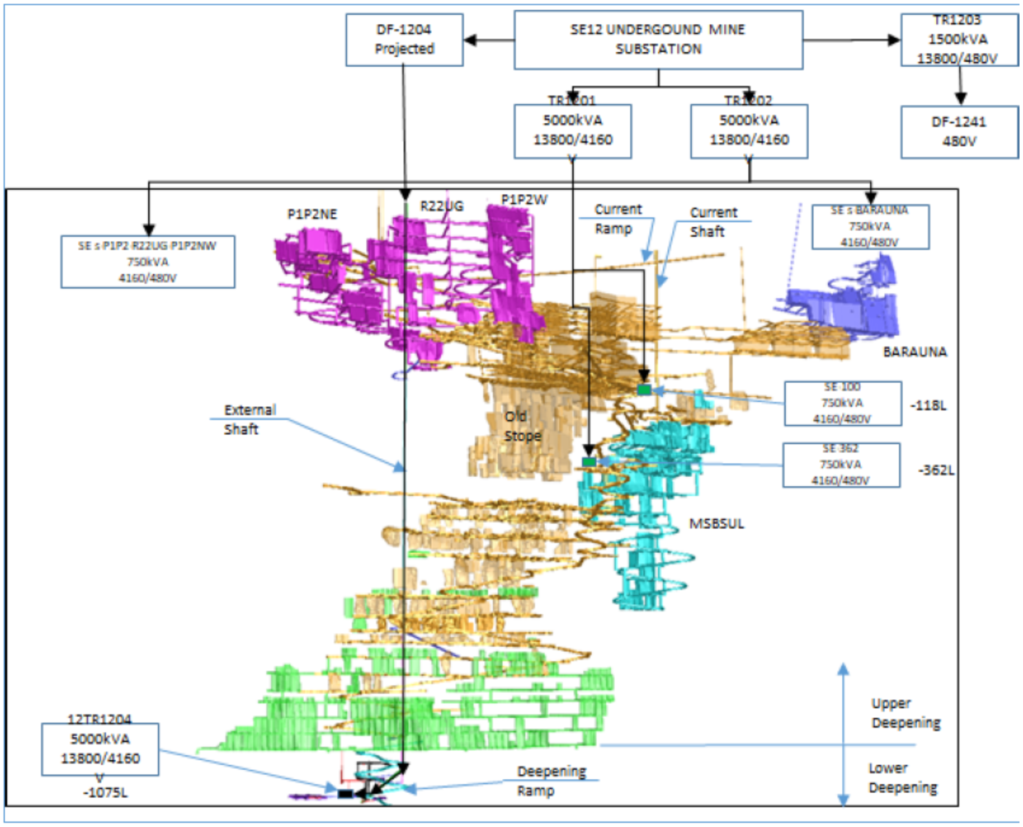


Figure 18-34: Pilar UG Mine Electrical Infrastructure (Ero Brasil, 2020)

18.9.2 Communication

Communication equipment, which includes but is not limited to, Wi-Fi as well as VoIP systems will be implemented following completion of the new external shaft. This requirement includes rolling out fibre network backbone, monitoring systems and leaky feeder system from surface to underground mining sections. The Pilar UG Mine is currently in the process of expanding wifi coverage within the mine.

Installation of control system equipment and field instrumentation has been designed to be in same vicinity as motor control centers and associated control systems. This will assist in reducing electrical copper cable requirements thereby implementing a cost-effective solution by means of leveraging on communication network to reduce cable requirements.

The shaft hoist control system consists of a standalone control system and an independent 48 Core Single Mode Fibre Network Backbone. The Hoist Control system interfaces with the mine control system via respective core switches as allocated according to feed from the respective 48 Core Single Mode Fibre Network Backbone.

The underground ore handling design basis constitutes RIOs and PLC Panels. Two crushers are designed with independent controllers for redundancy requirements. The system consists of sacrificial conveyors and feed conveyors which are respectively connected to the network backbone with surface control room system.

The Ore Handling System is subdivided into the following three sections

- Ore Tipping System
- Crushing System
- Conveyor and Flask Loading System (including Sacrificial Conveyors and the Feed Conveyor

18.9.3 **Pastefill**

All of the areas of the Pilar UG Mine, with the exception of P1P2NE, will use pastefill. Paste backfill will be delivered to P1P2, R22UG and Deepening Project via a new deepening paste line. Paste will be delivered to Project Honeypot and the remaining Upper Areas via the existing paste line, with a new distribution line. As a result of increased demands for the quality and delivery of paste associated with the Deepening Project, modifications of the existing Pastefill Plant have been designed to improve process control and ensure paste quality. These modifications have been divided into one refurbishment, and two expansion phases:

- Refurbishment of the current paste plant for 70 m3/h
- Phase 1 addition for the Deepening Project at 90 m3/h (Q3 2023 Commissioning)
- Phase 2 addition for the Legacy voids and Baraúna at 90 m3/h (Q4 2025 Commissioning)

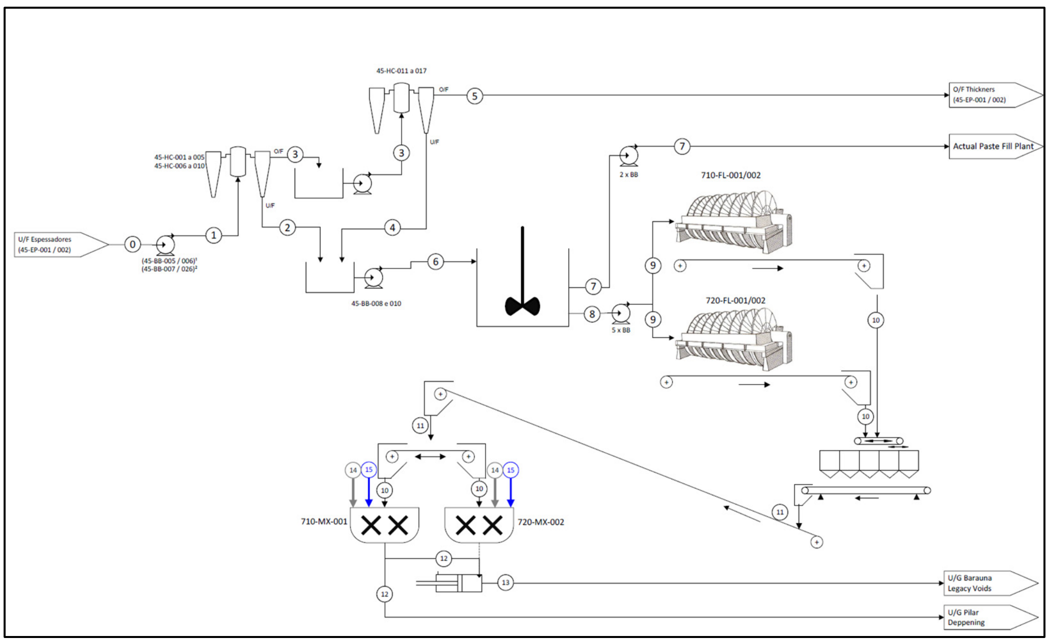


Figure 18-35: Paste Plant Upgrade and Expansion Flow Diagram (Ero Brasil, 2022)

18.9.4 **Materials Handling, Pilar Mine, New External Shaft**

A vertical shaft has been designed a 6.3 m (final lined dimension size) diameter shaft and a 6.9 m (excavation size) diameter shaft that will extend from surface to the loading station at shaft bottom, which is at a depth of 1552.75 m below top of collar (-1075 level).

Access to the Deepening Project will be conducted through the new vertical production shaft. This shaft is required for Ero Brasil to meet future underground production demands and ensure the mine remains fully ventilated and serviced as part of the Company's Pilar 3.0 initiative. The personnel will be lowered to a single loading and unloading level which is -1158m below collar. The shaft will be sunk using mechanised drill and blast techniques and equipment. There will be four access points on the vertical shaft, which will be accessed from the existing internal ramp system for purposes of raise boring.

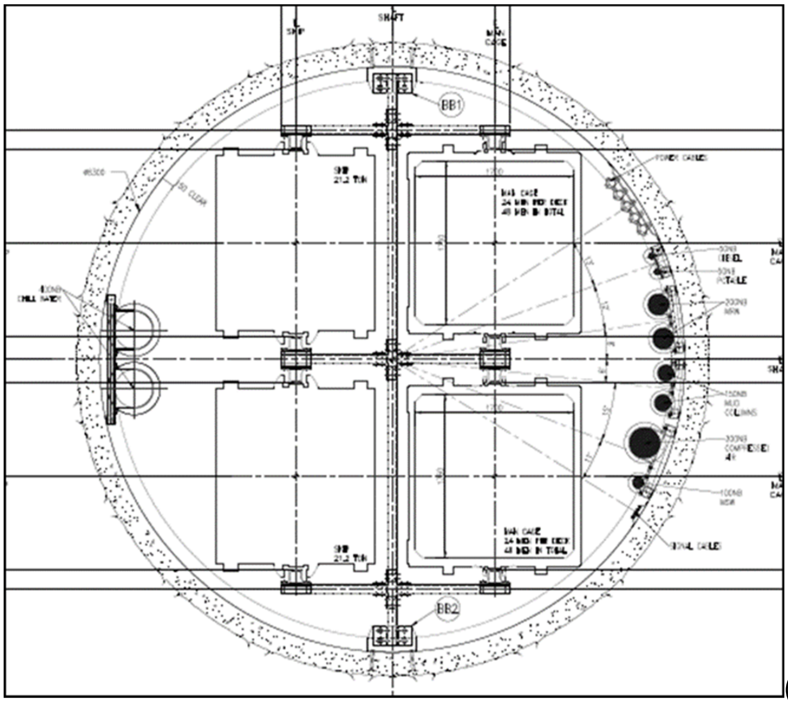
The underground ore and waste handling arrangements will consist of two ore tips and two Run-of-Mine (ROM) ore silos (one equipped and one raise bored), one waste rock tip and waste rock silo, an ore crusher chamber (with provision for two crushers – one provided for in Capex), a crushed ore silo, transfer arrangements from the ore and waste silos onto the shaft feed conveyors and transfer arrangement into the loading flask. One jaw crusher, identical to the existing underground crusher in the Pilar UG Mine, will be installed and one will be purchased later to meet ramp-up requirements.

The 6.3m diameter concrete lined shaft will be equipped with steel guides and buttons. The shaft will have 4 compartments, two for the rock hoisting 20 ton capacity Kibbles and two double deck personnel cages with a capacity of 24 persons per deck. The headgear will be a steel A frame headgear with load out facilities for handling the ore hoisted, by 27 tonne trucks on surface. The surface infrastructure includes a common winder house to house both the permanent personnel and rock winders. The headframe primary support structure is of an A-frame configuration and has been designed for both sinking and permanent conditions. To optimise the designs, the steelwork at the sheave levels – particularly the major primary beams, have been arranged so that there is expected to be minimal and quick changes to the beam layout when changing from sinking to permanent condition. Deflection sheaves are located between these floors to suit conveyance rope mechanical layouts.

Steelwork for the center tower for both sinking and permanent condition are designed to suit all mechanical requirements and support various equipment loadings including a crane above the top sheave level of the A-frame structure to facilitate the installation of the sheaves and for all other maintenance requirements.

For the sinking phase, the headframe structure is equipped at top level with sheaves for the bucket (kibble) and sinking Galloway platform (stage). Deflection sheaves for the Galloway between levels 37 and 46 in line with the mechanical requirements. For the permanent operational phase, the structure has been designed to incorporate a sheave wheel arrangement for the personnel cage located at 37 level (in the headframe) as well as for the skips at 46 level. The headframe is equipped with a skip discharge kick mechanism feeding into a headframe bin which will discharge ore material into trucks or a conveyor system.

A stair tower and access platforms for the center tower steelwork from bank level for access to various level along the center tower has been incorporated into the design.



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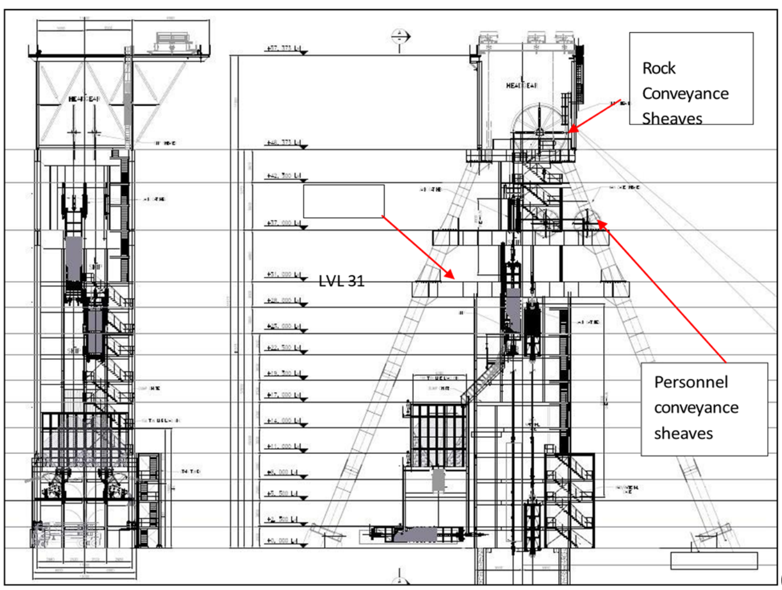


(b)

Figure 18-36: Pilar Mine, New External Shaft Configuration, Cross-Section (a) and Permanent Arrangement (b) (Ero Brasil, 2022)

18.9.5 Underground Crushing and Conveyance Systems

The underground ore and waste handling arrangements consist of two ore tips and two Run-of-Mine (ROM) ore silos, one waste rock tip and waste rock silo, an ore crusher chamber (with two crushers), a crushed ore silo, transfer arrangements from the ore and waste silos onto the shaft feed conveyors and transfer arrangement into the loading flask. The arrangements are illustrated in Figure 18-37.

Two jaw crushers, identical to the existing underground crusher, will be installed. The facilities include; two primary crusher arrangements and two transfer conveys. There are two independent crushing circuits transferring ore from the ROM silos into the crushed ore silo as illustrated.

Run of Mine ore is fed from the ROM ore silo via a bulkhead side-discharge and kick onto a vibrating grizzly feeder that controls the flow of ore into the primary jaw crusher. The kick work includes a radial door to isolate the vibrating grizzly from the silo for maintenance purposes. The radial door is actuated by pneumatic cylinders.

The vibrating grizzly also screens out the -200 mm ore through the grizzly section to ensure that only oversize ore is fed to the jaw crusher, the undersize material is directed via a kick to the transfer conveyor. The Primary Crusher has a design capacity of 366 t/h and the unit can accept a maximum feed size of 700 mm while producing a -250 mm product. The crusher is installed with a 160 kW electric motor. The product is discharged through a kick onto the Transfer Conveyor.

There are two independent ROM silos and truck-tip arrangements. The ROM Silo Is a vertical storage silo with a total capacity of 1,300 t and a live capacity of 1,180 t. The ROM Silo Tips are located above the silo on -984m Level and consists of a double-sided truck tip to accommodate the current 27 t trucks (and the potential to accommodate 35 t trucks) tipping onto a fixed grizzly with sloped edges where the trucks tip and a center flat section. The sloped edges allow undersize material to fall through into the silo while oversize rock will roll to the center, clearing the tipping area for next truck.

A fixed rock breaker, with associated control and hydraulic systems, is located next to the center of the grizzly to allow access to break any oversize rocks. The rock breaker is sized to have an operating envelope that will allow it to reach and function anywhere within the tip grizzly with a vertical orientation of the hydraulic hammer over the flat portion of the grizzly.

The 1,050 mm wide transfer conveyor transfers material from the vibrating grizzly feeder underflow and the primary crusher discharge into the crushed ore silo. A self-cleaning cross-belt arranged belt magnet will be installed at the head end of the conveyor to remove tramp metal.

Transfer Conveyor No. 1 – a sacrificial conveyor, transfers material from the Crusher Ore Silo or the Waste silo to Transfer Conveyor No. 2. This conveyor has a design capacity is 522 t/h at a belt speed of 1.2 m/s. The conveyor is approximately 80 m long with a lift of 7.5 m and installed with a 45 kW shaft-mounted drive unit mounted to the head/drive pulley. A self-cleaning cross-belt arranged belt magnet will be installed at the head end of the conveyor to remove tramp metal.

Transfer Conveyor No. 2 transfers material from Transfer Conveyor No. 1 to the Shaft Loading Station measuring flasks. The Shaft Feed Conveyor is a 1050 mm wide conveyor with class 800, 4 ply fabric belting with a 10 mm top cover and a 5 mm bottom cover based on the preliminary conveyor design. The design capacity is 522 t/h at a belt speed of 1.2 m/s. The conveyor is approximately 240 m long with a lift of 9.0 m and is installed with a 75 kW drive unit mounted to the head/drive pulley.

Two ROM ore passes/silo 5.1m diameter lined with 530 m^3 (1,044 t) of live capacity each (one fully equipped and one unequipped only raise bored ore pass), and one ROM 5.1m diameter lined waste pass fully equipped. The waste pass will have a live capacity of 1,624 m^3 (3,118 t).

The two ROM ore passes will feed the crushed ore into the 8.1m lined diameter crushed ore silo. The silo will have a live capacity of 2,030 m^3 (4,000 t). The crusher chamber has made provision for one 500t/h crusher plant (with capacity for two crushers).

The ore and waste silo area includes the two ROM truck tips and silos, the crushed ore silo and bulkhead and the waste truck tip, silo and bulkhead.

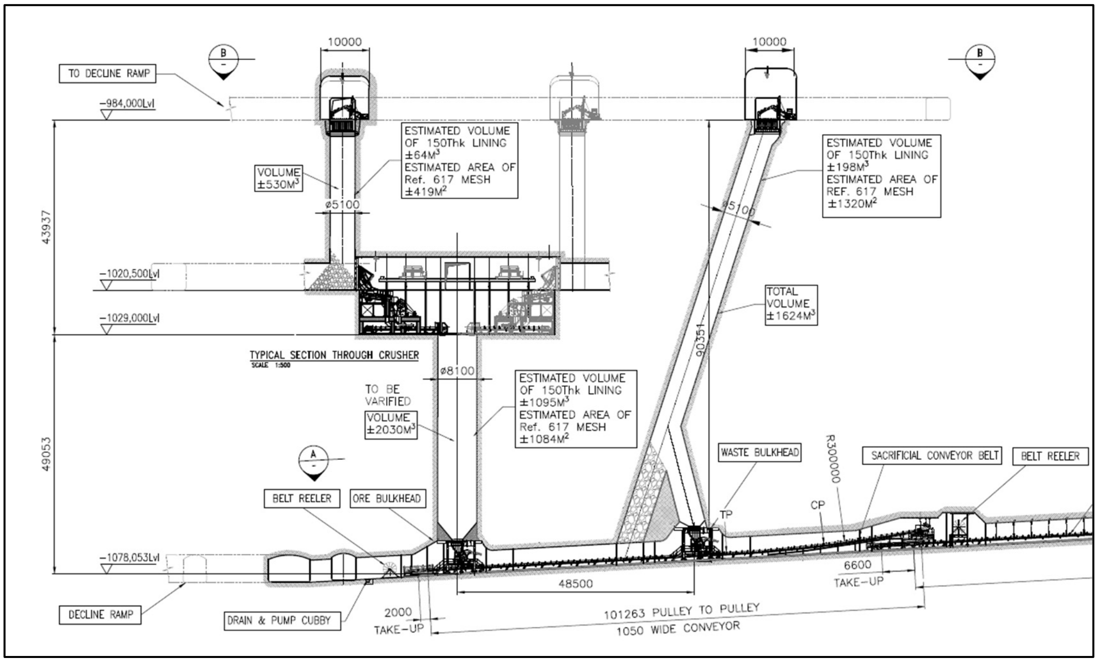


Figure 18-37: General Arrangement of the Crushing & Conveying System

18.9.6 Ventilation & Cooling

In order to increase the air flow to support the development of the Deepening Project, a booster in the Sector N-732 North of 1100 hp, in addition to 326 m of vertical development will be completed by the end of 2023. Together, these actions are expected to result in an air flow in the Deepening of 410 m3/s, meeting the needs of this sector for 2023.

To mee peak air flow demand in 2024, it will be necessary to install another booster in N-670, of 650 hp (within the exploration drift) that will allow airflow to reach 456 m3/s for the Deepening Project and satisfy peak demands for the project.

The main ventilation system will not undergo major changes in the period 2024-2025, until the completion of the new external shaft in 2026, which will supplement airflow into the mine by an additional 250 m3/s for the Deepening Project. The completion of the shaft will also decrease airflow resistance through internal vent raises and reduce the power consumption of the main ventilation system. Based upon modelled wet-bulb working face temperatures of the Deepening Project, to achieve cooling requirements, mine cooling has been divided into 3 phases:

- Phase 1: 6 MWR (surface BAC, currently in operation, Poco Sul 1)
- Phase 2: 9 MWR (surface BAC, currently in operation, Poco Sul 2)
- Phase 3: 12 MWR (surface cooling plant, expected to be operation in 2025-2026 together with the completion of the new external shaft).

Figure 18-38 shows the modelled ramp temperatures for the year 2032 considering different cooling capacities; as can be seen, temperatures above 30°C are expected on the ramp for 15 MWR (phases 1 and 2 only) and 21 MWR (6 MWR – Phase 3), reinforcing the need for the full 27 MWR that has been planned, and partially completed to date, for the Deepening Project.

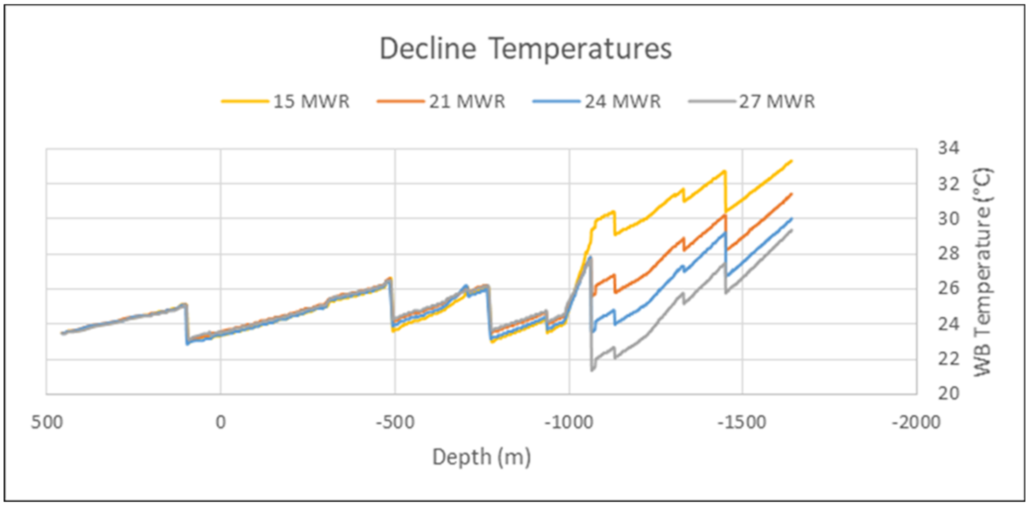


Figure 18-38: Modeled Wet Bulb Temperatures on Primary Ramp by Level (Ero Brasil, 2022)

19 MARKET STUDIES AND CONTRACTS

19.1 COPPER DEMAND

Copper is a strong conductor of heat end electricity. Today, the clean energy transition requires extensive electrification, for which copper is critical. Copper will be necessary to support renewable power generation technologies as well as the expansion and upgrade of aging power transmission infrastructure. The rapid growth of electric vehicles and associated charging infrastructure is expected to require significant quantities of copper. S&P Global and ICSG forecast annual global refined copper usage increasing from 25 million metric tonnes in 2021 to 49 million metric tonnes by 2035 to support the clean energy transition.

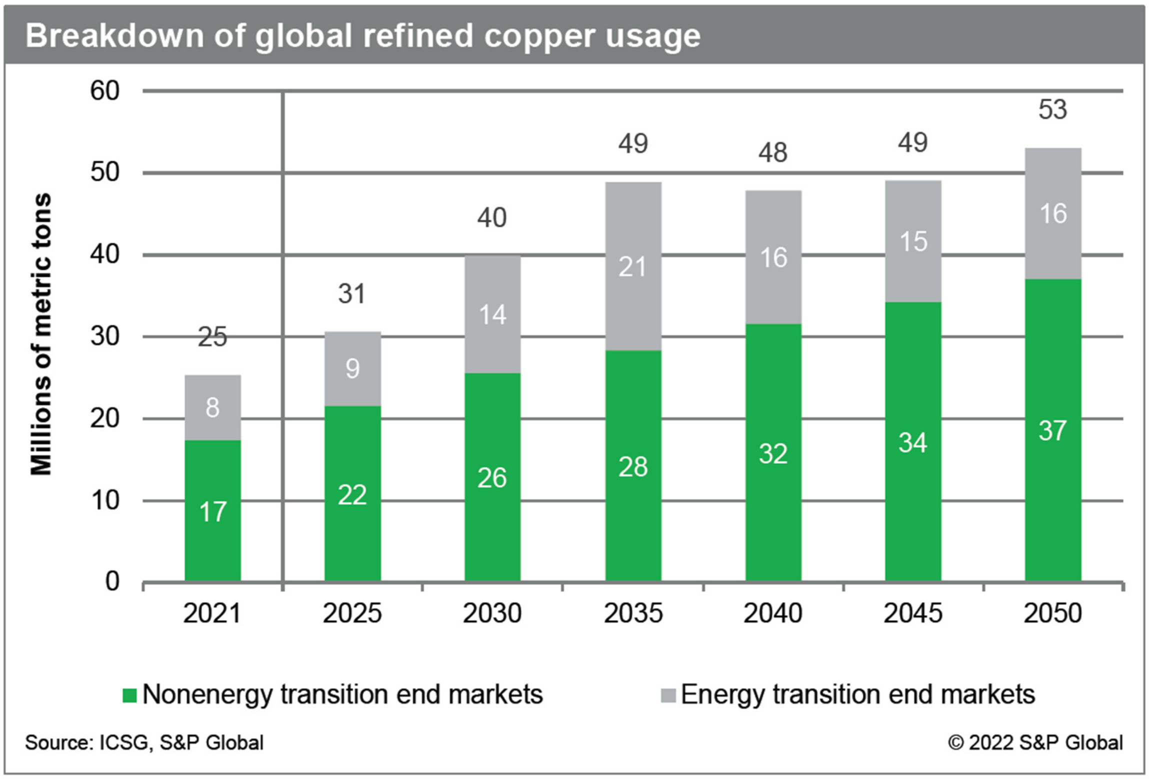


Figure 19-1: Breakdown of Global Refined Copper Usage (S&P Global, 2022)

19.2 COPPER SUPPLY

The expected increase in copper demand in the coming decades requires new mines to come on-line, expansions of existing mines and/or and increase in copper recycling rates. New mines typically take seven to ten years from discovery to first production, suggesting that mine expansions and increased recycling rates are critical in the short-term to avoid a supply deficit. Even with aggressive assumptions for mine expansions and increased copper recycling rates, a supply deficit is expected by market experts, such as S&P Global. In considering the factors above, the authors of this Report view US$3.30 per lb. as a long-term copper price to be reasonable and in line with the broader industry view.

19.3 CARAÍBA OPERATIONS

The Caraíba Operations currently produce a copper concentrate that grades approximately 33%-35% copper and contains low levels of impurity elements. Premium copper concentrates, such as those produced by Caraíba, have shown to be attractive to both smelters and metal traders. In the current market environment, and considering the factors above, demand for Caraíba's concentrate is expected to remain robust. Concentrate produced by the Caraíba Operations has historically been sold either to Paranapanema Smelter located in Dias D'Avila, near Salvador, or to international markets via the port in Salvador.

19.4 MARKETS AND CONTRACTS

The quality of the copper concentrate produced by the Caraíba Operations is desired by smelters and metal traders due to the high copper content and low levels of deleterious elements. Copper concentrate from the Caraíba Operations is expected to continue to be sold via internation and domestic sales channels. Existing contracts are renewed and/or re-negotiated from time-to-time commensurate with contracting under the normal course of business.

The authors of this Report relied on Ero Brasil and Ero Copper for commodity price forecasts. The QPs of this report are of the opinion that the information and studies provided by Ero Brasil and Ero Copper support the assumptions in the Report. Pricing and contract terms relied upon are within generally acceptable industry norms and consistent with prior operating performance of the Company.

20 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

This chapter presents a brief overview of the environmental and social aspects related to Ero Brasil's operations in the Curaçá Valley, addressing:

- Permitting requirements and the status of key permits and pending permit applications;
- A brief summary of the results of the environmental studies and overview of environmental and social considerations, if any, that could materially impact the Company's ability to extract the current mineral reserves;
- Conditions (and plans) for waste and tailings disposal, including monitoring and wastewater management;
- Overview of the social and community related requirements for the successful operation of the mine(s); and,
- Mine closure (remediation and reclamation) requirements and costs.

20.1 PERMITTING REQUIREMENTS

Environmental licensing requirements were introduced in Brazil by the National Environmental Policy ("PNMA") issued in 1981, and subsequently restated by the 1988 Federal Constitution. Currently, environmental licensing is regulated by a comprehensive framework of federal, state and municipal laws, notably by resolutions 01/1986 and 237/1997 issued by National Environmental Council ("CONAMA"). The Brazilian environmental and safety management system ("SISNAMA") is regulated by the Federal Decree 99.274, which defines the roles and authorities of all environmental agencies, at the federal, state and municipal levels, including CONAMA and the Institute of the Environment and Renewable Natural Resources ("IBAMA") that acts as the federal executive agency as well as numerous state (sectional) and municipal (local) agencies. IBAMA is in charge of licensing activities that may cause national or regional environmental impacts.

Brazil has a singular environmental licensing procedure, with licensing conducted in three stages, including the Preliminary Environmental License ("LP"), Installation License ("LI") and Operating License ("LO"). The LO is the most relevant phase for the operations of the Caraíba Operations, which is in production. In practice, the LO is granted, or renewed ("RLO"), after the project sponsor demonstrates compliance with all requirements and conditions set out in the prior licenses, including social issues, when applicable. The LO must be renewed on a regular basis under normal operating procedures, with the renewal period varying from two to ten years depending on the nature of the operations.

Each state and municipality have their own environmental agencies that are responsible for the application of their own supplementary environmental norms and standards within their respective jurisdictions and are responsible for ensuring compliance with all related federal norms. The Ero Brasil operations are licensed by the Bahia State environmental agency (Instituto do Meio Ambiente e Recursos Hídricos, "INEMA") in accordance with Bahia State environmental legislation, notably State Laws 10.431/ 2006 and 11.612/ 2009, and State Decree 15,682/2014 that regulates environmental permitting procedures in the state of Bahia.

The Caraíba Mine (within the Pilar District) feasibility studies were initiated in the late 60's and the mine started commercial operations in 1979, prior to the formation of the current environmental legislation in Brazil. As a result, the Pilar District environmental management plans, (including reclamation plan and closure plans), were developed in their current form after the mine was commissioned, following the formation of environmental legislation in Brazil. More recent operations, including those within the Surubim District and the Vermelhos District, were subject to formal environmental permitting processes including environmental impact studies, as more fully described in the next section.

20.2 ERO BRASIL ENVIRONMENTAL STUDIES AND BACKGROUND INFORMATION

A list of relevant environmental and social impact studies for each of the primary mining Districts of Pilar, Surubim and Vermelhos are detailed below:

<u>Main Environmental and Social Studies – Pilar District</u>

- BRANDT MEIO AMBIENTE. 2006. Closure plan: Pilar district – Jaguarari, BA – MINERAÇÃO CARAÍBA S/A. Nova Lima, MG, 2006.
- BRANDT MEIO AMBIENTE. 2007ª. Degraded areas reclamation plan to the targets R-22 and R-75: Pilar district – Jaguarari, BA – MINERAÇÃO CARAÍBA S/A. Nova Lima, MG, 2007.
- BRANDT MEIO AMBIENTE. 2007b. Environmental reclamation of Curaçá River, Sulapa Creek and Pedra de Fogo in the Mineração Caraíba S/A – Plan for desilting of river bed affected areas and revegetation of APP with native species of Caatinga biome: Distrito Pilar – Jaguarari, BA – MINERAÇÃO CARAÍBA S/A. Nova Lima, MG, 2007.
- BRANDT MEIO AMBIENTE. 2008. Environmental resources agreement term attendance – open pit mines, waste piles and marginal ore: Jaguarari, BA – MINERAÇÃO CARAÍBA S/A. Nova Lima, MG, 2008b.
- BRANDT MEIO AMBIENTE. 2008. Environmental resources agreement term attendance to the tailing dam: Jaguarari, BA – MINERAÇÃO CARAÍBA S/A. Nova Lima, MG, 2008.
- BRANDT MEIO AMBIENTE. 2008. Environmental resources agreement term attendance. Item VIII – socioeconomic issues – Núcleo Habitacional de Pilar / Município de Jaguarari Bahia. Jaguarari, BA – MINERAÇÃO CARAÍBA S/A. Nova Lima, MG, 2008.
- BRANDT MEIO AMBIENTE. 2013. Review of degraded areas reclamation plan – Pilar unit. Distrito Pilar – Jaguarari – BA. Nova Lima, MG, 2013.
- MINERAÇÃO CARAÍBA S/A. 2016. Characterization of the enterprise – Pilar unit. Jaguarari – BA, 2016.
- MINERAÇÃO CARAÍBA S/A. 2010. Attendance survey of the obligations included in the Environmental resources agreement term. Jaguarari – BA, 2010.
- MINERAÇÃO CARAÍBA S/A. 2015. Attendance report of the obligations included in the environmental resources agreement term. Jaguarari – BA, 2015.
- CAROSO, CARLOS Et al. 2013. Socioeconomics and cultural diagnosis. Audits of the sociocultural actuation in the influence area of Mineração Caraíba S/A. Jaguarari – BA, 2013.
- NUNES, JACINTO, 2016. Project of tailings disposal in waste piles of Caraíba Mines. April, 2016.
- BRANDT MEIO AMBIENTE. 2017. Review of degraded areas reclamation plan – Pilar unit. Distrito Pilar – Jaguarari – BA. Nova Lima, MG, 2017

- BRANDT MEIO AMBIENTE. 2020. Review Closure plan: Pilar district – Jaguarari, BA – MINERAÇÃO CARAÍBA S/A. Nova Lima, MG, 2020.
- MINERAÇÃO CARAÍBA S/A, 2020. Review Project of tailings disposal in waste piles of Caraíba Mines. December, 2020.
- MINERAÇÃO CARAÍBA S/A, 2019 Review of degraded areas reclamation plan – Pilar unit. Distrito Pilar – Jaguarari – BA, 2019.
- MINERAÇÃO CARAÍBA S/A, 2022 Review of degraded areas reclamation plan – Pilar unit. Distrito Pilar – Jaguarari – BA, 2022
- SETE Soluções e Tecnologia Ambiental LTDA. 2021. Conceptual mining closure plan review – Pilar Unit – Jaguarari, BA. Belo Horizonte, MG, 2021.

Main Environmental and Social Studies – Surubim Mine

- COPA CONSULTORIA EM PROJETOS AMBIENTAIS. 2008. Environmental Impact Study – EIA. Copper Ore Mining. Surubim Project. Distrito de Poço de Fora Curaçá – BA. Salvador, BA, 2008.
- BRANDT MEIO AMBIENTE. 2008ª. Environmental Impact Study (EIA) – Copper ore mining for extraction of 5.6 million tons in the Surubim Target: Distrito Poço de Fora – Curaçá, BA – MINERAÇÃO CARAÍBA S/A. Nova Lima, MG, 2008ª.
- BRANDT MEIO AMBIENTE. 2014. Closure Plan – Surubim Mine. Curaçá, BA. MINERAÇÃO CARAÍBA S/A. Nova Lima, MG, 2014.
- BRANDT MEIO AMBIENTE. 2017. Review of degraded areas reclamation plan – Surubim mine. Distrito Pilar – Jaguarari – BA. Nova Lima, MG, 2017.
- MINERAÇÃO CARAÍBA S/A. 2017. Characterization of the enterprise – Surubim Mine. Jaguarari – BA, 2017.
- BRANDT MEIO AMBIENTE. 2020. Review Closure Plan – Surubim Mine. Curaçá, BA. MINERAÇÃO CARAÍBA S/A. Nova Lima, MG, 2020.
- SETE Soluções e Tecnologia Ambiental LTDA. 2021. Conceptual mining closure plan review – Surubim mine – Curaçá, BA. Belo Horizonte, MG, 2021.
- MINERAÇÃO CARAÍBA S/A, 2022 Review of degraded areas reclamation plan – Surubim mine – Curaçá, BA. 2022

Main Environmental and Social Studies – Vermelhos UG Mine

- MINERAÇÃO VALE DO CURAÇÁ. 2015. Medium Environmental Impact Study – EMI – Projeto Vermelhos. Juazeiro– BA, 2015.

- MINERAÇÃO VALE DO CURAÇÁ. 2015. Characterization of the Enterprise – Vermelhos Project. Juazeiro – BA, 2015.

- COPA CONSULTORIA EM PROJETOS AMBIENTAIS. 2015. Environmental Impact Study – EIA. Copper Ore Mining. Vermelhos Project. - Município de Juazeiro – BA. Salvador, BA, 2015.

- BRANDT MEIO AMBIENTE. 2018. Closure Plan – Vermelhos Mine. Juazeiro, BA. MINERAÇÃO CARAÍBA S/A. Nova Lima, MG, 2018.

- XYZ Temas, Consultoria e Serviços ltda. 2018. Hydrological and Hydrogeological Study to Evaluate Potential Impacts in Relation to Aquiferos And Wells Existing in the Environment of the Vermelhos Project. Juazeiro, BA. Salvador, BA, 2018

- HIDROGEO, Engenharia e Gestão de Projetos. 2018. Technical Advice: “Technical Evaluation of the Potential of Generating Acid Effluent From Originating Oil Batteries or Another Mining Structure”. Vermelhos Project. Juazeiro, BA, Brasil. Belo Horizonte, MG, 2018.

- LIMA Consultoria Ambiental, 2018. Degraded areas reclamation plan. Juazeiro, BA. 2018.

- BRANDT MEIO AMBIENTE. 2020. Review Closure Plan – Vermelhos Mine. Juazeiro, BA. MINERAÇÃO CARAÍBA S/A. Nova Lima, MG, 2020.

- SETE Soluções e Tecnologia Ambiental LTDA. 2021. Conceptual mining closure plan review – Vermelhos mine – Juazeiro, BA. Belo Horizonte, MG, 2021.

- MINERAÇÃO CARAÍBA S/A, 2022 Review of degraded areas reclamation plan – Vermelhos mine – Itamotinga, Juazeiro, BA. 2022.

The mining and processing operations of the Caraíba Operations are located within the Curaça River basin, on the south-eastern margin of the São Francisco River Valley. The region has a semiarid climate, classified as BSh (semiarid – hot) in accordance to Köppen and Geiger. The average annual rainfall is less than 700 mm/year, concentrated to the summer rainy season. Temperatures range from a low of 20°C in the winter months to a high of 40°C in the summer months. Summer average temperatures are 29°C while winter averages are 23°C. Average annual rainfall totals have declined in the region over the last several decades, as illustrated in the following figure.

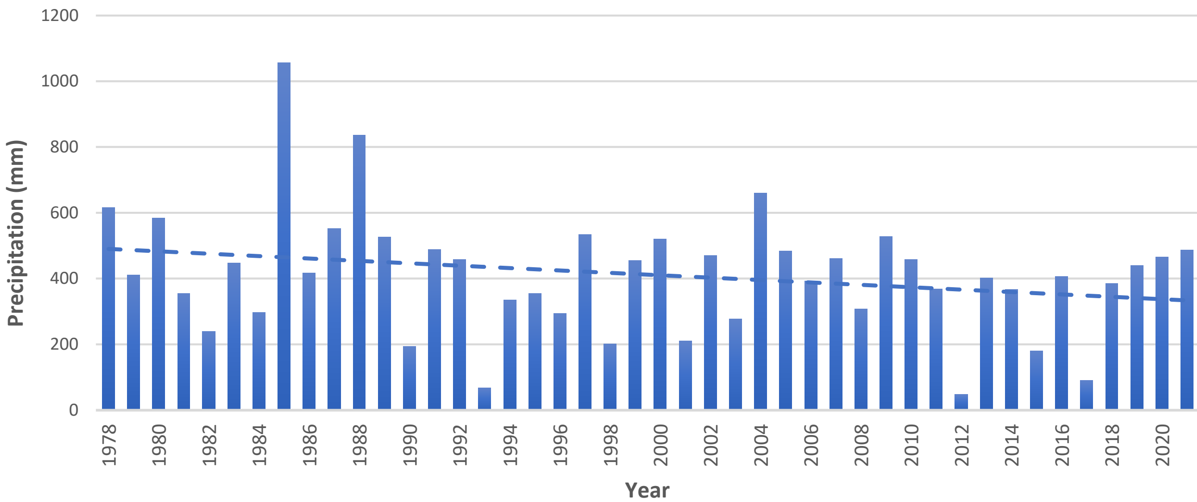


Figure 20-1: Annual Rainfall – Period from 1978 to 2021 (Caraíba Station – Bahia State).

Ero Brasil's operations are within the Caatinga Biome. The Caatinga consists of small trees, cacti, thick-stemmed plants, and arid grasses. The soils are poorly developed and rocky. The region has been developed since the 17th century and the native vegetation has been altered by extensive livestock grazing and locally, farming activities, with the latter primarily concentrated along the banks of the Sao Francisco River. Population centers in the region are also concentrated along the banks of the major rivers and water reservoirs, aside from villages that receive water via water pipeline.

The environmental studies for the Caraíba Operations have determined that the potential impacts of Ero Brasil's operations in the Curaçá Valley on water resources, local populations and native vegetation are limited. The mining operations are located distal to any natural bodies of water, within a sparsely occupied region and have a limited operational footprint.

Figure 20-2: Typical Caatinga Vegetation (Ero Brasil, 2020)

20.3 STATUS OF ERO BRASIL ENVIRONMENTAL PERMITS & LICENSES

The Caraíba Mine, including the integrated processing operations, was granted its most recent renewed LO on August 23, 2022 and is valid until August 23, 2025. The mining license was issued by Portaria No. 13,776, from INEMA, in support of both the underground operations of the Pilar UG Mine complex and the R22W Mine, with current estimated production rate of 1,440,000 tonnes/year under ANM 812.998/1973 (Portaria de Lavra nº 206/2008, R22W Mine, and 000737/1940 and Manifesto de Mina nº 417/1946). The LO supports the Caraíba Mill with a current estimated processing rate of 3,300,000 tonnes/year as well as administrative and operational support infrastructure, totaling approximately 2,400 ha of permitted area within the five mining concessions. The alteration license ("LA") was issued on September 8, 2022 and is valid until August 23, 2025, permitting the expansion of the production rate from 1,440,000 tonnes/year to 2,600,000 tonnes/year for the Pilar UG Mine complex and the R22W Mine. The LA also permits the expansion of the Caraíba Mill from 3.3 Mtpa to up to 5.5 Mtpa and installation of a new ~50 hectare tailings disposal pile (known as the South Pile) including fauna re-location authorization and vegetation supression permitting for site clearing activities.

The first environmental license for the Caraíba Mine was issued in 2000, (CEPRAM Resolution no 1459/97, dated April 10, 2000). The mine's LO has been renewed on a regular basis since 2003, and the current LO was granted on August 23, 2022 – for a three-year period, ending on August 23, 2025. In addition to the LO, the Pilar District has specific licenses for chemical products used in the processing and maintenance areas as well as a fuel station which are licensed by the local municipality.

The LO for the Surubim Mine was granted by INEMA (Ordinance No. 13.741 / 2010) on April 1, 2022, for a period of three years, expiring on April 1, 2025. The fuel station in Surubim has a specific environmental license issued by the local municipality.

The first environmental license for the Vermelhos UG Mine was issued by INEMA in 2015 (Ordinance No. 10.559 / 2015) for a three year period. It was subsequently renewed (INEMA Ordinance No. 17.064 dated of October 10, 2018) for a period of two years, ending on October 10, 2020. The LO was recently renewed by INEMA Ordinance No. 27.250 dated of October, 25, 2022, valid for the next three years.

Table 20-1 below details the primary environmental licenses of the Caraíba Operations. The authors of this Report have reviewed the permitting requirements and environmental aspects related to the forecast LOM production plan and have not identified any issues that are expected to materially impact Ero Brasil's ability to extract the current mineral reserves of the Caraíba Operations.

Table 20-1: Permitting Status of the Caraíba Operations

Mine/Project	License Scope	Project Phase	Permit Period		Status
			Start	Expiry	
Pilar Mine	Mining Operations	Operational	August 23, 2022	August 23, 2025	Valid
Pilar Mine	Alteration	Operational	September 9, 2022	August 23, 2025	Valid
Pilar Mine	Chemical Products	Operational	April 4, 2022	October 22, 2023	Valid
Pilar Mine	Fuel Station	Operational	May 6, 2020	May 6, 2023	Valid
Surubim Mine	Mining Operations	Operational	April 1, 2022	April 1, 2025	Valid
Surubim Mine	Alteration	Operational	May 27, 2022	May 27, 2024	Valid
Surubim Mine	Fuel Station	Operational	May 18, 2021	May 18, 2024	Valid
Surubim Mine	Deforestation and Fauna Management	Operational	May 27, 2022	May 27, 2024	Valid

Surubim Mine	Creek Deviation	Operational	May 27, 2022	May 27, 2027	Valid
Vermelhos UG Mine	Mining Operations	Operational	October 26, 2022	October 26, 2025	Valid
Vermelhos UG Mine	Fuel Station	Operational	November 11, 2021	October 28, 2024	Valid
Vermelhos UG Mine	Fauna Management	Operational	November 6, 2021	November 6, 2023	Valid
Vermelhos UG Mine	Creek Deviation	Operational	March 15, 2022	March 15, 2027	Valid

The Operation Licenses for the Pilar, Surubim, and Vermelhos Mines are valid and in compliance with the applicable legislation, specifically the State Decree 15,682/2014 that regulates environmental permitting in the Bahia State.

All environmental licenses issued by INEMA have a series of clauses detailing the environmental management procedures to be followed by Ero Brasil, and in some cases, deadlines to present additional studies or to conclude reclamation actions, among others. The Caraíba Mine license has 24 clauses/conditions, the Surubim License has 23 clauses and the Vermelhos License 37 clauses. The Ero Brasil environmental team presented an overview of the status of all clauses of the referred licenses, including conditions that could affect the renewal process. The Ero Brasil environmental team confirmed that the Company complies with all terms of the licenses and it is the opinion of the authors of this Report that there are no identified issues that could adversely impact the renewal of the licenses.

All environmental licenses issued by INEMA have a series of clauses detailing the environmental management procedures to be followed by Caraíba, and in some cases, deadlines to present additional studies or to conclude reclamation actions, among others. The Pilar Mine License (RLO)has 29 clauses/conditions, the Surubim License (RLO) has 37 clauses and the Vermelhos License (RLO) 35 clauses. The Caraíba environmental team confirmed that the Company complies with all terms of the licenses and it is the opinion of the authors of this Report that there are no identified issues that could adversely impact the renewal of the licenses.

20.3.1 Deepening Project Environmental Permitting

The Deepening Project is considered part of the existing Pilar UG Mine and does not require a material expansion of the existing infrastructure that would require additional permitting. This includes the processing plant, power and water supply systems. The Deepening Project, as currently defined, is not expected to create additional environmental or additional social impacts. Therefore, there is no specific or additional permitting required for the Deepening Project other than periodic renewal requirements obtained in the ordinary course of business. Nevertheless, all information of the Deepening Expansion project was reported to the agency in the renewal process of the LO.

20.3.2 Water Rights

Ero Brasil has the water rights needed to conduct ongoing mining operations. The main water right was issued by the National Water Agency (Resolution nº18 dated of January 8, 2016), valid for 10 years, allowing the use of up to 1,690,000 m³/month from the São Francisco River via an 86 km water pipeline connecting the pumping station to the Pilar Mine. As noted in Chapter 18, Project Infrastructure, Ero Brasil does not use all of the water pumped from the São Francisco River in its mining and processing operations and provides excess water to several communities located along the pipeline. Ero Brasil also has water rights to exploit three wells in the Vermelhos UG Mine site, granted by INEMA Ordinance No. 10,554 / 2015 and INEMA Ordinance No. 19,285 / 2019, as summarized in the table below.

Table 20-2: Water Rights Status – Caraíba Operations

Mine/Project	Water Right	Granted Period	Status

		Start	End	
Caraíba Mine	Water Use Permit (São Francisco River)	January 8, 2016	January 8, 2026	Valid
Surubim Mine	Groundwater Use Permit (Well # 1)	September 13, 2019	September 13, 2023	Valid
Surubim Mine	Effluent Discharge Permit	March 20, 2019	March 20, 2023	Valid
Surubim Mine	Effluent Discharge Permit (C12)	August 10, 2019	August 10, 2023	Valid
Sucuarana Mine	Effluent Discharge Permit	March 20, 2019	March 20, 2023	Valid
Vermelhos OP Mine	Effluent Discharge Permit	September 15, 2020	September 15, 2025	Valid
Vermelhos UG Mine	Groundwater Use Permit (Wells # 1 and 2)	May 28, 2021	May 28, 2025	Valid
Vermelhos UG Mine	Groundwater Use Permit (Well # 3)	October 5, 2019	October 5, 2023	Valid
Vermelhos UG Mine	Groundwater Use Permit (Wells # 4, #5 and #6)	April 6, 2022	April 6, 2026	Valid

The authors of this Report have reviewed the permitting requirements and environmental aspects related to the LOM production plans proposed by Ero Brasil, and has not identified an issues that could materially impact Ero Brasil's ability to extract the current mineral reserves presented in this Report.

20.4 ENVIRONMENTAL MANAGEMENT – POLLUTION CONTROL

Ero Brasil conducts several pollution control measures, including treatment and monitoring of effluent solutions, emissions reduction measures and air quality monitoring, among others, to ensure compliance within the Brazilian standards established by CONAMA as well as specific permitting terms defined by INEMA.

20.4.1 Liquid Effluents

The effluent discharge system of the Caraíba Mine consists of reclamation pumping, thickeners and treatment facilities to maintain site-wide water quality and reduce consumption of raw water through effluent recycle. Monthly sampling and analysis of effluent solutions is carried out in an effluent monitoring network, all performed in accordance with the Water Resources Quality Monitoring Plan approved under INEMA Ordinance No. 13.776 / 2017. Lubricating oils and hydraulic fluids are collected, stored and sent to third-parties for proper disposal or sold to recycling companies for re-use.

20.4.2 Solid Waste

Ero Brasil operates a controlled landfill for non-hazardous and non-recyclable waste, a composting unit for organic waste and a warehouse for the temporary storage of recyclable waste, all licensed by INEMA through Ordinance 13.776 / 2017. Hazardous waste produced on site is removed from site and sent for proper disposal by licensed third-parties.

For human waste, distal operations such as the Surubim Mine and the Vermelhos UG Mine utilize a combination of chemical toilets and septic systems to collect and treat organic effluent as established by the Brazilian Association of Technical Standards, through standards NBR 7,229 and NBR 13,969.

20.4.3 Atmospheric Emissions

Ero Brasil has an Air Quality Monitoring Plan to ensure that air quality standards are met on the site and surrounding areas. Monitoring points are distributed throughout all inhabited areas of the Curaçá Valley to measure total particulates and particulates in suspension that can be inhaled, as specified in the monitoring plan. The main sources of particulate emission in the mining activities of the Vermelhos UG Mine and the Surubim Mine are the fugitive emissions from ore haulage along unpaved routes within the area of the mining operations, and along the route to the Caraíba Mine. With ongoing mitigation measures such as haul road dust suppression and air quality monitoring, the environmental impacts in these areas have been deemed reversible and insignificant. Air quality monitoring is carried out in accordance with CONAMA Resolution 003/90.

20.5 DISPOSAL OF TAILINGS

Ero Brasil used a conventional tailings dam until the year 2010. The conventional tailings dam has a capacity of 45 million m^3 and covers an area of approximately 653 ha^2. While inactive, the Company has maintained the dam in operating condition and has a valid environmental license in place for tailings deposition.

Approximately 11% of tailings generated in the Caraíba mill operations are mixed with cement and used in the Pilar UG Mine for paste-backfill operations to enhance mineable recoveries and ground stability. The balance, approximately 89% of the tailings, are disposed over waste rock piles or withing exhausted open pits in an effort to avoid the use of using a conventional tailings dam, improving site-wide water recovery, and reclaiming historically mined open pits. As a result of these ongoing initiatives, Ero Brasil currently employs two different systems for tailings disposal, including:

- Back-fill open stopes within the Pilar UG Mine with cemented paste fill as part of production process; and,
- Co-disposal of tailings into waste rock stockpiles.

20.5.1 Disposal of tailings – Back-fill Open Stopes

Since 1998, approximately 7.8 million tonnes of tailings have been used to back-fill open stopes at Pilar UG mine utilizing cemented paste backfill. The following figure illustrates the paste fill plant and the backfill operation using tailings.

Figure 20-3: Paste fill plant on surface and underground tailings disposal as cemented paste (Ero Brasil, 2022)

20.5.2 **Disposal of tailings, Co-disposal of Tailings**

Since 2011, approximately 17.2 million tonnes of tailings, have been sent for co-disposal within the surface waste rock stockpiles. The co-disposal method entails utilizing the inherent void space within the waste rock stockpiles by allowing tailings to permeate the piles and, after fully filled, covering the final surface of the co-disposal pile with soils suitable for revegetation. The process is shown graphically in Figure 20-4 to Figure 20-6 and described in greater detail below. The method has produced excellent results, allowing increased water recovery, significantly reduced pumping costs, creating a substrate for revegetation of the waste rock stockpiles, and, since implementation, has eliminated the need for conventional tailings dam storage.

In practice, waste tailings, after thickening to approximately 65% solids, are pumped to the waste rock stockpiles for co-disposal. Small discrete compacted start rock berms are created along each stockpile to allow the material to be retained when first disposed on the pile. When the berm is completed, pumping maintains 1 m of freeboard along the berm. Operation then is stopped after an initial 21 days to allow time for percolation and drying of the material. After this first cycle, an excavator raises the dike on the top of the initial rock berm according to the design parameters. This lifting process is carried out continuously until the structure reaches the expected final dimensions, as shown in Figure 20-5. Multiple discrete ponds are prepared to allow operators to fill multiple sections according to natural drying sequence, accommodate various percolation rates, and enhance control of the co-disposal process. Revegetation with native plant species of Caatinga is conducted on the fully-completed piles.

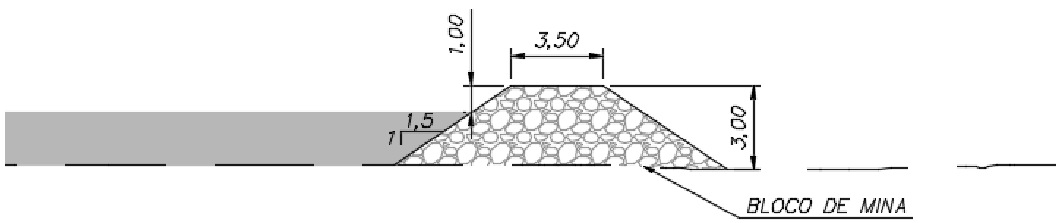


Figure 20-4: Initial dike dimensions prepared for co-disposal (Ero Brasil, 2020)

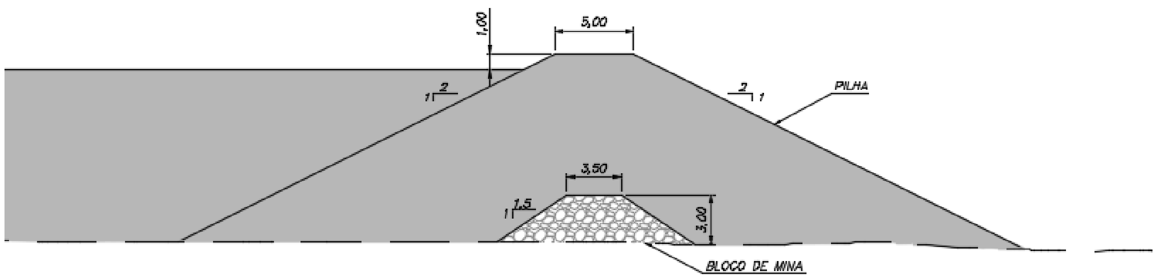


Figure 20-5: Illustrative scheme showing final dimensions of a typical co-disposal stockpile berm (Ero Brasil, 2020)

Based on Ero Brasil's operating history of co-disposal, the system has the following benefits:

- Eliminated the need to utilize the Company's conventional-tailings dam;
- Recover up to 90% of the water from the tailings produced, reducing the freshwater make-up requirements of the operations;
- Reduced pumping costs due to waste rock stockpiles' proximity to the Caraíba Mill; and
- Recontoured berms containing a mixture of coarse and fine particles create an enhanced substrate for revegetation efforts.

Figure 20-6: Photograph of Co-disposal Method on completion of Deposition (Ero Brasil, 2019)

20.5.3 Disposal of tailings – Exhausted Pits

In total, approximately 7.3 million tonnes of tailings have been deposited in depleted open pits at the Caraíba Mine. This process allows topographic restoration and revegetation of previously mined pit areas, as well as promoting the reuse of the water during the disposal process. In practice, after pumping into the depleted pit, fine tailings settle to the bottom of the depleted pit, allowing a pumping and filtration system to deliver fresh water to the process plant for re-use. Upon completion of back-fill, revegetation using native Caatinga plant species can occur.

The sequence of photographs below provides an illustrative example of the evolution of back-filling operations for a previously mined open, known as R75 located in the Pilar District.

This tailings deposition method is not currently in use following reclamation of available near-mill excavated open pits.

Figure 20-7: R75 open pit after its exhaustion in 2010 (Ero Brasil, 2010)

Figure 20-8: R75 open pit during filling in 2011 (Ero Brasil, 2011)

Figure 20-9: R75 open pit commencing revegetation in 2015 (Ero Brasil, 2015)

Figure 20-10: R75 open pit revegetation in 2019 (Ero Brasil, 2019)

20.5.4 Dry-stack Tailing Deposition, Technical Evaluation Work

At the time of this Report, Caraíba is currently undertaking a technical study to further evaluate the use of dry-stack tailings disposal on surface in addition to, or as an alternative to, future co-disposal options. There is sufficient space available on surface for long-term disposal of tailings implementing this method.

Several areas are being evaluated for dry stacking that are owned by the Company. These areas are:

- South Pile
- Pile 18
- Dry stacking on existing paddocks 9 and 11

In 2022, condemnation drilling undertaken beneath the location of the South Pile design was confirmed not to contain copper and the engineering design was concluded for a dry stacking system. The environmental permit was approved in October 2022 and this area is expected to be operational by the end of 2023 when existing co-disposal paddock capacity is expected to be utilized.

Pile 18 was also identified as a dry stacking area and a conceptual study is being done to apply for an environmental permit. Dry stacking on existing paddocks is also in design for approval.

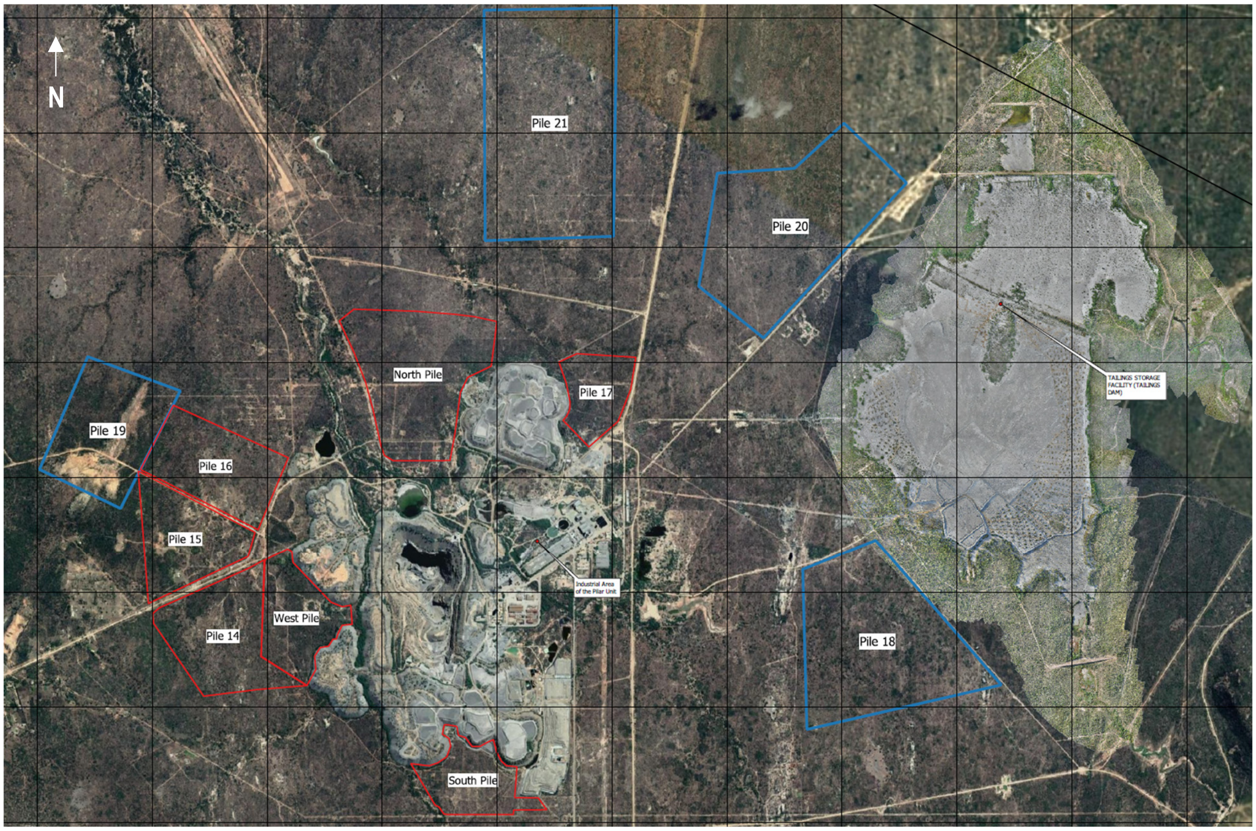


Figure 20-11: Site overview of sites located for future tailings disposal relative to the historic tailings facility (right in image) and the existing milling infrastructure (center left in image). Grid spacing is 1km by 1km. (Ero Brasil, 2022)

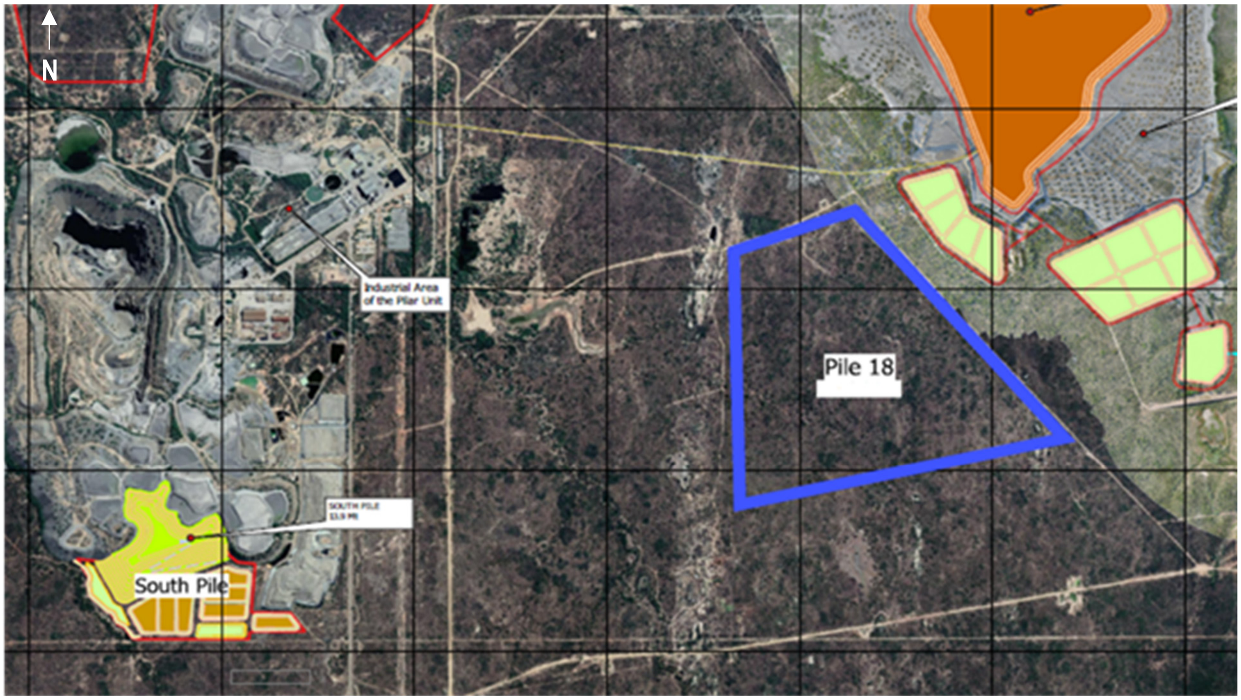


Figure 20-12: Location of South Pile design, location of Pile 18 and the historic tailings-dam showing additional locations identified for dry-stack tailings storage. Grid spacing is 1km by 1km. (Ero Brasil, 2022).

In summary, with permits in-place on the South Pile dry-stacking system, which is expected to provide sufficient storage capacity for tailings through 2031, ongoing technical trade-off studies ongoing, available locations identified for future tailings-disposal sites and considering all current technical, environmental and economic parameters, the authors of this Report have concluded that Caraíba has no tailings or waste disposal restrictions that could adversely impact the extraction of the current mineral reserves.

20.6 RECLAMATION OF DEGRADED AREAS

Ero Brasil has developed Reclamation of Degraded Areas Plans ("PRADs") for each mine currently in operation as well as the past producing mines within the Curaçá Valley. The plans are managed by Ero Brasil personnel in consultation with the environmental agency. The PRADs are reviewed and updated on a regular basis, incorporating new techniques, and rehabilitation alternatives as well as periodic adjustments for depletion, new mining activities and the restart of previously mined areas.

20.7 MINE CLOSURE COST ESTIMATE

Brandt Meio Ambiente, and SETE Serviços Técnicos Ambientais, Brazilian environmental consulting firms, with support from Ero Brasil's environmental team prepared conceptual mine closure reviews and reclamation plans for each mine currently in operation as well as the past producing mines in the region. The closure cost estimates, and trade-off studies are periodically updated by external consultants. The total estimated reclamation costs for the Caraíba Operations in the Curaçá Valley are approximately R$192 million. The costs were estimated maintaining the synergy in the LOM operations, with the use of resources (labor and equipment) to maintain continuity of operations. These estimates have been reviewed by the authors of this Report, who find the amounts to be reasonable and in-line with expectations given the nature of the operations and operational history of previously performed and ongoing reclamation activities.

20.7.1 Caraíba Mine

The estimated reclamation costs for the Caraíba Mine, excluding operations elsewhere in the Curaçá Valley, totals approximately R$144 million. The estimate includes the removal of surface infrastructure, re-contouring, revegetation and reclamation of the SX/EW plant and associated infrastructure. Detail is shown in the table below.

Table 20-3: Summary of Mine Closure Costs for the Caraíba Mine

Caraíba Mine Structures	Estimated Reclamation Cost (R$ 000s)	
Socio-Economic Programs	R$	11,187
Waste Stockpiles	R$	11,139
Administrative Structures and Other Areas	R$	8,835
Underground Mine	R$	9,120
Open Pits	R$	8,857
Tailings Dam	R$	41,282
Industrial area	R$	24,973
Total Caraíba Mine Structures	**R$**	**115,394**
Oxide Leach Facilities		
Oxidized Waste Stockpiles	R$	23,364
Administrative and Support Structures	R$	3,018
Sumps and tanks	R$	2,173
Total Oxide Leach Facilities	**R$**	**28,554**
Total, Caraíba Mine	**R$**	**143,948**

20.7.2 Surubim Mine

The estimated reclamation cost for the Surubim Mine totals approximately R$10.9 million. The estimate includes the removal of surface infrastructure, re-contouring, and revegetation. Detail is shown in the table below.

Table 20-4: Summary of Mine Closure Costs for the Surubim Mine

Structures	Estimated Reclamation Cost (R$ 000s)	
Open Pit	R$	1,507
Administrative and Support Structures	R$	1,142
Underground Mine	R$	3,619
Waste Stockpiles and Sump	R$	4,627
Total	**R$**	**10,894**

20.7.3 Angicos Mine

The estimated reclamation cost for the Angicos Mine totals approximately R$4.6 million. The estimate includes the removal of surface infrastructure, re-contouring, and revegetation. Detail is shown in the table below.

Table 20-5: Summary of Mine Closure Costs for the Angicos Mine

Structures	Estimated Reclamation Cost (R$ 000s)	
Open Pit	R$	1,175
Waste Stockpiles	R$	2,774
Infrastructure & Operational Support	R$	657
Total	**R$**	**4,607**

20.7.4 Suçuarana Mine

The estimated reclamation cost for the Suçuarana Mine totals approximately R$7.1 million. The estimate includes the removal of surface infrastructure, re-contouring, and revegetation. Detail is shown in the table below.

Table 20-6: Summary of Mine Closure Costs for the Suçuarana Mine

Structures	Estimated Reclamation Cost (R$ 000s)	
Open Pit	R$	2,415
Waste Stockpiles	R$	3,617
Administrative & Support Structures	R$	1,066
Total	**R$**	**7,099**

20.7.5 Vermelhos UG Mine

The estimated reclamation cost for the Vermelhos Mine totals approximately R$25.6 million. The estimate includes the removal of surface infrastructure, re-contouring, and revegetation. Detail is shown in the table below.

Table 20-7: Summary of Mine Closure Costs for the Vermelhos Mine

Structures	Estimated Reclamation Cost (R$ 000s)	
Socio-Economic Programs	R$	73
Waste Stockpiles	R$	5,455
Open Pit	R$	2,592
Administrative & Support Structures	R$	1,837
Underground Mine	R$	9,048
Industrial Area	R$	6,613
Total	**R$**	**25,620**

20.8 SOCIAL AND COMMUNITY OUTREACH

Ero Brasil maintains an excellent relationship with the communities throughout the Curaçá Valley, having held regular meetings and consultation sessions with all stakeholders over the 40 year operating history of the operations. In support of this relationship, Ero Brasil undertakes several key initiatives focused on sustainable community development.

The following table sets out the main programs, projects and social outreach activities carried out by Ero Brasil in the influenced areas of its mining projects in the Curaçá Valley. The table is not intended to be an exhaustive list of all activities and programs supported by Ero Brasil, which are extensive.

Table 20-8: Portfolio of Socio-Environmental Work

Portfolio of Socio-Environmental Work in the Curaçá Valley	
Program	**Project**
Rural Sustainability in the Semiarid	Sheep and Goat Production Chain Leather Workshop Entrepreneurship, a Matter of Attitude Women in Action Community Vegetable Garden Communitary Nursery
Education and Vocational Training	Young Entrepreneurship Firsts Steps (JEPP) - SEBRAE Young Apprentice - SENAI Support of the Pilar Student Association (AEP) Incentive to the Sport of Pilar (PIEP) and Surubim (FEET) - Pilar Club Association
Cultural Identity	Rescue and Valorization of Local Culture
Socio-Environmental Communication	Community Relationship and Participatory Management Plan

21 CAPITAL AND OPERATING COSTS

21.1 INTRODUCTION

The capital and operating costs outlined in Chapter 21 correspond to the Mineral Reserves LOM Production Plan as outlined in Chapter 16 of this Report. The capital and operating cost estimates were prepared based on operating performance of the Caraíba Operations.

The Authors reviewed the capital and operating cost estimates prepared by Ero Brasil and found them to be in accordance with industry norms, and sufficient for use in support of the current mineral reserve estimate.

21.2 CAPITAL COST ESTIMATES

21.2.1 Capital Cost Summary

The total Mineral Reserve LOM Production Plan capital costs estimate is approximately US$1,083M and have been based on supporting the requirements for the mining and processing operations of the current mineral reserves over the 20-year estimated operating life of the Caraíba Operations. Total capital investments include capitalized mine development as well as ongoing capital requirements primarily in the form of equipment replacement at the end of each unit's useful life. Capital cost projections are based upon vendor quotes and management estimates incorporating historical operating data and previously supplied quotes from the current operations. Capital expenditure estimates reflect the total cost for developing and extracting the current mineral reserves included in the Mineral Reserve LOM Production Plan. Total estimates by category are presented in USD in Table 21-1.

Table 21-1: Total LOM Capital Expenditure Estimate

Category	LOM Total (USD 000s)
UG Mine Development	346,019
OP Mine Pre-Stripping	151,551
Infrastructure	209,083
UG Equipment	79,273
OP Equipment	43,079
Mineral Processing	99,051
Tailings	44,075
Safety & Environment	73,306
IT & Services	3,799
Other Capital Costs	33,890
Total Capital Cost	**1,083,126**

(*) BRL amounts converted to USD at a USD:BRL foreign exchange rate of 5.29.

The capital cost breakdown can be described as follows:

Underground capitalized development includes underground horizontal development, infrastructure required for the Pilar UG Mine, the Vermelhos UG Mine, and the Surubim UG Mine, and it is estimated to be US$346M over the LOM production plan.

Capitalized infrastructure includes the new Deepening Project shaft, and all pumping, electrical, civil and mechanical works to expand and sustain the open pit and underground operations. It is estimated to be US$209M over the LOM production plan.

Total mineral processing capital costs are estimated at US$99M, which consists primarily of the mill expansion and the construction of the ore sorting facility for implementation by 2031. Other capital consists primarily of equipment rebuilds, equipment replacements, and ongoing reclamation work. Safety and environmental costs are estimated at US$73M and it include all requirements for mine, tails and waste dump recoveries, licensing & permitting expenditures, and safety investments (refugee chambers, materials, scape ways, fire suppression systems, and other protection systems). An additional US$44M has been estimated for tailings expansion investments over the LOM.

Capital costs do not include project financing and interest charges, working capital, capitalized exploration or capital costs estimated to be required to upgrade the inferred mineral resources of the Strategic LOM Plan. The differential capital between the Mineral Reserves LOM Production Plan capital requirements and that of the Strategic LOM Plan is estimated to be an incremental US$160M, primarily for underground development.

21.3 OPERATING COST ESTIMATES

21.3.1 Operating Cost Summary

An operating cost model was generated based on actual historic operating performance at the Caraíba Operations, utilizing specific consumption coefficients based on operational data, after application of adjustments for differences between ore sources in the Mineral Reserves LOM Production Plan. Cost estimates are built using first principles incorporating both fixed and variable components to account for production rate variations. Costs were adjusted annually based on the changes to ore sources including rock support, transport, and infrastructure requirements. Underground mining costs consist of the operational costs related to ore extraction at the Pilar UG Mine, Vermelhos UG Mine, and Surubim UG Mine. Direct mining costs include drilling, blasting, and mucking. Indirect costs include ore and waste transport, mine services, and mine supplies

Open pit mining costs consist of the operational costs related to ore extraction at the Surubim OP, C12 OP, N8 / N9 OP, and N5 (Siriema) OP Mines. Direct mining costs include drilling, loading, and mucking. Indirect mining costs include ore and waste transport, mine services, and mine supplies. Operating costs for all mines consider the differential transport component to deliver ore to the Caraíba Mill as well as any costs associated with ore sorting.

The Caraíba Mill is a conventional three-stage crush and flotation operation producing a high-grade copper concentrate. The plant operates 24 hours per day, seven days per week. The primary components of plant costs are salaries, operating materials, and power. For the purposes of differentiating operating mines, fixed costs associated with the Caraíba Mill are allocated to the Pilar UG Mine and the Vermelhos UG Mine, which correspond to the majority of mill feed.

The operating cost estimates rely on the following assumptions:

- The specific consumption coefficients for all consumables for mining and processing were analyzed based on historical usage over the last 18 months and projected forward incorporating changes in the production plan, as well as continuous improvement projects, assuring alignment with the mine production and capital improvement projects.

- Power costs were calculated based on power capacity load of each equipment and area, considering the availability, utilization, and power factor. The prices were based on the contract for demand and supply.

- General and administrative (G&A) costs consider the mine supporting functions, such as human resources, accounting, HSEC, IT, general services, security and procurement. It also includes sales expenses related to concentrate assaying, insurance, other sales related expenditures and administrative expenses related to sale of concentrate.

- Contractor costs are based on existing contracts, where the most relevant costs are the mine hauling contract and light vehicles rental. The costs for the hauling contract were calculated considering contract rates, truck productivity, and necessary working hours to support the mine plan, including fixed contract costs.

- Concentrate transport costs are based on a 50/50 weighting between international and domestic sales channels.

Table 21-2: Average LOM Operating Costs

	Underground Operations			Open Pit Operations		
Cost Parameter, Average LOM	**Pilar UG Mine**	**Vermelhos UG Mine**	**Surubim Mine, underground**	**Surubim Mine, open pit**	**N8/N9 & N5 (Siriema) OP Mines**	**Suçuarana OP Mine**
Mining Cost *(BRL per tonne mined)*	157.07	147.54	153.36	11.06	11.06	11.06
Transport to Caraíba Mill *(BRL per tonne moved)*	n/a	53.16	16.88	16.88	34.23	10.32
Processing Costs* *(BRL per tonne processed)*	49.25	49.25	30.15	30.15	30.15	30.15
Concentrate Transport *(BRL per wet metric tonne of concentrate)*	404.69	404.69	404.69	404.69	404.69	404.69

(*) Fixed processing costs are allocated to the Pilar UG and Vermelhos UG Mines which comprise the majority of Caraíba Mill feed.

22 ECONOMIC ANALYSIS

Financial information has been excluded as Ero Copper is a producing issuer, as such term is defined under NI 43-101. The Caraíba Operations are currently in production and no material expansion of operations is currently planned.

23 ADJACENT PROPERTIES

The information contained in this Report is based solely on the Caraíba Operations and the mineral assets therein.

24 OTHER RELEVANT DATA AND INFORMATION

The update of the last study for the extraction of the Inferred mineral resources defined within the Deepening Extension Zone of the Pilar UG Mine are considered relevant to the conclusions and recommendations of the 2022 LOM plan, since they describe the Company's work undertaken on the project and indicate future potential of this deposit as well as shared synergies between the Deepening Inferred Project, as described herein, and the envisioned Deepening Project, as more fully described in Chapters 15, 16 and 18 of this Report.

24.1 INTRODUCTION TO DEEPENING INFERRED PROJECT

The Deepening Inferred Project is based upon an ongoing exploration campaign in the Pilar UG mine below level -965 which as at the Effective Date, had updated the numbers of a significant portion of inferred mineral resources within the Deepening Extension Zone that are included in the Company's 2022 Strategic LOM Plan. Given the intrinsic synergies associated with the Deepening Project, Ero Brasil undertook engineering studies for the development of the Deepening Inferred Project.

The Company's 2022 Strategic LOM Plan, which encompasses the Deepening Inferred Project are preliminary in nature and based on the inferred mineral resources which 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 Deepening Inferred Project will be realized. Mineral resources that are not mineral reserves do not have a demonstrated economic viability. The Company has commenced a program to continue infill drilling of the Inferred resource to further upgrade this material; however, until this work is completed, and the Inferred resources have been upgraded to reserves, there is no certainty this material will be converted into mineral reserves.

24.2 MINE DESIGN, DEEPENING INFERRED PROJECT

24.2.1 Inferred Mineral Resources and Modifying Factors, Deepening Extension Zone

Production from the mineral reserves of the Deepening Project as outlined elsewhere in this Report will be supported by the construction of a new external shaft, as further detailed in Chapter 15 and 18. In the Company's 2022 Mineral Reserve LOM plan, inferred mineral resources, where unavoidably mined were reported at zero grade.

The primary objective of the Deepening Inferred Project is to evaluate the potential to utilize the planned infrastructure to mine and process the Inferred mineral resources within the in the Pilar UG Mine, as well as evaluate the potential for the integration of required development in support of the Deepening Inferred Project. Inferred mineral resources of the Pilar UG Mine, Deepening Extension are detailed below. Mineral resources which are not mineral reserves do not have demonstrated economic viability. Please refer to Chapter 14 for additional details on the determination of inferred mineral resources of the Caraíba Operations.

The Deepening Inferred Project envisions application of the same mining and recovery methods as Pilar UG Mine as more fully described in Chapters 13, 15 and 16 of this Report. Accordingly, the same mining, recovery and dilution modifying factors have been applied to the Deepening Inferred Project. Specifically, these modifying factors include mining recovery of 90.44% and dilution that varies with stope height. For planned stopes in the Deepening Extension, dilution of 23% has been applied.

The assumed available material and contained copper based on these parameters, after application of stated mining factors, is shown in the table below. Modified Inferred mineral resources are not mineral reserves. Mineral resources that are not mineral reserves do not have a demonstrated economic viability.

Table 24-1: Modified Inferred Mineral Resources in the Pilar UG Mine Below Level -965

	Deepening Extension Zone, Inferred Resources	Modified Inferred Mineral Resources
Tonnes (000s)	7,428	5,589
Grade (% Cu)	1.81	2.05
Contained Cu (000 tonnes)	**134.8**	**114.6**

Deepening Inferred Project Notes:

1. Mineral resource effective date of June 30th, 2022. All figures have been rounded to the relative accuracy of the estimates. Summed amounts may not add due to rounding. Mineral resources which are not mineral reserves do not have demonstrated economic viability.
2. The Inferred mineral resources (undiluted) outlined in this table are further detailed in Chapter 14 – Mineral Resource Estimates, of this Report. Mineral resources of the Pilar Mine are based on copper prices of US$3.30 per pound, net smelter return of 97.66%, average metallurgical recoveries of 90.44%, processing costs of US$9.31 per tonne (run of mine) and mining costs of US$29.68 per tonne.
3. Mineral resources have been constrained within newly developed 3D lithology models applying a 0.45% and 0.20% copper grade envelope for high and marginal grade, respectively. Within these envelopes, mineral resources for underground deposits were constrained using varying stope dimensions of up to 20m by 10m by 35m applying a 0.70% copper cut-off grade, as well as a 0.52% copper marginal cut-off grade. Mineral resources have been estimated using ordinary kriging inside 5m by 5m by 5m block sizes. The mineral resource estimates were prepared in accordance with the CIM Standards, and the CIM Guidelines, using geostatistical and/or classical methods, plus economic and mining parameters appropriate to the deposit. Please refer to Chapter 14 – Mineral Resource Estimates of this Report for additional details.

24.2.2 **Stope Optimization**

To optimize the stope design of the Inferred mineral resource, a cut-off-grade of 0.70% copper was used and SO runs were performed with the inferred resources maintained at the mineral resource grade within the volume. SO was configured for the levels between -1693L and -991L. Mining operations were assumed to be the same as for the Deepening Project, using a combination of transverse stoping and longitudinal stoping mining method. Dilution was set to 1.0 m, comprised of 0.5 m for the hanging wall, 0.5m for the footwall and a maximum waste percentage of 75%. The optimization by SO was run along the X axis (east coordinate), with the other two axes fixed at 15 m (Y) and 26 m (Z).

The current geological model indicates that mineralization within the Deepening Extension Zone, as defined by drilling to date, tends to increase in copper grades at depth – future drilling campaigns should confirm this. Average stope grades are presented in the figure below.

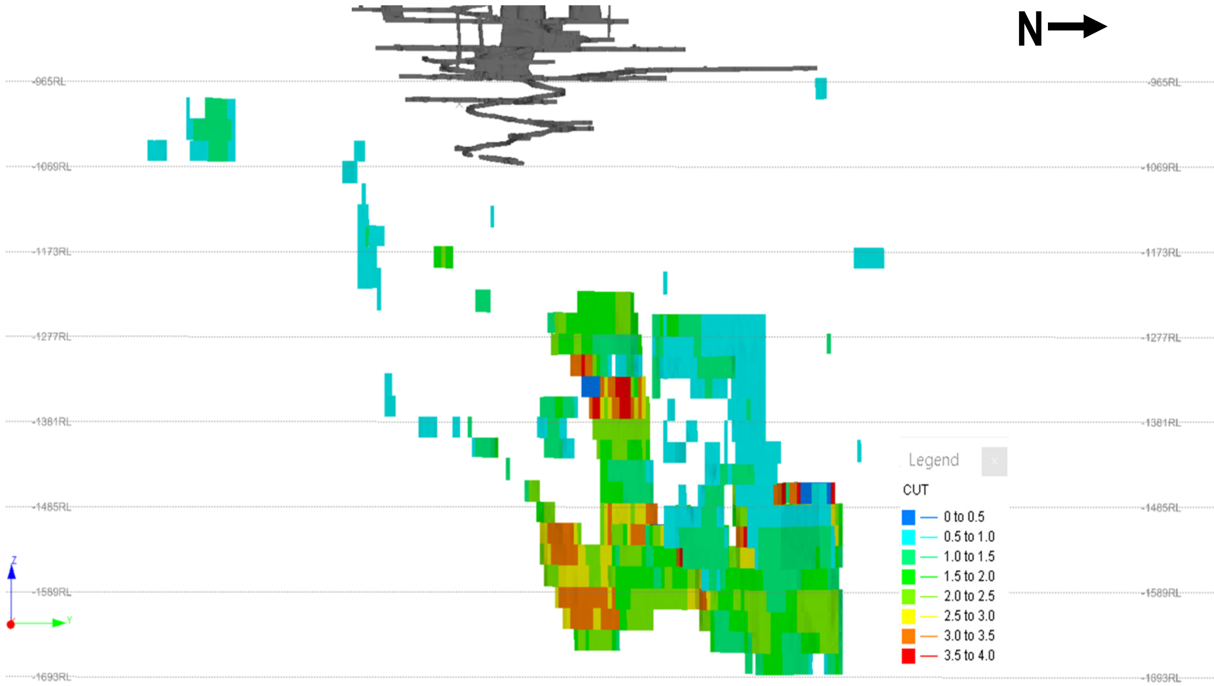


Figure 24-1: Copper Grade Distribution (%), Deepening Inferred Project (Ero Brasil, 2022)

Extraction of mined material from the Deepening Inferred Project required the addition of three new panels below -1,381L, as the production panels and supporting infrastructure to be built from level -1069 to -1381 are shared by the Deepening Project. The distribution of panels by level for the Deepening Extension Zone is shown in Table 24-3 below.

Table 24-2: Distribution of Panels within the Pilar UG Mine, Deepening Extension Zone

Mining Method	Panel	Elevation of Reference
Longitudinal Stoping (Shared with Deepening Extension Project)	1	Level -1069
	2	Level -1173
Longitudinal and Transverse Stoping (Shared with Deepening Extension Project)	3	Level -1277
	4	Level -1381
	5	Level -1485
Longitudinal and Transverse Stoping (Deepening Inferred Project only)	6	Level -1589
	7	Level -1693

The figure below illustrates these production panels across a vertical section. Based on information as at the Effective Date, the mineralization narrows to depth and only Longitudinal Stopes are planned below -1381L.

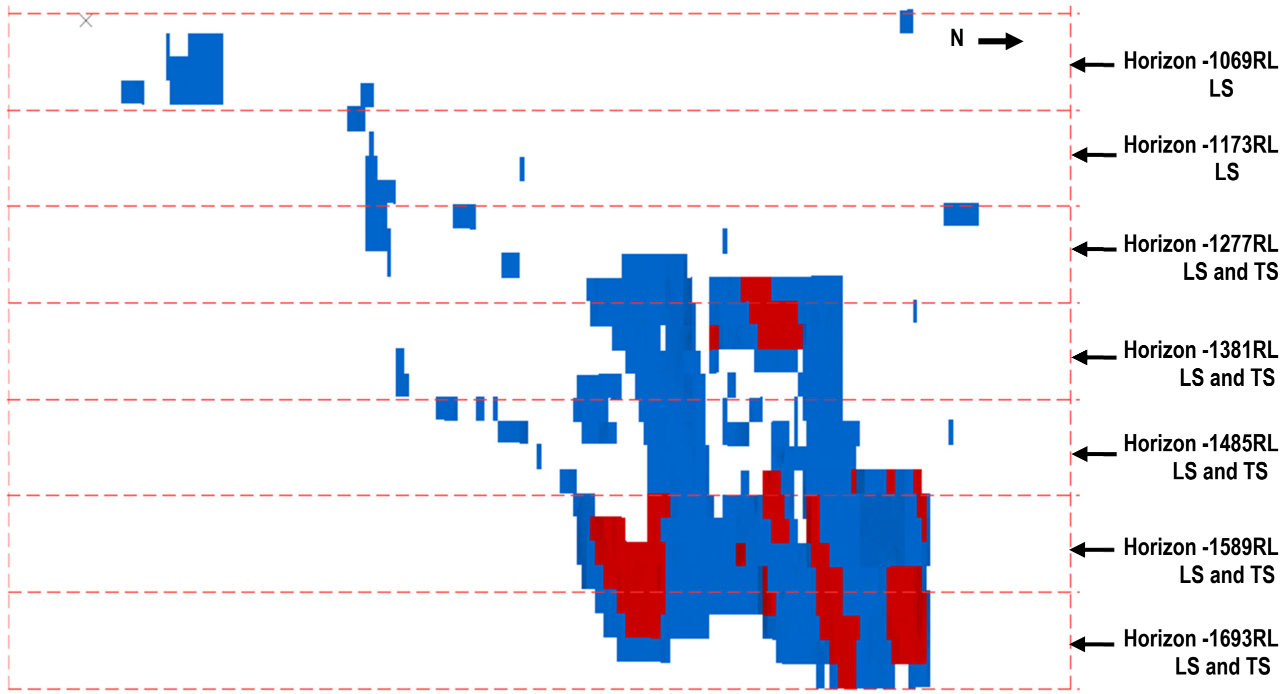


Figure 24-2: 2D Schematic of stope design by mining method (blue = longitudinal, red = transverse) (Ero Brasil, 2022)

24.2.3 Mine Design

The primary ramp design for the Deepening Inferred Project is presented in the figure below. The primary ramp continues at depth beyond the Deepening Project and is designed to follow the mineralization to the north, as more fully described in Chapter 16 and 18. The bottom of the new external shaft that will be built in support of the Deepening Project that will be completed to the -1075 Level. Two new panels with 4 new production levels each have been designed below -1381 Level in support of the Deepening Inferred Project.

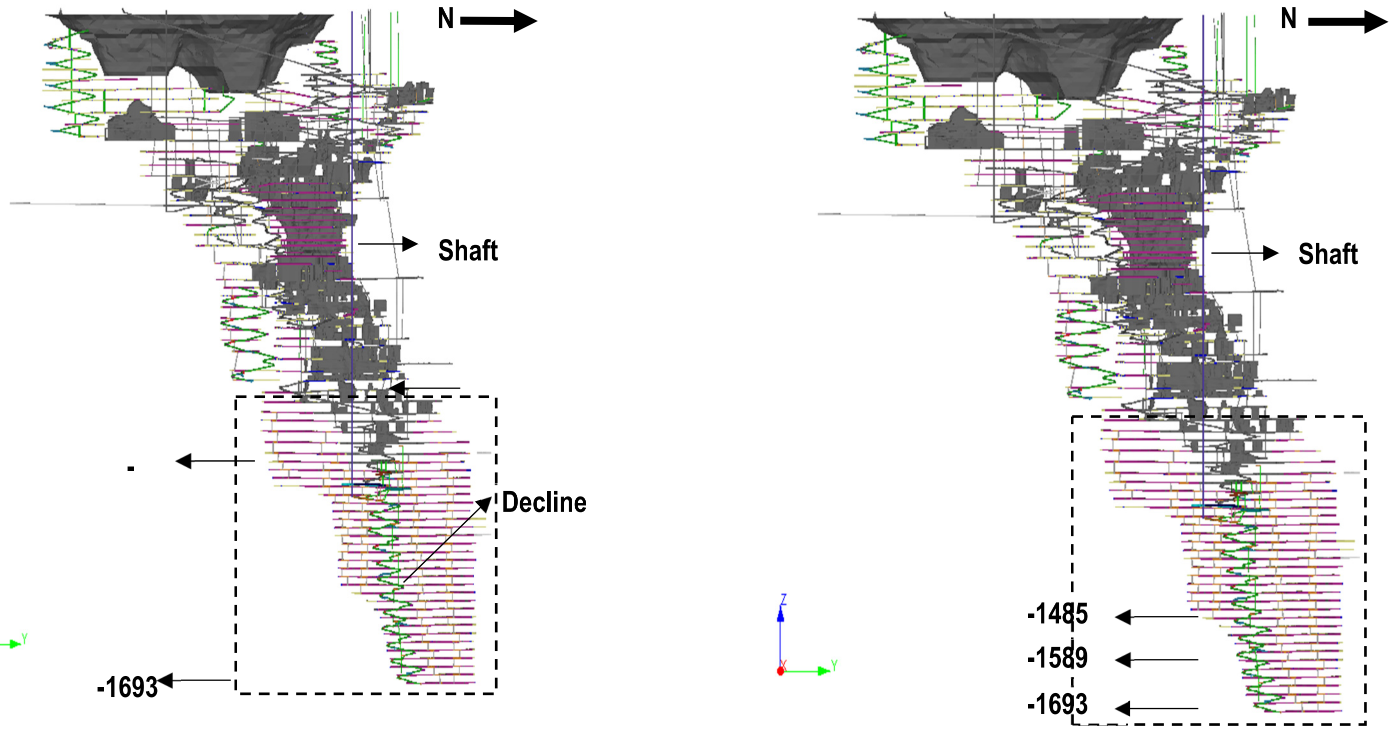


Figure 24-3: General Layout of Pilar UG Development, Deepening Extension Zone (Ero Brasil, 2022)

The mine ventilation system for the deeper panels of the mine in support of the Deepening Inferred Project will utilize the existing mine ramp and internal ventilation raises connecting the production levels. This infrastructure, including cooling requirements, will be shared with the Deepening Project, as more fully described in Chapter 18 of this Report.

24.2.4 Mine Development Schedules & Equipment Selection

The same assumptions for development rates and production schedules were incorporated into the mine design for the Deepening Inferred Project as were used for the mineral reserves incorporated into the Deepening Project.

In support of the Deepening Inferred Project, an additional 22km of horizontal development is required when compared to the Deepening Project. As much of the developed infrastructure, including development, will be shared by the Deepening Project, the table below presents the development requirements for the Deepening Project, as well as incremental development required for the Deepening Inferred Project.

Table 24-3: Horizontal Development Schedule for the Deepening Inferred Zone, Pilar UG Mine(meters)

Description (meters)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	Total
Dewatering	-	-	-	-	-	-	75	114	110	-	-	-	-	-	299
Level Accesses	-	-	-	-	-	-	65	98	33	-	-	-	-	-	196
Access Drifts	-	34	53	370	420	435	1,276	1,921	2,096	345	328	296	63	-	7,637
Production Drifts	-	86	170	628	744	279	1,115	1,785	1,486	925	654	641	202	19	8,734
Transport Drifts	-	-	-	-	-	-	427	1,209	1,052	5	-	-	-	-	2,693
Ventilation Drifts	-	-	-	-	-	-	-	427	497	-	-	-	-	-	924
Loading Points	-	-	-	-	-	17	45	142	149	-	-	-	-	-	353
Ramp	-	-	-	-	-	-	529	540	42	-	-	-	-	-	1,111
Substation	-	-	-	-	-	-	24	36	12	-	-	-	-	-	72
Deepening Inferred Project	**-**	**120**	**223**	**998**	**1164**	**731**	**3556**	**6272**	**5477**	**1275**	**982**	**937**	**265**	**19**	**22,019**

In support of the Deepening Inferred Project, an additional 263m of vertical development is required when compared to the Deepening Project. As much of the developed infrastructure, including development, will be shared by the Deepening Project, the table below presents the development requirements incremental development required for the Deepening Inferred Project.

Table 24-4: Vertical Development Schedule for the Deepening Inferred Project, Pilar UG Mine (meters)

Description (meters)	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
Exhaust Raises	-	-	-	-	-	-	-	79	76	155
Ventilation Raise Borer	-	-	-	-	-	-	-	108	-	108
Deepening Inferred Project (incremental)	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**187**	**-**	**263**

A summary of the additional fleet requirements estimated to deliver the forecast production rates from the Deepening Inferred Project is presented in the table below. As a result of the production sequence and synergies with the Deepening Project, the equipment fleet presented below is expected to be fully augmented by equipment that will be shared jointly with the production requirements of the Deepening Project.

Table 24-5: Mining Fleet Requirements for the Deepening Inferred Project

Fleet Requirement	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Jumbo	-	-	-	1	1	1	2	3	3	1	1	1	-	-	-	-
Rockbolt	-	-	-	1	1	1	2	3	3	1	1	1	-	-	-	-
Scaler	-	-	-	1	1	1	2	3	3	1	1	1	-	-	-	-
Shortcrete Mixer	-	-	-	1	1	1	2	4	4	1	1	1	-	-	-	-
Shotcrete Launcher	-	-	-	1	1	1	1	2	2	1	1	1	-	-	-	-
LHD	-	-	-	1	1	1	1	2	2	2	2	2	2	2	1	1
Haul Trucks	-	-	-	1	1	1	2	4	4	3	3	3	3	3	2	2
Cubex	-	-	-	1	1	1	1	1	1	1	-	-	1	1	1	-
Simba/Solo	-	-	-	1	1	1	1	1	1	1	1	1	1	1	1	1
Cabolt	-	-	-	1	1	1	1	1	1	1	1	1	1	1	1	1
Blindhole	-	-	-	-	-	-	-	1	1	1	1	1	1	1	1	1

24.2.5 QP Opinion, Deepening Inferred Project

The authors of this Report have reviewed the Deepening Inferred Project technical parameters and found them to be in-line with industry best-practices.

The Deepening Inferred Project is preliminary in nature and based on the Inferred mineral resources of the Deepening Extension Zone which 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 Deepening Inferred Project will be realized as part of the Company's Strategic LOM Production Plan. Mineral resources that are not mineral reserves do not have a demonstrated economic viability. The Company has commenced a program to continue infill drilling of the Inferred resource to further upgrade this material; however, until this work is completed, and the Inferred resources have been upgraded to reserves, there is no certainty this material will be converted into mineral reserves.

The authors of this Report recommend that the planned drill program be executed to promote the resource classification from Inferred to Measured or Indicated. Additionally, engineering work should continue alongside the exploration program to promote the confidence of the mine design and costing parameters.

25 INTERPRETATION AND CONCLUSIONS

25.1 MINERAL EXPLORATION AND GEOLOGY

In general terms, the geological descriptions, sampling procedures and density tests that were evaluated were found to be of acceptable quality and in accordance with industry best practices.

It was noted that the data collection process was executed with the aim of maintaining data security. Data was stored in a standardized database, which was found to be secure and auditable.

The complexity of the mineralization controls and the quantity and phases of data in the Curaçá Valley merits the use of visualization and data integration tools that are more advanced than those which Ero Brasil had at its disposal at the time of this Technical Report.

While GE21 believes that the current QA/QC program can guarantee the quality of the exploration data used in the resource estimates, GE21 suggests that a chain of custody program be implemented for good measure.

GE21 supervised the process through which density was determined and concluded that it was in conformity with industry best practices.

25.2 QA/QC

GE21 performed the evaluation of the data generated after the last validation and concludes that the QAQC procedures are being followed using the same standards. GE21 considered the standard QA/QC procedures to be in accordance with mining industry best practice and appropriate for use in the current mineral resource estimate.

It was observed throughout the GE21 review period, that the Ero Brasil laboratory continues to display a tendency to systematically underestimate the copper assay values when using CRM ITAK 825; however, the results of the laboratory when using CRM ITAK 851, which features a similar copper grade range, demonstrate better reproducibility.

25.3 GEOLOGICAL MODEL

The procedure that was adopted to produce the 3D geological model (wireframes), consisting of generating triangulations between interpreted geological cross sections, was executed properly and in accordance with the opinions of GE21 staff. Due to the plunge of the mineralized zone at the Pilar UG Mine towards the north and the east-west geological cross sections, a pattern of sub-vertical discontinuous lenses was created locally within the regions of lower drill hole density. Despite these occurrences, verification of the mineralized zone interpretation was performed within regions of denser drill spacing.

GE21 noted that, with respect to the integration and interpretation of geological data, limited lithostructural mapping (mine, surface and subsurface) had been undertaken and no supporting petrographic data was used. GE21 also notes that the field interpretation and 3D interpretation were historically focused on interpreting only copper grade, therefore, few vertical and horizontal lithostructural geological sections were developed which may provide greater understanding and control of aspects relating to the geology and other potential metals of significance in the Curaçá Valley. In 2020, Ero Brasil started to adopt 3D implicit modelling techniques based upon grouped lithologies and copper grade shells using Leapfrog software. This methodology was used by GE21 to create 3D validation models. GE21 believes this methodology of modelling helps to standardize the modelling of different targets by different teams.

25.4 GRADE ESTIMATION

The variograms that were used in the estimation method are satisfactory and consistent with respect to the grade estimation that was calculated via Ordinary Kriging, making use of search anisotropy determined in the variographic study.

The Kriging estimation strategy that was chosen made it possible to classify the resource in accordance with an empirically calculated search radius and the requisite data density for resource classification.

GE21 considers the resource classification model and the analysis of criteria for the classification of those Mineral Resources, to be satisfactory although some items could be improved. Such recommended improvements did not impose limitations on the classification of Measured and Indicated Resources.

25.5 MINERAL RESOURCE ESTIMATE

GE21 has not identified any mining, metallurgical, infrastructure, permitting, legal, political, environmental, technical, or other relevant factors that could materially affect the potential development of Mineral Resources.

25.6 MINERAL RESERVE ESTIMATE

BNA and NCL SpA carried out a detailed review of the current mineral reserves for Curaçá Valley, aimed at demonstrating its technical and profitable extraction for the production and sale of copper concentrate. The results for this review, demonstrated a good adherence using detailed verification procedures performed by the authors of this Report. In general resulting in differences of less than 1% in the total copper metal contained, which BNA considered acceptable.

The authors of this Report note the following related to the current mineral reserve:

- The metallurgical recovery benefits from the commissioned and operational HIG Mill were applied to the underground mining operations of Ero Brasil;
- Within the Vermelhos District ore sorting will be integrated within the open pit operations to reduce transport and processing costs. However, these potential savings have not been considered in current reserve estimation as the global Ero Brasil geology team continues to conduct additional project assessments as at the Effective Date of this Report;
- The core operating mines of the Company (Pilar UG Mine and Vermelhos UG Mine) currently employ a joint reconciliation process in which it is difficult to accurately differentiate mine-to-mill reconciliation from one mine to another; and,
- As at the date of this Report, the ventilation and cooling infrastructure for the Pilar UG Mine, is being upgraded according to the plans developed by Ero Brasil.

The mineral reserve estimation has been performed according to industry best practice and conform to the CIM Standards and CIM Guidelines.

BNA has not identified any mining, metallurgical, infrastructure, permitting, legal, political, environmental, technical, or other relevant factors that could materially affect the potential development of the current mineral reserves.

26 RECOMMENDATIONS

26.1 MINERAL RESOURCE ESTIMATION

Regarding the mineral resource estimate, the authors recommend a work program to include the following, most of which can be completed at little or no cost. Estimated costs of the work program are shown in the table below.

i. Formalize the use of implicit modelling internally throughout the Company, emphasizing structural geology and variation in lithology for domain definition and exploration target integration.

ii. Implement additional empirical criteria for resource classification, based on the ‘15% Rule’, as commonly attributed to Dr. Harry Parker and since expanded upon in multiple sources of geostatistical literature.

iii. Expand ongoing geometallurgical studies to encompass all deposits and blends therein to study mill feed interaction. Suggest including standardized laboratory tests as normal operating procedure. Additionally, it is recommended that the Company advance geometallurgical studies for inclusion in mineral reserve definition, in order to classify metallurgical recovery according to the different characteristics associated with each lithological domain rather than by deposit.

iv. Validate of the certified grade for CRM ITAK 825 due to the observed inconsistencies in assay values, in contrast with the consistent results obtained when utilizing CRM ITAK 851, which has a similar Cu grade range.

v. Recommend standardizing QA/QC mass controls during assay sample crushing and grinding in order to evaluate the quality of the comminution procedures and ensure no sample loss during sample preparation.

vi. Install a sample tower to improve the mine to mill reconciliation process for the current operating mines. Such an installation will allow differentiation of ore source reconciliation within the processing plant.

vii. Improve systems for mineral reserve attribute database management to standardize fleet sizing, economic and consumable parameters, swell factors, dilution and mine call factors as well as store historic block model and design attributes including mathematical pit designs and supporting assumptions within a centralized validated database to improve the application of mineral reserve modifying factors in future studies.

Table 26-1: Proposed Budget for Recommended Work, Mineral Resources

Program	Budget (US$)
Advance geometallurgical studies	$200,000
Continued multi-element assays for the Vermelhos District (incl. check assays)	$50,000
Installation of sampling tower to enhance Mine-to-Mill reconciliation for multiple mining operations	$500,000
Improvement of reconciliation systems	$60,000
Advance geotechnical monitoring campaigns and geotechnical-lithology model development	$100,000
Deepening Inferred Project drill program	$7,000,000
Total	**$7,910,000**

26.2 MINERAL RESERVE ESTIMATION

Additional engineering work should continue alongside the exploration program to promote the confidence of the mine design and costing parameters of the Strategic LOM Production Plan, including stress modelling & monitoring system for the Pilar UG Mine, pilot test for stopes in the Honeypot area to calibrate modifying factors, expansion of survey investigation on the historic mining and Baraúna crown pillar stability analysis. The Qualified Person, Dr. Beck Nader of BNA notes the following recommendations related to mineral reserve estimation:

- Continue with the ongoing geometallurgical studies to encompass all deposits and blends therein to study mill feed interaction. Suggest including standardized laboratory tests as normal operating procedure. Additionally, it is recommended that the Company advance geometallurgical studies for inclusion in mineral reserve definition, in order to classify metallurgical recovery according to the different characteristics associated with each lithological domain rather than by deposit.

- Continuing with the studies to improve the mine to mill reconciliation process for the current operating mines.

- Continue with the system improvements for the mineral reserve attribute database management to standardize fleet sizing, economic and consumable parameters, swell factors, dilution, and mine call factors as well as store historic block model and design attributes including mathematical pit designs and supporting assumptions within a centralized validated database to improve the application of mineral reserve modifying factors in future studies.

- The authors recommend that a drill program for the Deepening Inferred Project be executed to promote the resource classification from Inferred to Measured or Indicated. Additional engineering work should continue alongside the exploration program to promote the confidence of the mine design and costing parameters of the Deepening Inferred Project. The authors note at the time of this Report, such programs were underway.

- The SMU methodology was applied to estimate the dilution for the Open Pit projects and for the Underground projects modeled stope dilution was estimated using the equivalent linear over-break slough ("ELOS") method including additional 1.0 m in the Hangingwall (HW) and 1.0 m in the Footwall (FW). Future studies should be done to improve the application of mineral reserve modifying factors.

Alejandro Sepúlveda, Qualified Person of NCL SpA recommends the following actions for Project Honeypot and the Upper Areas of the Pilar UG Mine:

- Develop a stress measurement campaign and a comprehensive lithological geotechnical and structural model.

- Utilize the seismic and stress monitoring data for design and scheduling.

- The integration with current operations must produce minimum interferences.

- Prepare a detailed analysis, including boreholes to ensure the backfill type and the strength of the cemented paste fill on those stopes already mined. This is highly recommended for Sector 1 and Sector 2 of the Pilar UG Mine.

- Develop engineering for a comprehensive stope test on the areas limited by historic excavations. The following information should be validated from these tests:

- Mining recovery assumptions
- Waste/backfill dilution assumptions
- Productivity assumptions

Table 26-2: Proposed Budget for Recommended Work for Mineral Reserves

Program	Budget (US$)
Stress modelling & monitoring for Pilar UG	$200,000
Pilot test for Honeypot area to calibrate modifying factors	$1,200,000
Baraúna crown pilar stability analysis	$20,000
Advance survey on Honeypot historic mining activities	$700,000
Total	**$2,120,000**

27 REFERENCES

Barbosa, J.S.F. and Sabaté, P. 2002. Geological features and the Paleoproterozoic colic collision of four Archean crustal segments of the São Francisco Craton, Bahia, Brazil. A Synthesis. Annals of the Brazilian Academy of Sciences, vol 74, pp. 434-359.

Barbosa, J.S.F. and Sabaté, P. 2004, Archean and Paleoproterozoic crust of the São Francisco Craton, Bahia, Brazil: geodynamic features, in: Precambrian Research, Volume 133, Issues 1-2, Abstract.

Barbosa, J.S.F., Leal, A. B. de M., 2016. Ultrahigh-temperature metamorphism of 2.0 Ga-old sapphirine-bearing granulite from the Itabuna-Salvador-Curaçá block, Bahia, Brazil. Revista do Instituto de Geosciencias – USP v. 17, n. 1, pp. 89-108.

Born, R.H., Meyer, F.M. & Cawthorn, R.G. 1994. Stable isotopic evidence for crustal contamination and desulfidation of the cupriferous Koperberg Suite, Namaqualand, South Africa. Geochim Cosmochim Acta, vol. 58, pp. 2677-2687.

Cawrthorn, R.G. & Meyer, F.M., 1993. Petrochemistry of the Okiep copper district basic intrusive bodies, northwestern Cape province, South Africa. Economic Geology, vol. 88, pp. 590-605

Clifford, T.N. and Barton, E.S., 2012. The O'okiep Copper District, Namaqualand, South Africa: a review of the geology with emphasis on the petrogenesis of the cupriferous Koperberg Suite. Miner Deposita, vol. 47, pp. 837–857.

Conceiçao, H. and Otero, O.M.F. 1996. Magmatismo granítico e alcalino no estado da Bahia: uma epítome do tema. Salvador, SGM, pp. 152.

Correa-Gomes, L.C., Santiago, S., Pereira, G.M., Barbosa, Peucat, J-J., Paquette, J-L., Simões, C.B., 2012. Novos dados U/Pb para as idades dos protólitos e da colisão entre os Blocos Jequié e Itabuna-Salvador-Curaçá, Cráton do São Francisco, no centro-leste do estado da Bahia, Brasil. In: SBG, CONGRESSO BRASILEIRO DE GEOLOGIA, 46, Santos.

D'El Rey Silva L.J.H., 1984. Geologia e controle structural do depósito cuprífero Caraíba, Vale do Curaçá, Bahia, Brasil. Dissertação de mestrado, Universidade Federal da Bahia. 158 pages.

D'El Rey Silva L.J.H., Oliveira J.G., Gaal E.G., 1996. Implication of the Caraíba deposit's structural controls on the emplacement of the Cu bearing hypersthenites of the Curaçá Valley, Bahia-Brazil. Revista Brasileira de Geociências 26 (3), pp. 181-196.

D'El Rey Silva L.J.H., Cavalcante P.R.B., Mota R.R., Rocha A.M.R da, 1988. Controle estrutural da mina de cobre Caraíba: implicações na lavra e na tectônica das faixas moveis do Proterozóico inferior. XXXV Congresso Brasileiro de Geologia, Belem, Anais, SBG 1:16-29.

Desrochers, J-P. 2019. Core observations, Vermelhos UG visit, Suçuarana OP visit, and regional field visits. Internal presentation for Ero Brasil. 9 pages.

Desrochers, J-P., Porto, F., Napier, S., and Thompson, J.F.H, 2020. Curaca Valley Copper Deposits – Geological and exploration review. Internal Ero Brasil report. 29 pages.

Frugis G.L. 2017. Levantamento estrutural do Vale do Rio Curaçá. Relatório Interno. Mineração Caraíba S.A.

Garcia., P., 2013. Metalogenese dos depositos cupriferos de Caraiba, Surubim, Vermelhos e Suçuarana, Vale do Curaca, Bahia, Brasil. M.Sc. thesis. 220 pages.

Garcia., P., 2017. A Provincia Cuprifera do Nordeste dos processos e modelos metalogeneticos. Ph.D. thesis. 287 pages.

Garcia, P.M. de P., Teixeira, J. B. G., Misi, A., Silva, J. H. and Silva, M da G., 2018. Tectonic and metallogenic evolution of the Curaçá valley copper province, Bahia, Brazil: a review based on new SHRIMP zircon U-Pb dating and sulfur isotope geochemistry. Ore Geology Reviews, vol. 93, pp. 361-381.

Jacutinga, E., 2020. Brownfield exploration – Angicos Deposit. Internal MCS report, 10 pages.

Ladeira E.A. and Brockes H. Jr., 1969. Geologia das quadrículas de Poço de Fora, Esfomesdo, Tanque Novo e Lages, Distrito cuprífero do rio Curaçá, Bahia. Belo Horizonte, DNPM/GEOSOL, Projeto Cobre, Relatório, fev., Unpublished Report.

Mach L., 2008. Mineral Resources Update Report- Surubim Project-Bahia, Brazil – SRK Consulting Engineers and Scientists – Project Reference No. 175601

Marques J. C., Carlson R. W., 2008. Re-Os Geochronology of the Várzea do Macaco chromite deposit and Ni prospect, Jacurici Complex, Brazil. Geochim. Cosmochim. Acta. 72: A593.

Marques, J.C. and Filho, C.F.F., 2003. The Chromite Deposit of the Ipueira-Medrado Sill, São Francisco Craton, Bahia State, Brazil, in: Economic Geology, Volume 98, pp. 87-100.

Marques J.C., Frantz J.C., Pimentel M.M., Dias J.R.P., Henrichs I.A. ,2010. U-Pb Zircon Geochronology of alkaline pegmatites: new constraints on the age of the Jacurici Complex, São Francisco Craton, Brazil. In: South American Symposium on Isotope Geology. Brasilia.

Maier W.D, and Barnes S.J, 1996. Unusually High Concentrations of Magnetite at Caraíba and other Cu-Sulphide Deposits in the Curaçá Valley, Bahia, Brazil. The Canadian Mineralogist, Volume 34, pp. 717-731.

Mayer W.D, and Barnes S.J, 1999. The origin of Cu sulphide deposits in the Curaçá Valley, Bahia – Brazil: Evidence from Cu, Ni, Se and platinum-group element concentration. Economic Geology, vol. 94, pp. 165-184.

Oliveira, E. P. et al., 2004. Contrasting copper and chromium metallogenic evolution of terranes in the Paleoproterozoic Itabuna-Salvador-Curaçá orogeny, São Francisco craton, Brazil: new zircon (SHRIMP) and Sm-Nd (model) ages and their significance for orogeny parallel escape tectonics. Precambrian Research, Volume 128, pp. 143-165.

Ramsay, J.G., 1967. Folding and Fracturing of Rocks. McGraw-Hill, New York, 568 pages.

Silva, L. C. et al., 1997. U-Pb SHRIMP ages in the Itabuna-Caraíba TTG high-grade complex: the first window beyond the paleoproterozoic overprinting of the eastern Jequié Craton, NE Brazil. In: Intern. Simp. Granites and Assoc. Mineralizations, 2, Salvador, Extended Abstracts, pp. 282, 283.

Silva, L. C. et al., 2002. Reavaliação da evolução geológica em terrenos pré-cambrianos brasileiros, com base em novos dados U-Pb SHRIMP, Parte I: Limite centro-oriental do Cráton do São Francisco na Bahia. Revista Brasileira de Geociências, Volume 32, pp. 501-512.

Tappert, R., 2020. Petrography of polished drill core slabs from the Siriema deposit, the Vermelhos and Pilar mines, and the Santo Antônio exploration target. Internal report for Ero Copper. Hyperspectral Intelligence Inc. 214 pages.

Teixeira, J. B. G. et al., 2010. Depósitos de Cobre da região do Vale do Rio Curaçá Bahia. In: BRITO, R. S. C. de; SILVA, M. G. da; KUYUMIJAN, R. M. Modelos de Depósitos de Cobre no Brasil e sua resposta ao intemperismo. São Paulo, CPRM.

Vazelhes, V. de B., Bedard, E. and Beaudoin, G., 2018. Petrography and mineral chemistry of magnetite. Internal report for Ero Copper.

An Introduction to Cut-Off Grade Estimation - Jean-Michel Rendu, SME, 2008. 115p.

Hartman, H.L.; Mutmansky, J.M. Introductory to mining engineering. 2nd ed. 2002. 622 p.

Hustrulid, W.; Kuchta, M. Open pit mine planning and design. 2nd. ed. London : Taylor and Francis, 2006.v. 1: Fundamentals.

SME-AIME (1992) SME Mining engineering handbook. 2nd edition, ed. Hartman, H. L., Littleton, 2v.

Underground Mining Methods, William A. Hustrulid, Richard L. Bullock, SME, 2001 - 718 p.

Effective Date: September 30, 2022

Report Date: December 22, 2022

<signed & sealed in the original>

Porfírio Cabaleiro Rodriguez, FAIG

<signed & sealed in the original>

Bernardo Horta de Cerqueira Viana, FAIG

<signed & sealed in the original>

Fábio Valério Câmara Xavier, MAIG

<signed & sealed in the original>

Ednie Rafael Moreira de Carvalho Fernandes, MAIG

<signed & sealed in the original>

Dr. Beck Nader, FAIG

<signed & sealed in the original>

Alejandro Sepulveda, (#0293)
(Chilean Mining Commission)

APPENDIX A

Technical Report QP Certificates

I, Porfirio Cabaleiro Rodriguez, FAIG, (#3708), as an author of the technical report titled "2022 Mineral Resources and Mineral Reserves of the Caraíba Operations, Curaçá Valley, Bahia, Brazil", dated December 22, 2022, with an effective date of September 30, 2022 (the "Technical Report"), prepared for Ero Copper Corp. (the "Issuer"), do hereby certify that::

1) I am a Mining Engineer and Director for GE21 Consultoria Mineral Ltda., which is located on Avenida Afonso Pena, 3130, 12th floor, Savassi, Belo Horizonte, MG, Brazil - CEP 30130-910.

2) I am a graduate of the Federal University of Minas Gerais, located in Belo Horizonte, Brazil, and hold a Bachelor of Science Degree in Mining Engineering (1978). I have practised my profession continuously since 1979.

3) I am a Professional enrolled with the Australian Institute of Geoscientists ("AIG") - ("FAIG") #3708.

4) I am a professional Mining Engineer, with more than 42 years' relevant experience in Mineral Resource and Mineral Reserves estimation, which includes numerous mineral properties in Brazil, including copper properties.

5) I have read the definition of "qualified person" set out in National Instrument 43-101 – *Standards of Disclosure for Mineral Projects* ("NI 43-101") and certify that, by reason of my education, affiliation with a professional association as defined in NI 43-101, and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.

6) I have supervised the preparation of the Technical Report. I am responsible for Chapters 2, 3, 13 14, 17, 19, 20, 21, 22, 23, and 27 and jointly responsible for Chapter 24. I am also responsible for the corresponding sections within Chapters 1, 25 and 26 that are related to the foregoing Chapters of this Technical Report.

7) I have maintained a close technical relationship with the property that is the subject of this Technical Report since 2006, while still working under the name of Geoexplore, and subsequently Coffey Mining. I was also hired as a consultant by companies interested in negotiating with Mineração Caraíba S.A. ("MCSA"). I was also an author of the independent technical report titled "2017 Updated Mineral Resources and Mineral Reserves Statements of Mineração Caraíba's Vale do Curaçá Mineral Assets, Curaçá Valley", dated September 7, 2017, with an effective date of June 1, 2017; an author of the independent technical report titled "2018 Updated Mineral Resources and Mineral Reserves Statements of Mineração Caraíba's Vale do Curaçá Mineral Assets, Curaçá Valley", dated October 17, 2018, with an effective date of August 1, 2018; an author of the independent technical report titled "2019 Updated Mineral Resources and Mineral Reserves Statements of Mineração Caraíba's Vale do Curaçá Mineral Assets, Curaçá Valley" dated November 25, 2019, with an effective date of September 18, 2019; and an author of the independent technical report titled "2020 Updated Mineral Resources and Mineral Reserves Statements of Mineração Caraíba's Vale do Curaçá Mineral Assets, Curaçá Valley", dated January 14, 2021, with an effective date of October 1, 2020, each prepared for the Issuer. The relationship with the Issuer and its subsidiary, MCSA, was solely for professional works in exchange for fees based on rates set by commercial agreement. Payment of these fees is in no way dependent on the results of the Technical Report.

8) I personally inspected the property that is the subject of this Technical Report in visits with four days' duration in September 2021 and three days' duration in February 2020, June 2019, July 2018 and January 2017.

9) As of the effective date of the Technical Report, to the best of my knowledge, information, and belief, the sections of the Technical Report that I have authored and am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

10) I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

11) I am independent of the Issuer, applying all the tests in section 1.5 of NI 43-101.

12) I have read NI 43-101 and Form 43-101F1 – Technical Report, and the Technical Report has been prepared in compliance with such instrument and form.

Belo Horizonte, Brazil, December 22, 2022

<signed & sealed in the original>

Porfirio Cabaleiro Rodriguez, FAIG

I, Bernardo Horta de Cerqueira Viana, FAIG, (#3709), as an author of the technical report titled "2022 Mineral Resources and Mineral Reserves of the Caraíba Operations, Curaçá Valley, Bahia, Brazil", dated December 22, 2022, with an effective date of September 30, 2022 (the "Technical Report"), prepared for Ero Copper Corp. (the "Issuer"), do hereby certify that:

1) I am a Geologist and Director for GE21 Consultoria Mineral Ltda., which is located on Avenida Afonso Pena, 3130, 12th floor, Savassi, Belo Horizonte, MG, Brazil - CEP 30130-910.

2) I am a graduate of the Federal University of Minas Gerais, located in Belo Horizonte, Brazil, and hold a Bachelor of Science Degree in Geology (2002). I have practiced my profession continuously since 2002.

3) I am a Professional enrolled with the Australian Institute of Geoscientists ("AIG") - ("FAIG") #3709.

4) I am a professional Geologist, with more than 20 years' relevant experience in ore resource estimation and geology exploration, which includes numerous mineral properties in Brazil, including copper properties.

5) I have read the definition of "qualified person" set out in National Instrument 43-101 – *Standards of Disclosure for Mineral Projects* ("NI 43-101") and certify that, by reason of my education, affiliation with a professional association as defined in NI 43-101, and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.

6) I am jointly responsible for Chapters 4, 5, 6, 7, 8, 9, 10, 11, 12 and 24. I am also responsible for the corresponding sections within Chapters 1, 25 and 26 that are related to the foregoing Chapters of this Technical Report.

7) I have maintained a close technical relationship with the property that is the subject of this Technical Report since 2006, while still working under the name of Geoexplore, and subsequently Coffey Mining. I was also hired as a consultant by companies interested in negotiating with Mineração Caraíba S.A. ("MCSA"). I was also an author of the independent technical report titled "2017 Updated Mineral Resources and Mineral Reserves Statements of Mineração Caraíba's Vale do Curaçá Mineral Assets, Curaçá Valley", dated September 7, 2017, with an effective date of June 1, 2017; an author of the independent technical report titled "2018 Updated Mineral Resources and Mineral Reserves Statements of Mineração Caraíba's Vale do Curaçá Mineral Assets, Curaçá Valley", dated October 17, 2018, with an effective date of August 1, 2018; an author of the independent technical report titled "2019 Updated Mineral Resources and Mineral Reserves Statements of Mineração Caraíba's Vale do Curaçá Mineral Assets, Curaçá Valley" dated November 25, 2019, with an effective date of September 18, 2019; and an author of the independent technical report titled "2020 Updated Mineral Resources and Mineral Reserves Statements of Mineração Caraíba's Vale do Curaçá Mineral Assets, Curaçá Valley", dated January 14, 2021, with an effective date of October 1, 2020, each prepared for the Issuer. The relationship with the Issuer and its subsidiary, MCSA, was solely for professional works in exchange for fees based on rates set by commercial agreement. Payment of these fees is in no way dependent on the results of the Technical Report.

8) I personally inspected the property that is the subject of this Technical Report in visits with four days' duration in September, 2021 and three days' duration in February 2020, June 2019, July 2018 and January 2017.

9) As of the effective date of the Technical Report, to the best of my knowledge, information, and belief, the sections of the Technical Report that I have authored and am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

10) I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

11) I am independent of the Issuer, applying all the tests in section 1.5 of NI 43-101.

12) I have read NI 43-101 and Form 43-101F1 – Technical Report, and the Technical Report has been prepared in compliance with such instrument and form.

Belo Horizonte, Brazil, December 22, 2022

<signed & sealed in the original>

Bernardo Horta de Cerqueira Viana, FAIG

I, Fábio Valério Câmara Xavier, MAIG, (#5179), as an author of the technical report titled "2022 Mineral Resources and Mineral Reserves of the Caraíba Operations, Curaçá Valley, Bahia, Brazil", dated December 22, 2022, with an effective date of September 30, 2022 (the "Technical Report"), prepared for Ero Copper Corp. (the "Issuer"), do hereby certify that:

1) I am a Geologist for GE21 Consultoria Mineral Ltda., which is located on Avenida Afonso Pena, 3130, 12th floor, Savassi, Belo Horizonte, MG, Brazil - CEP 30130-910.

2) I am a graduate of the Federal University of Rio Grande do Norte, located in Natal, Brazil, and hold a Bachelor of Science Degree in Geology (2003). I have practised my profession continuously since 2003.

3) I am a Professional enrolled with the Australian Institute of Geoscientists ("AIG") - ("MAIG") #5179.

4) I am a professional Geologist, with more than 19 years' relevant experience in resource estimation and geology exploration, which includes numerous mineral properties in Brazil, including copper properties.

5) I have read the definition of "qualified person" set out in National Instrument 43-101 – *Standards of Disclosure for Mineral Projects* ("NI 43-101") and certify that, by reason of my education, affiliation with a professional association as defined in NI 43-101, and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.

6) I am jointly responsible for Chapters 4, 5, 6, 7, 8, 9, 10, 11 and 12. I am also responsible for the corresponding sections within Chapters 1, 25 and 26 that are related to the foregoing Chapters of this Technical Report.

7) I have had prior involvement with the property that is the subject of this Technical Report as an author of the independent technical report titled "2017 Updated Mineral Resources and Mineral Reserves Statements of Mineração Caraíba's Vale do Curaçá Mineral Assets, Curaçá Valley", dated September 7, 2017, with an effective date of June 1, 2017; as an author of the independent technical report titled "2018 Updated Mineral Resources and Mineral Reserves Statements of Mineração Caraíba's Vale do Curaçá Mineral Assets, Curaçá Valley", dated October 17, 2018, with an effective date of August 1, 2018; and an author of the independent technical report titled "2020 Updated Mineral Resources and Mineral Reserves Statements of Mineração Caraíba's Vale do Curaçá Mineral Assets, Curaçá Valley", dated January 14, 2021, with an effective date of October 1, 2020, each prepared for the Issuer. The relationship with the Issuer and its subsidiary, MCSA, was solely for professional works in exchange for fees based on rates set by commercial agreement. Payment of these fees is in no way dependent on the results of the Technical Report.

8) I personally inspected the property that is the subject of this Technical Report in visits with three days' duration in May 2022, four days' duration in September 2021, five days' duration in July 2018, five days' duration in June 2018 and two days' duration in June 2017.

9) As of the effective date of the Technical Report, to the best of my knowledge, information, and belief, the sections of the Technical Report that I have authored and am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

10) I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

11) I am independent of the Issuer, applying all the tests in section 1.5 of NI 43-101.

12) I have read NI 43-101 and Form 43-101F1 – Technical Report, and the Technical Report has been prepared in compliance with such instrument and form.

Belo Horizonte, Brazil, December 22, 2022

<signed & sealed in the original>

Fábio Valério Câmara Xavier, MAIG

I, Ednie Rafael Moreira de Carvalho Fernandes, MAIG, (#7974), as an author of the technical report titled “2022 Mineral Resources and Mineral Reserves of the Caraíba Operations, Curaçá Valley, Bahia, Brazil”, dated December 22, 2022, with an effective date of September 30, 2022 (the “Technical Report”), prepared for Ero Copper Corp. (the “Issuer”), do hereby certify that:

1) I am a geologist for GE21 Consultoria Mineral Ltda., which is located on Avenida Afonso Pena, 3130, 12th floor, Savassi, Belo Horizonte, MG, Brazil - CEP 30130-910.
2) I am a graduate of the Federal University of Bahia. I have practiced my profession continuously since 2011.
3) I am a Professional enrolled with the Australian Institute of Geoscientists (“AIG”) - (“MAIG”) #7974.
4) I am a professional Geologist, with more than 11 years' relevant experience in geology exploration, which includes numerous mineral properties in Brazil, including copper properties.
5) I have read the definition of “qualified person” set out in National Instrument 43-101 – *Standards of Disclosure for Mineral Projects* (“NI 43-101”) and certify that, by reason of my education, affiliation with a professional association as defined in NI 43-101, and past relevant work experience, I fulfill the requirements to be a “qualified person” for the purposes of NI 43-101.
6) I am jointly responsible for Chapter 12. I am also responsible for the corresponding sections within Chapters 1, 25 and 26 that are related to the foregoing Chapter of this Technical Report.
7) I have no prior involvement with the property that is the subject of this Technical Report.
8) I personally inspected the property that is the subject of this Technical Report in a visit with two days' duration in May 2022.
9) As of the effective date of the Technical Report, to the best of my knowledge, information, and belief, the section of the Technical Report that I have authored and am responsible for contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.
10) I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.
11) I am independent of the Issuer, applying all the tests in section 1.5 of NI 43-101.
12) I have read NI 43-101 and Form 43-101F1 – Technical Report, and the Technical Report has been prepared in compliance with such instrument and form.

Belo Horizonte, Brazil, December 22, 2022

<signed & sealed in the original>

Ednie Rafael Moreira de Carvalho Fernandes, MAIG

I, Dr. Beck Nader, FAIG (#4472), as an author of the technical report titled "2022 Mineral Resources and Mineral Reserves of the Caraíba Operations, Curaçá Valley, Bahia, Brazil", dated December 22, 2022, with an effective date of September 30, 2022 (the "Technical Report"), prepared for Ero Copper Corp. (the "Issuer"), do hereby certify that:

1) I am a Mining Engineer for BNA Mining Solutions., which is located on Rua Desembargador Leão Starling, 200, Ouro Preto, Belo Horizonte, MG, Brazil - CEP 31310-370.

2) I am a graduate of the University of São Paulo - USP, located in São Paulo-SP, Brazil, and hold a Bachelor of Science Degree in Mining Engineering (1981). I hold a Master of Science Degree in Mineral Technology and a Doctoral of Science Degree in Mineral Engineering. I have practiced my profession continuously since 1982.

3) I am a Fellow enrolled with the Australian Institute of Geoscientists ("AIG") - ("FAIG" #4472).

4) I am a professional Mining Engineer, with more than 40 years' relevant experience in Mineral Resource and Mineral Reserves estimation, which includes numerous mineral properties in Brazil, including copper properties.

5) I have read the definition of "qualified person" set out in National Instrument 43-101 – *Standards of Disclosure for Mineral Projects* ("NI 43-101") and certify that, by reason of my education, affiliation with a professional association as defined in NI 43-101, and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.

6) I am jointly responsible for Chapters 15, 16, 18 and 24. I am also responsible for the corresponding sections within Chapters 1, 25 and 26 that are related to the foregoing Chapters of this Technical Report.

7) I was an author of the independent technical report titled "2020 Updated Mineral Resources and Mineral Reserves Statements of Mineração Caraíba's Vale do Curaçá Mineral Assets, Curaçá Valley", dated January 14, 2021, with an effective date of October 1, 2020.

8) I personally inspected the property that is the subject of this Technical Report in a visit with three days' duration in September, 2021.

9) As of the effective date of the Technical Report, to the best of my knowledge, information, and belief, the sections of the Technical Report that I have authored and am responsible for contain all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

10) I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

11) I am independent of the Issuer, applying all the tests in section 1.5 of NI 43-101.

12) I have read NI 43-101 and Form 43-101F1 – Technical Report, and the Technical Report has been prepared in compliance with such instrument and form.

Belo Horizonte, Brazil, December 22, 2022

<signed & sealed in the original>

Dr. Beck Nader, FAIG

I, Alejandro Sepulveda, Registered Member (#0293) (Chilean Mining Commission), as an author of the technical report titled "2022 Mineral Resources and Mineral Reserves of the Caraíba Operations, Curaçá Valley, Bahia, Brazil", dated December 22, 2022, with an effective date of September 30, 2022 (the "Technical Report"), prepared for Ero Copper Corp. (the "Issuer"), do hereby certify that:

1) I am a Mining Engineer and Board President for NCL Ingeniería y Construcción SpA ("NCL"), which is located on General del Canto 230, of 401, Providencia, Santiago, Chile.

2) I am a graduate of the Universidad de Chile. I have practiced my profession continuously since 1981.

3) I am a Registered Member enrolled with the Comision Calificadora de Competencias en Recursos y Reservas Mineras (Chilean Mining Commission) (#0293).

4) I am a professional Engineer, with more than 39 years' relevant experience in reviews and reports as a consultant on numerous explorations, mining operation and projects around the world for due diligence and regulatory requirements and have extensive experience in mining engineering, which includes numerous mineral properties in Brazil, including copper properties.

5) I have read the definition of "qualified person" set out in National Instrument 43-101 – *Standards of Disclosure for Mineral Projects* ("NI 43-101") and certify that, by reason of my education, affiliation with a professional association as defined in NI 43-101, and past relevant work experience, I fulfill the requirements to be a "qualified person" for the purposes of NI 43-101.

6) I am jointly responsible for Chapters 15, 16, 18 and 24. I am also responsible for the corresponding sections within Chapters 1, 25 and 26 that are related to the foregoing Chapter of this Technical Report.

7) I have no prior involvement with the property that is the subject of this Technical Report.

8) I personally inspected the property that is the subject of this Technical Report in a visit with five days' duration in August 2022, five days' duration in July 2022 and nine days' duration in June 2022.

9) As of the effective date of the Technical Report, to the best of my knowledge, information, and belief, the section of the Technical Report that I have authored and am responsible for contains all scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

10) I have no personal knowledge, as of the date of this certificate, of any material fact or material change which is not reflected in this Technical Report.

11) I am independent of the Issuer, applying all the tests in section 1.5 of NI 43-101.

12) I have read NI 43-101 and Form 43-101F1 – Technical Report, and the Technical Report has been prepared in compliance with such instrument and form.

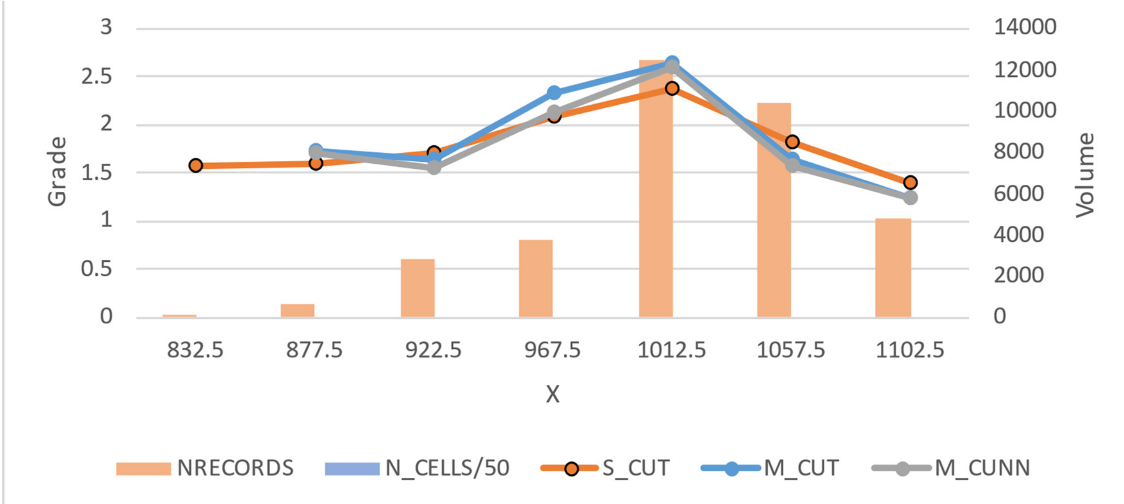
Belo Horizonte, Brazil, December 22, 2022

<signed & sealed in the original>

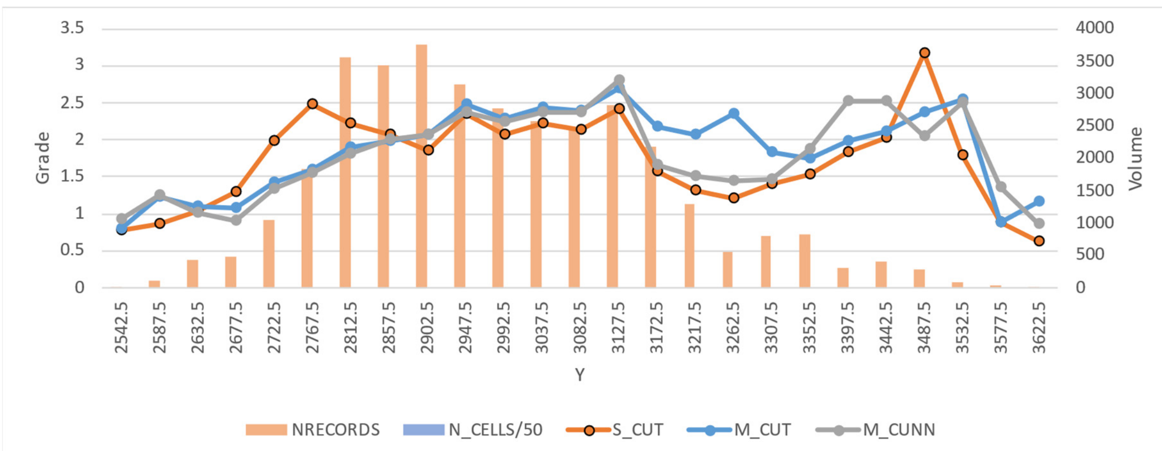
Alejandro Sepulveda, (#0293)
(Chilean Mining Commission)
NCL Ingeniería y Construcción SpA

APPENDIX B

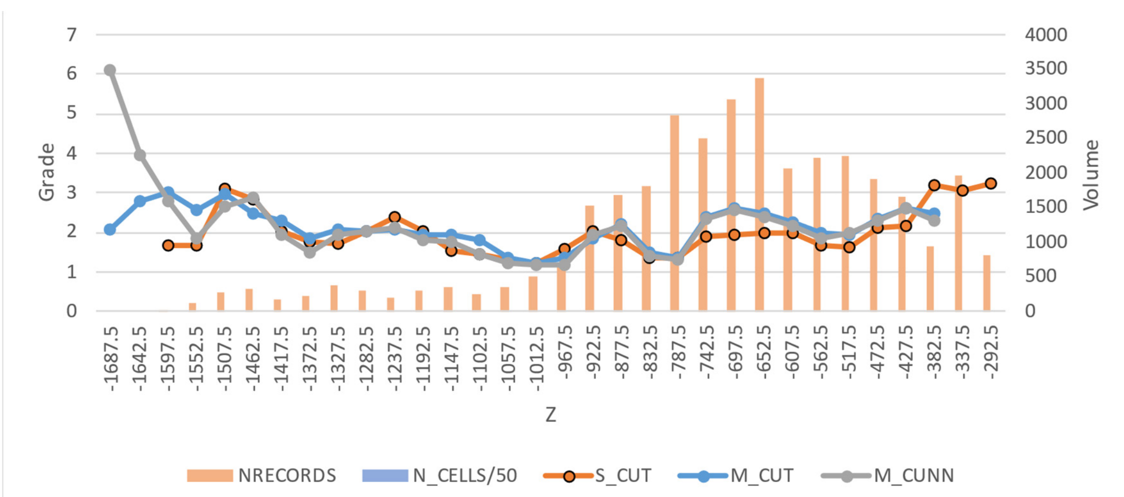
Swath Plots



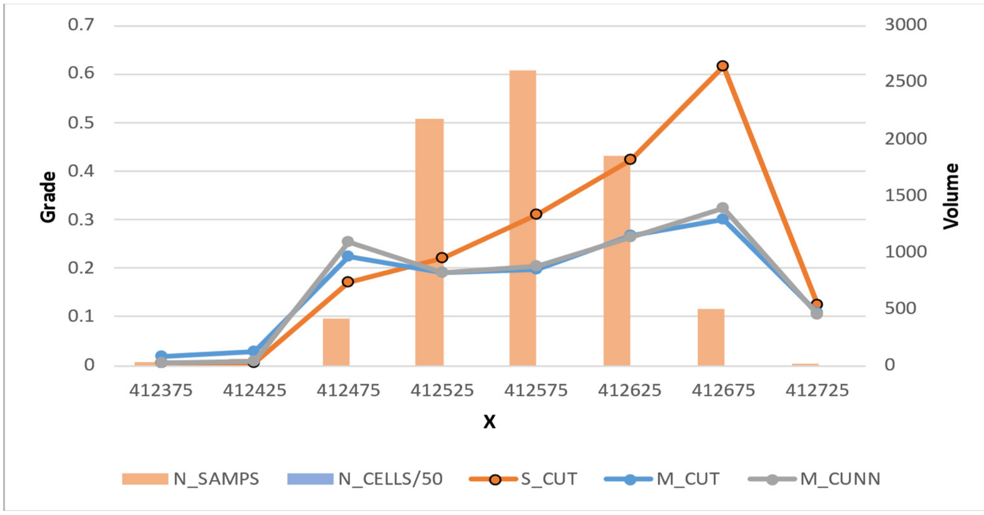
Swath Plot X axis – Deepening Domain, Total



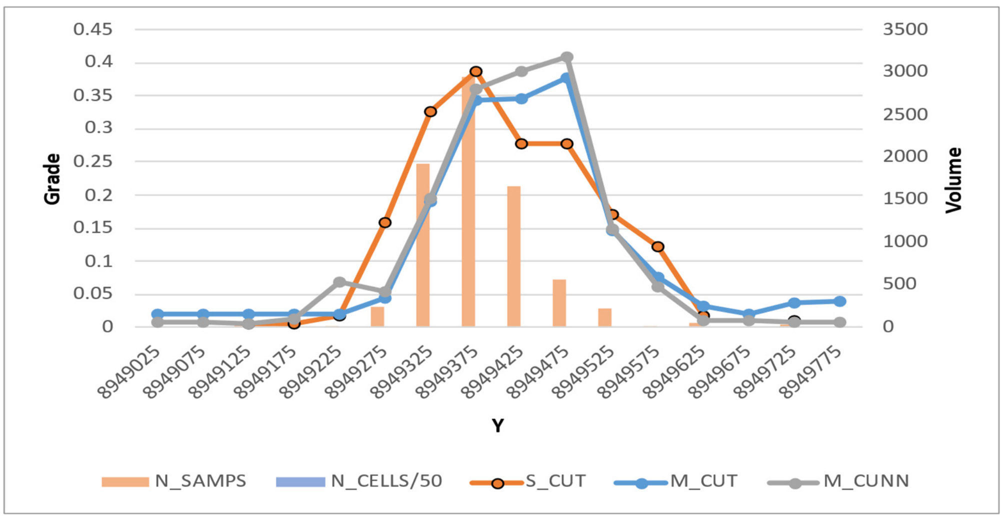
Swath Plot Y axis – Deepening Domain, Total



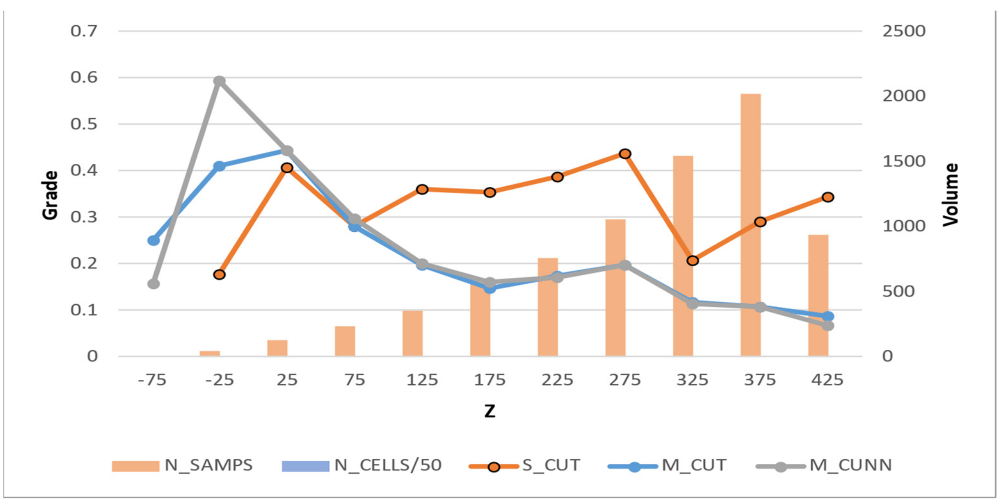
Swath Plot Z axis – Deepening Domain, Total



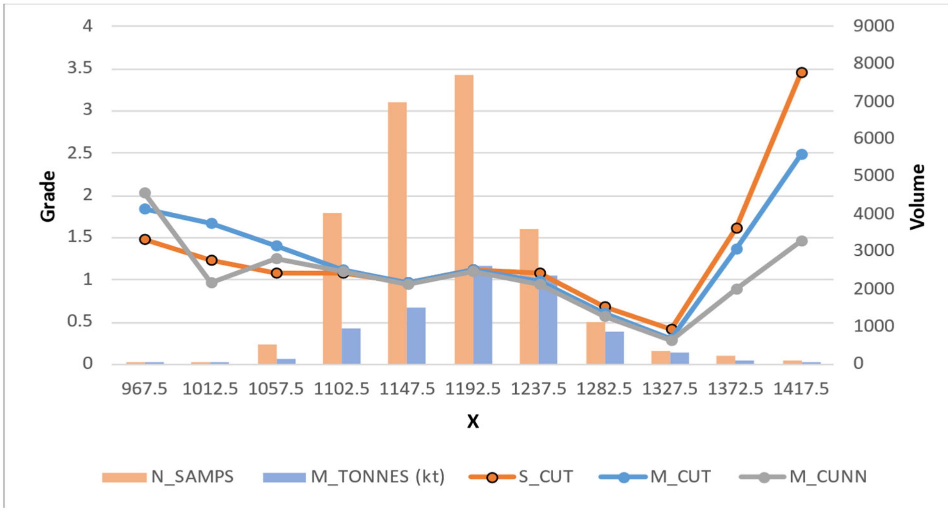
Swath Plot X axis – Lagoa da Mina, Total



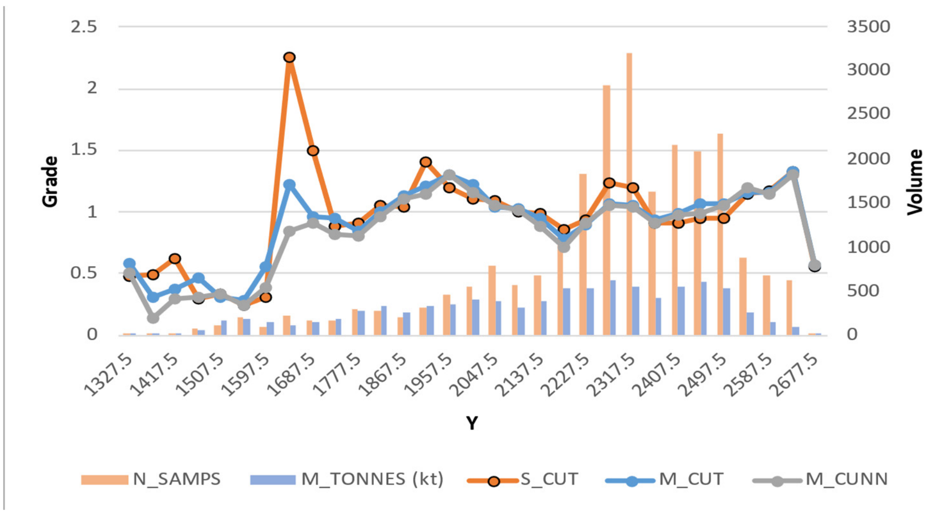
Swath Plot Y axis – Lagoa da Mina, Total



Swath Plot Z axis – Lagoa da Mina, Total



Swath Plot X axis – MSBS, Total



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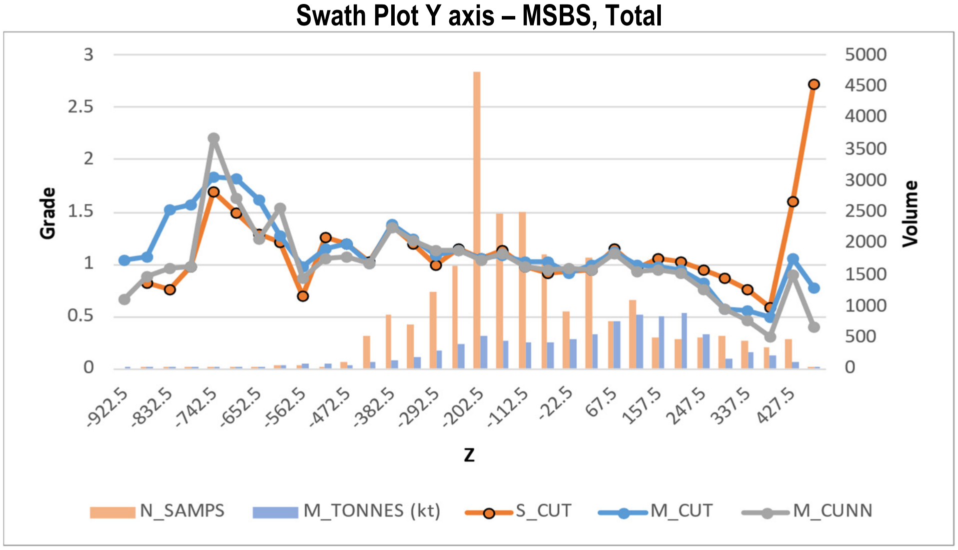
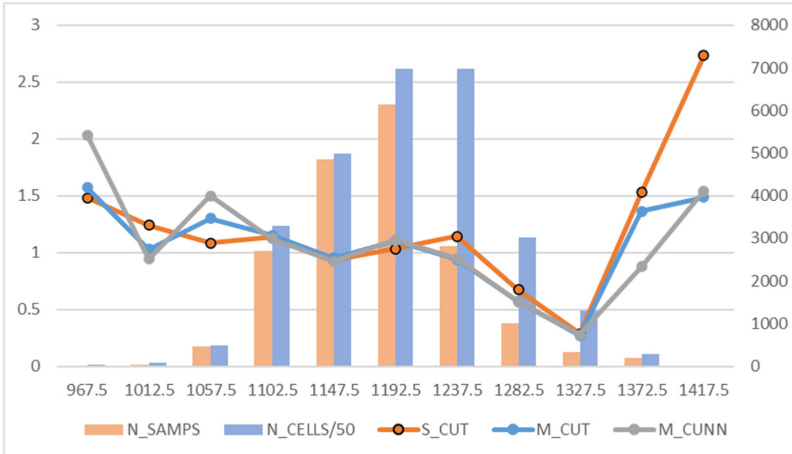
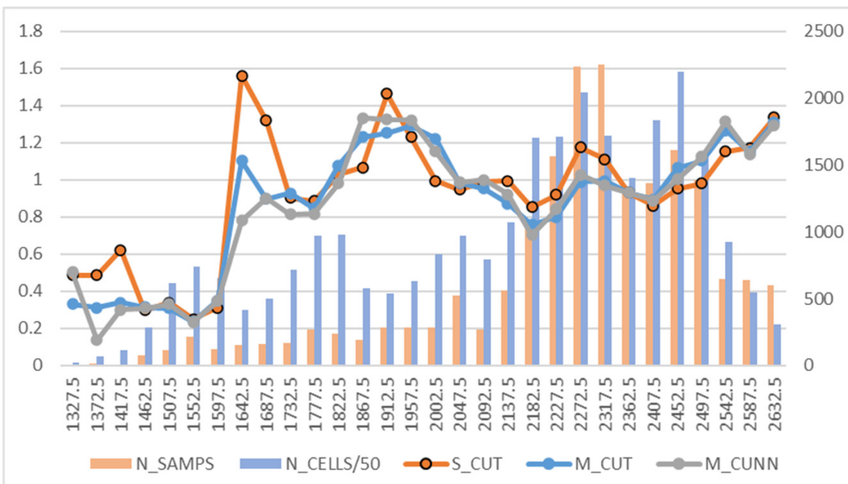


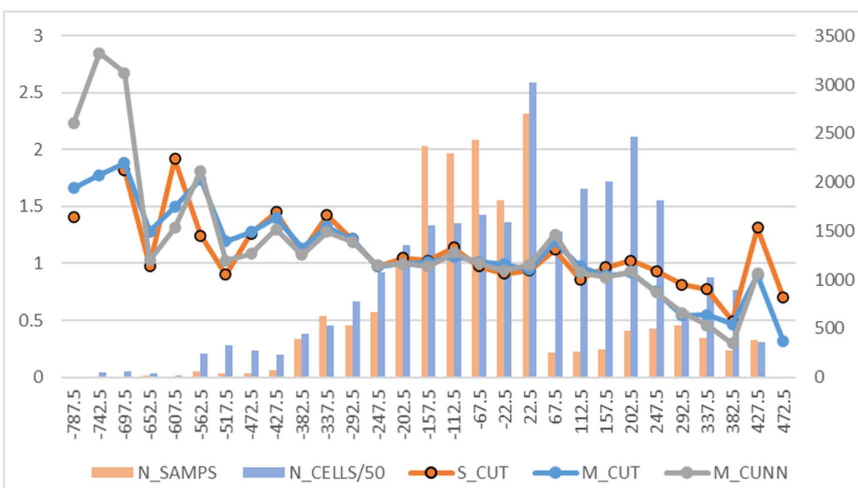
Swath Plot Z axis – MSBS, Total



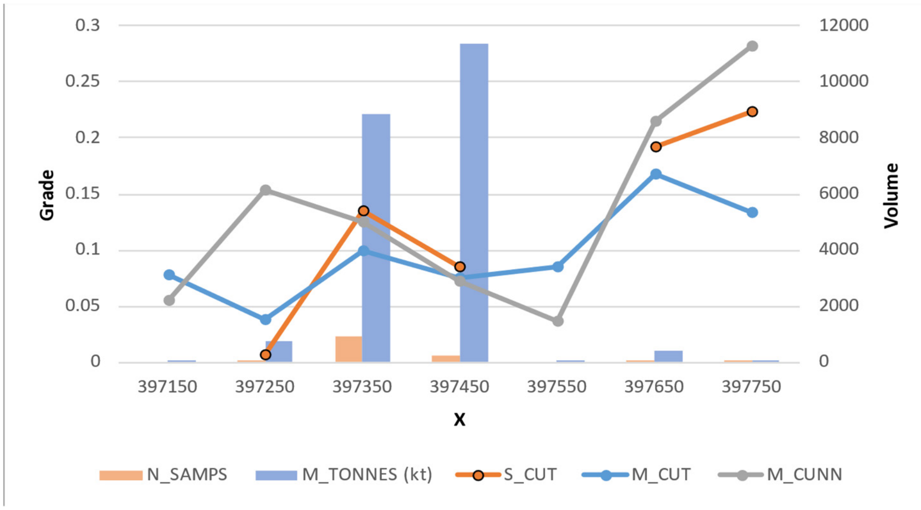
Swath Plot X axis – MSB Sul/ Barauna Domain



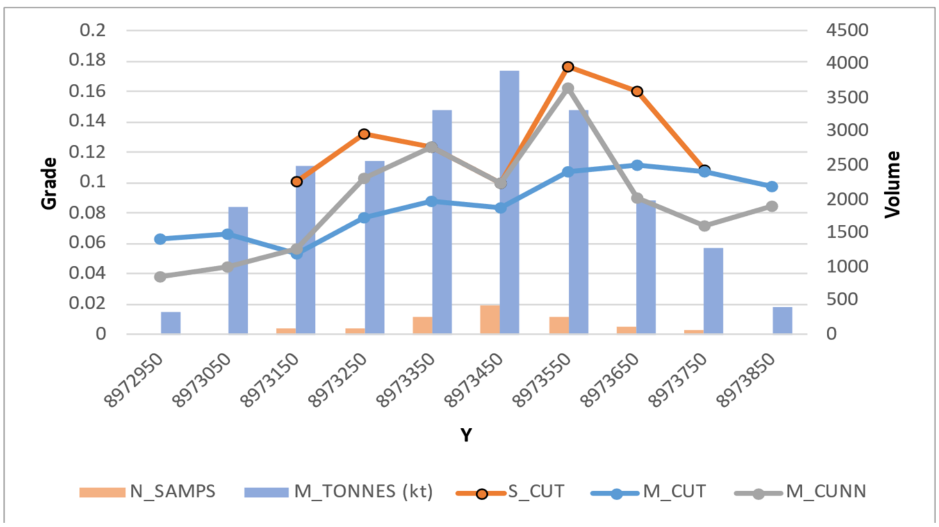
Swath Plot Y axis – MSB Sul/ Barauna Domain



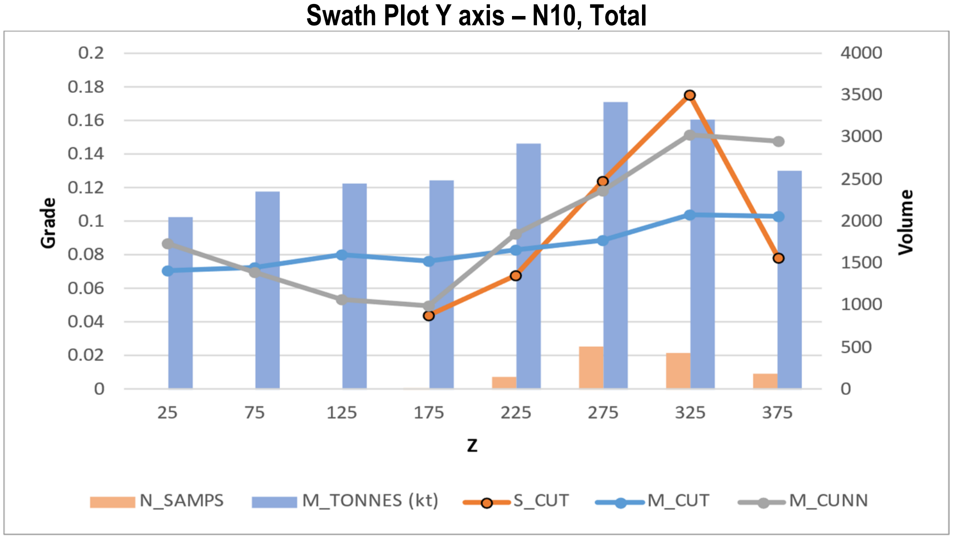
Swath Plot Z axis – MSB Sul/ Barauna Domain



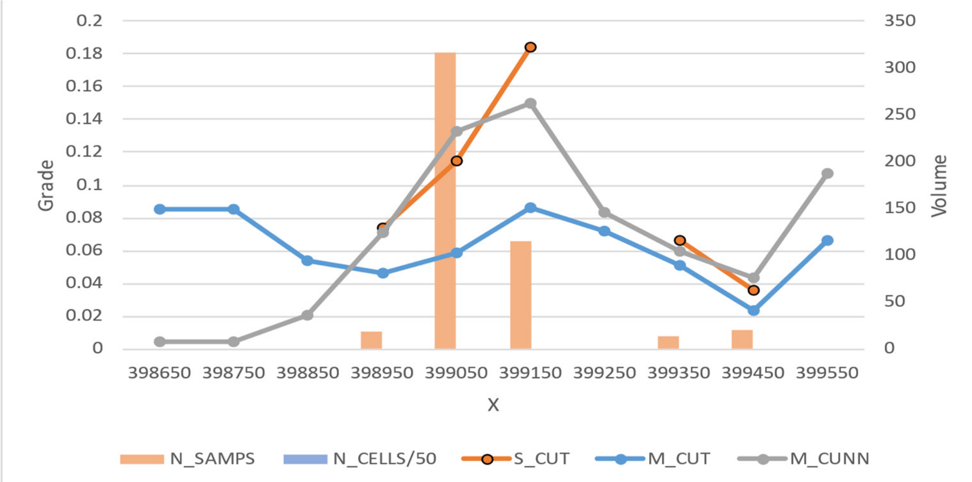
Swath Plot X axis – N10, Total



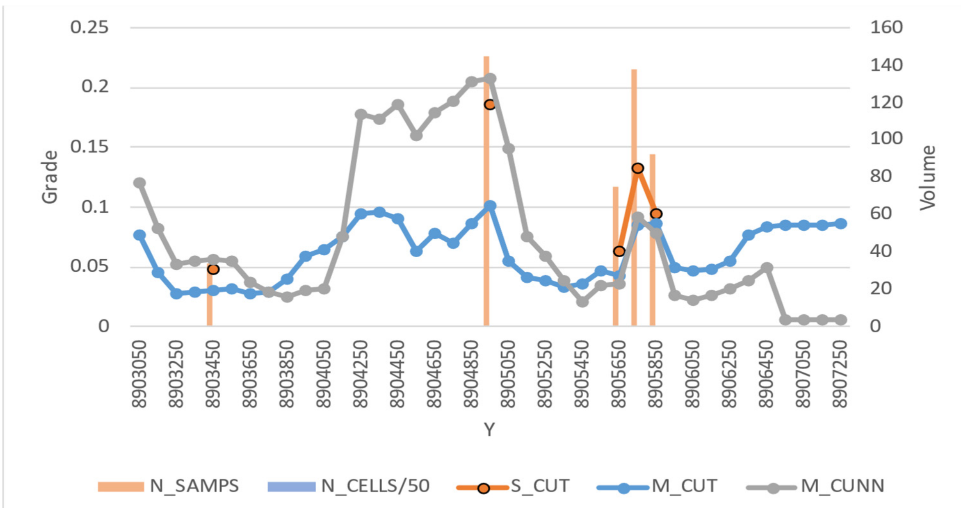
Swath Plot Y axis – N10, Total



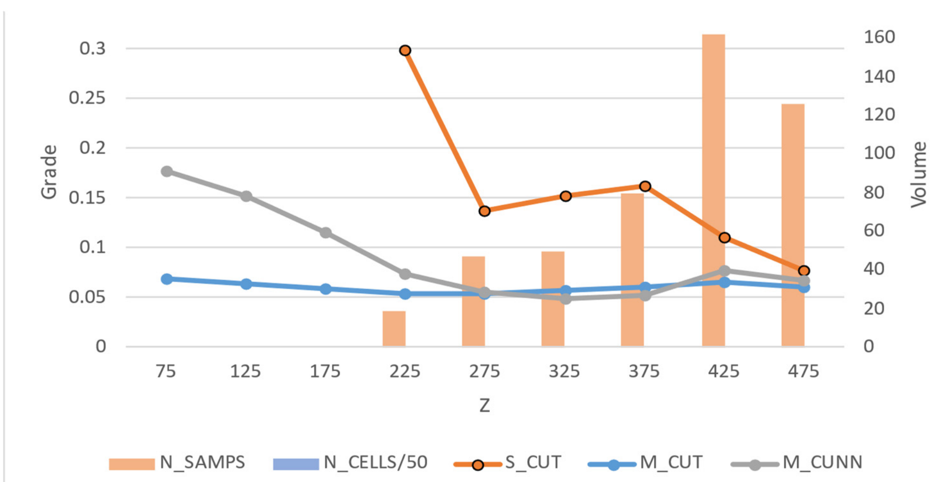
Swath Plot Z axis – N10, Total



Swath Plot X axis – S3, Total

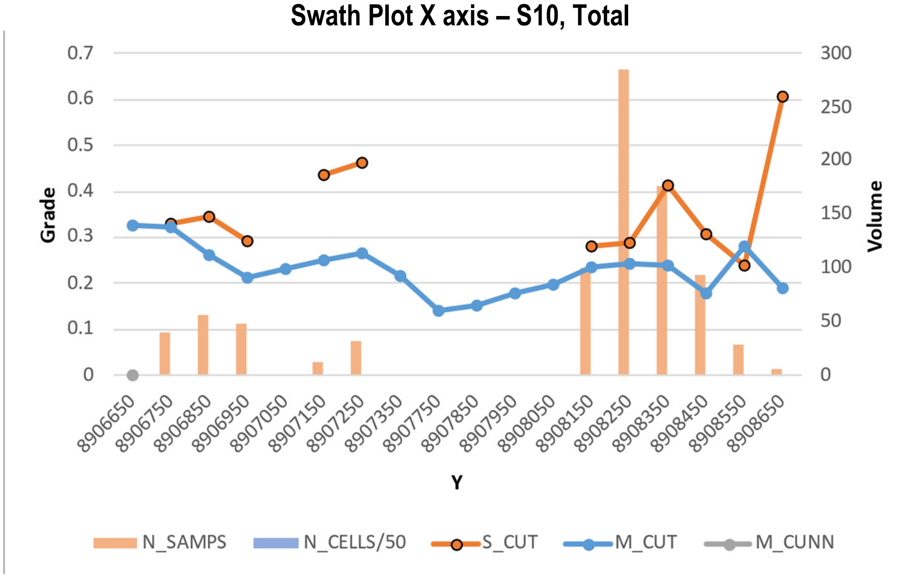


Swath Plot Y axis – S3, Total

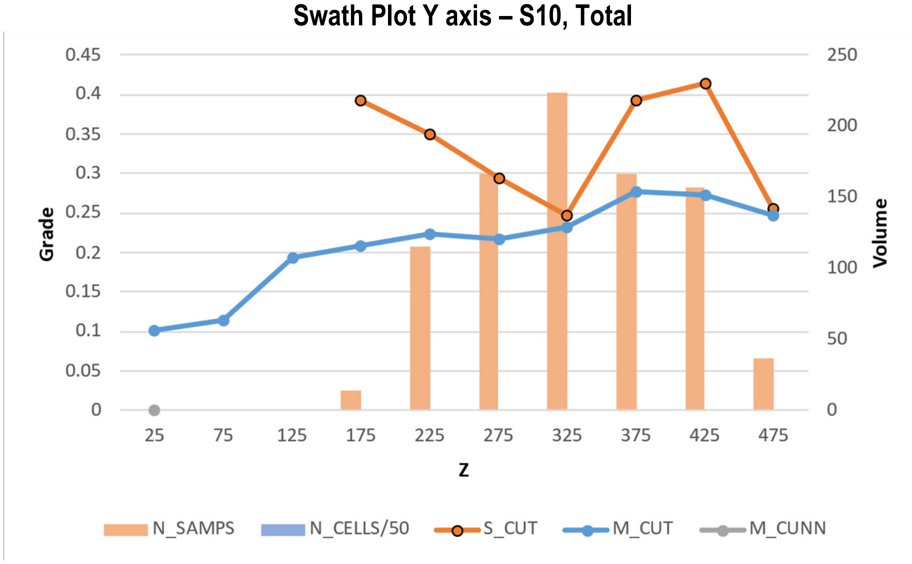


Swath Plot Z axis – S3, Total

Swath Plot X axis – S10, Total



Swath Plot Y axis – S10, Total



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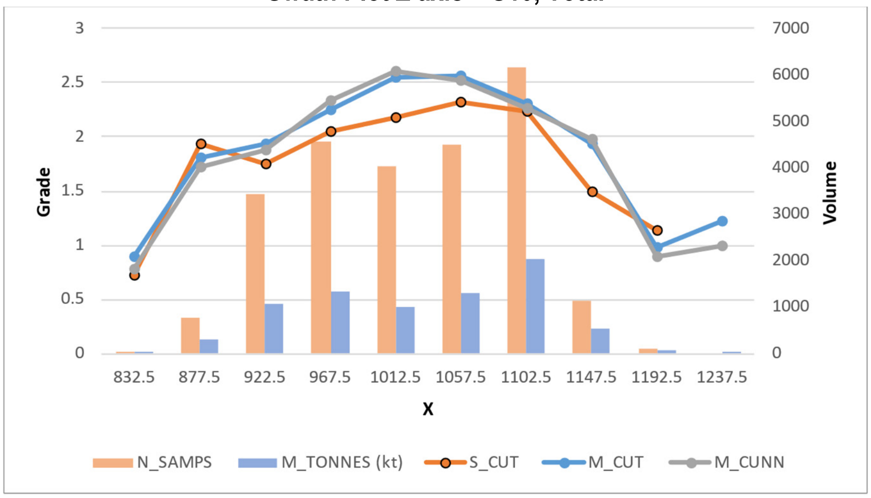
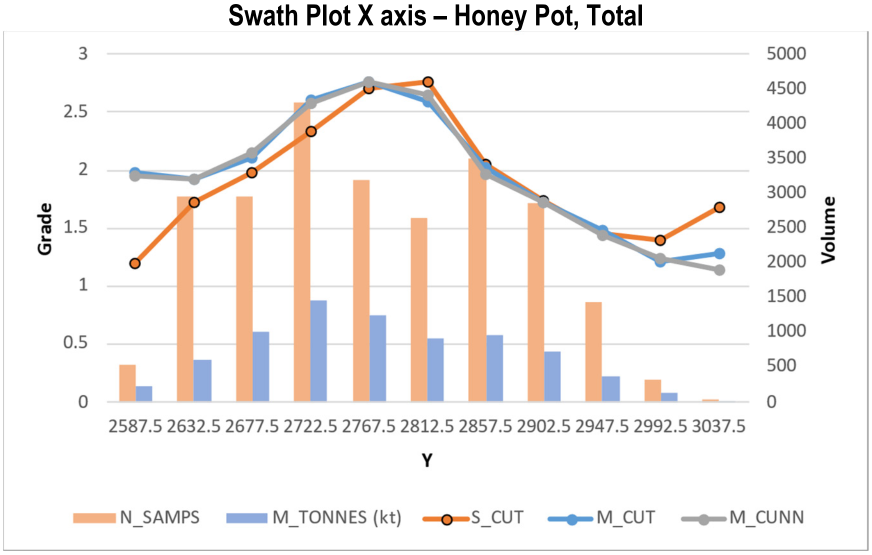
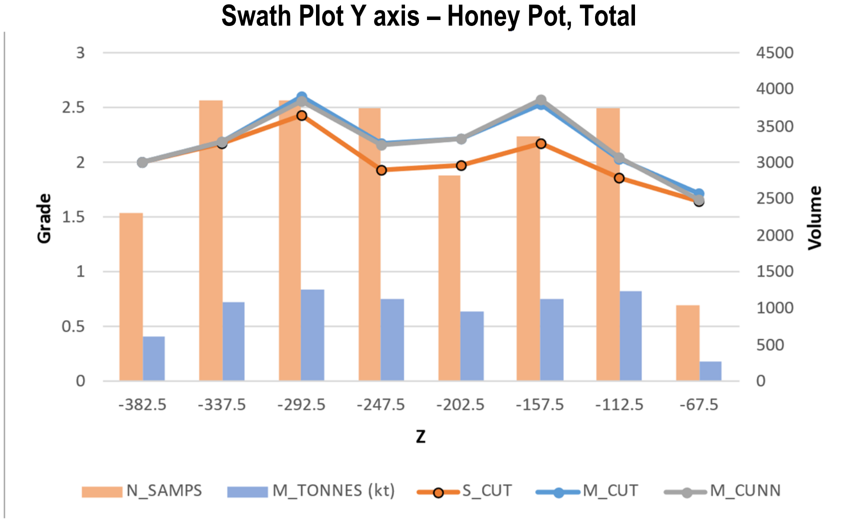


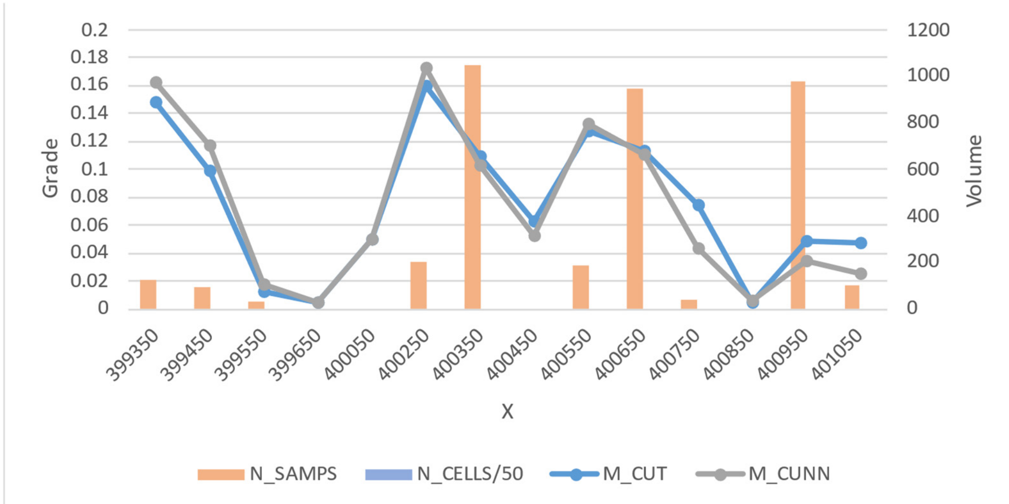
Swath Plot X axis – Honey Pot, Total



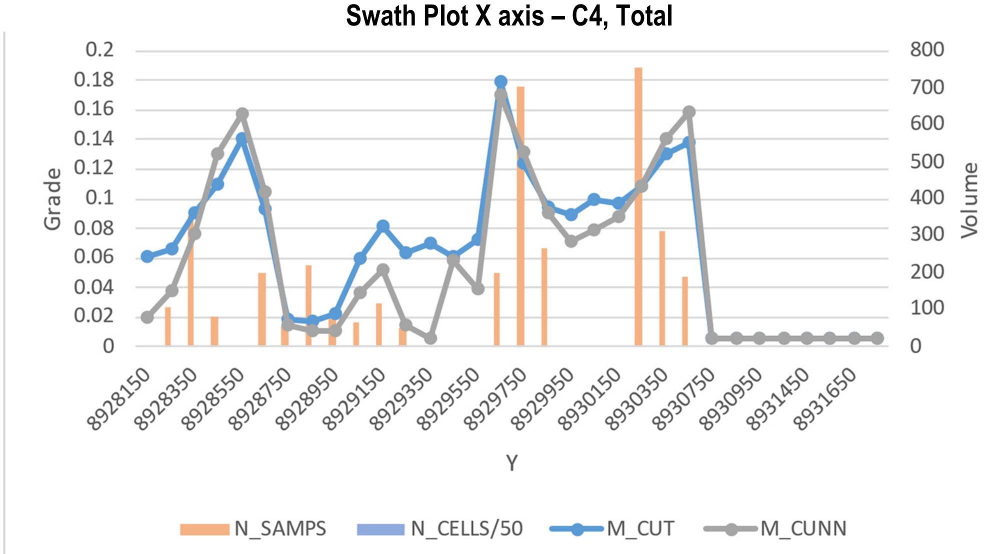
Swath Plot Y axis – Honey Pot, Total



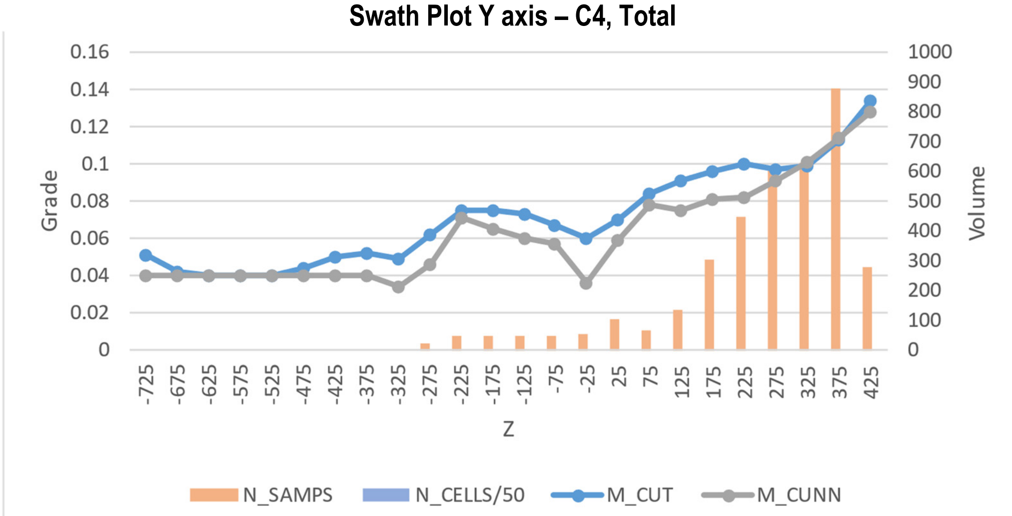
Swath Plot Z axis – Honey Pot, Total



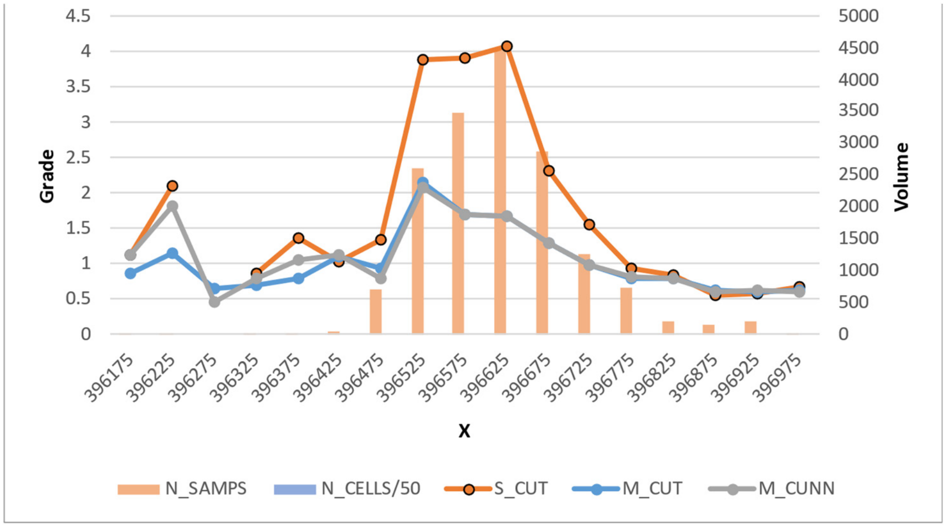
Swath Plot X axis – C4, Total



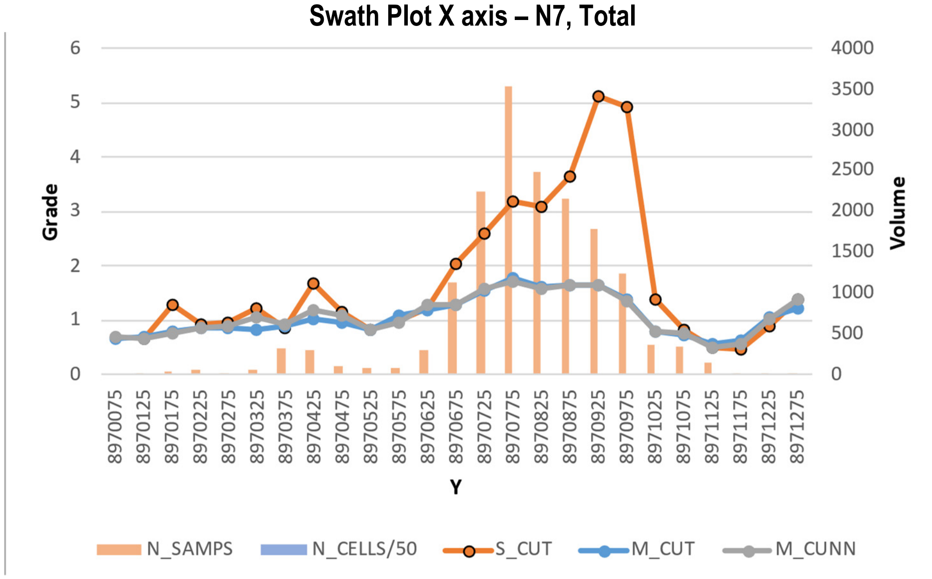
Swath Plot Y axis – C4, Total



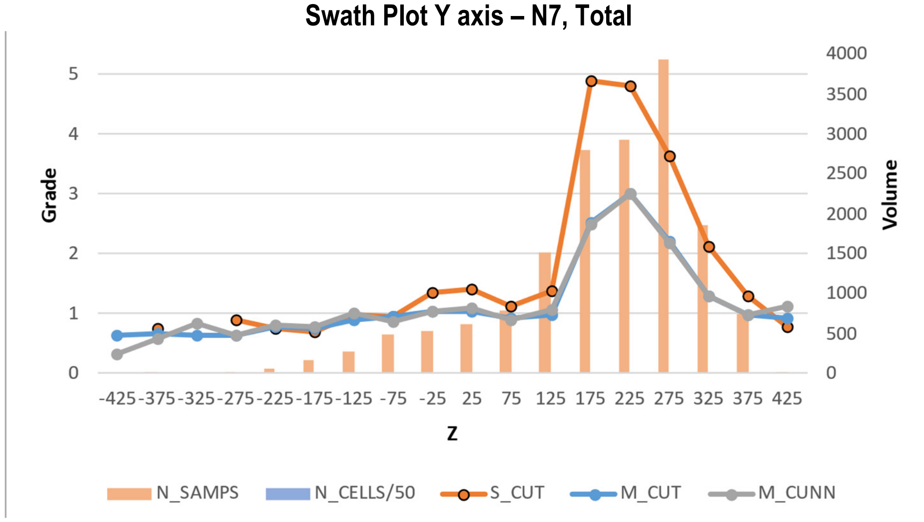
Swath Plot Z axis – C4, Total



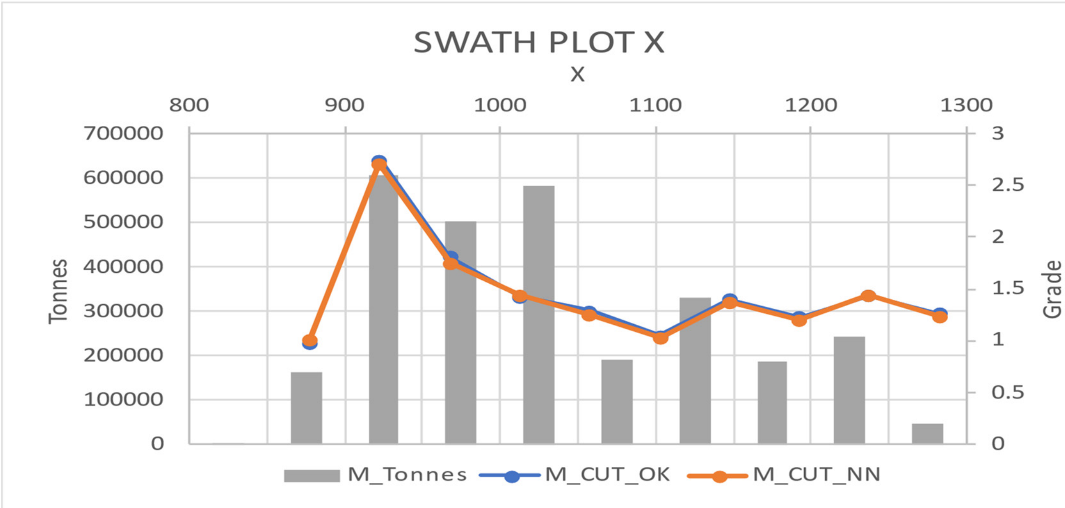
Swath Plot X axis – N7, Total



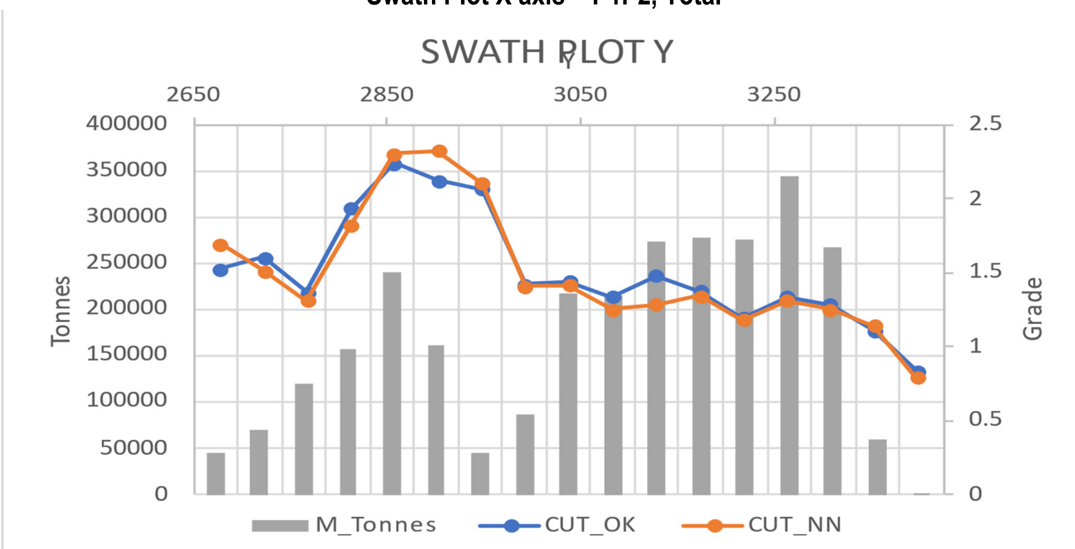
Swath Plot Y axis – N7, Total



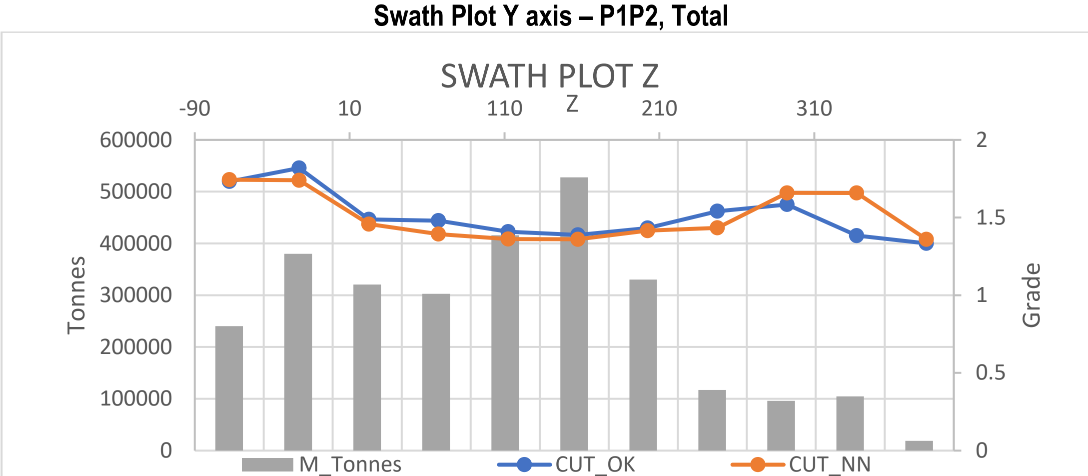
Swath Plot Z axis – N7, Total



Swath Plot X axis – P1P2, Total



Swath Plot Y axis – P1P2, Total



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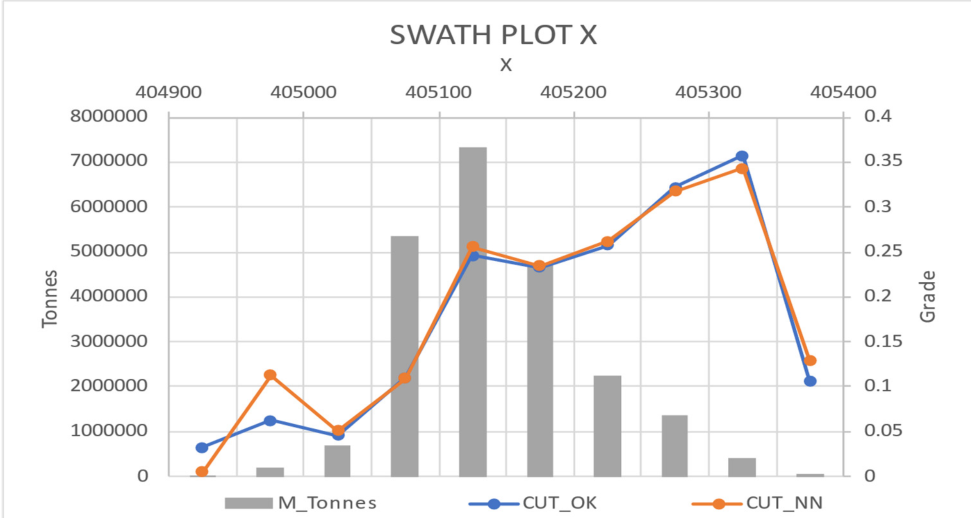
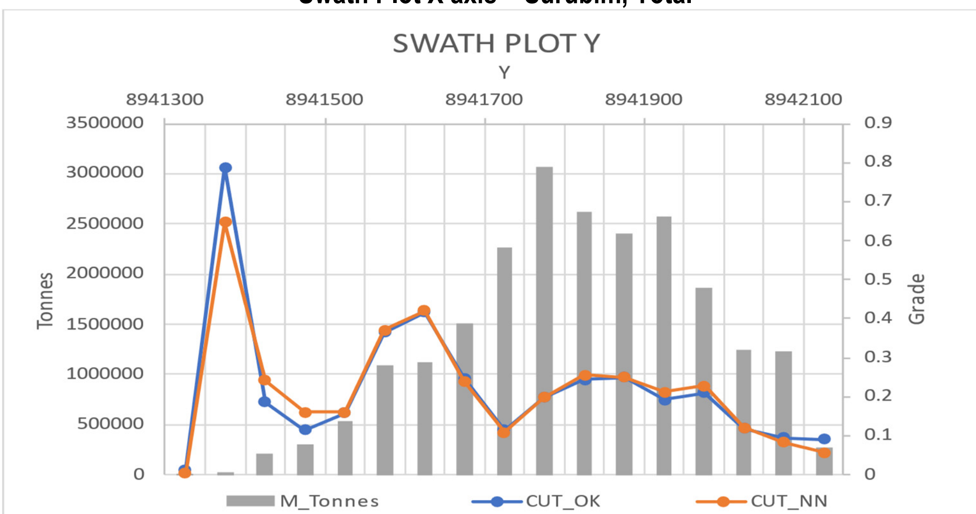
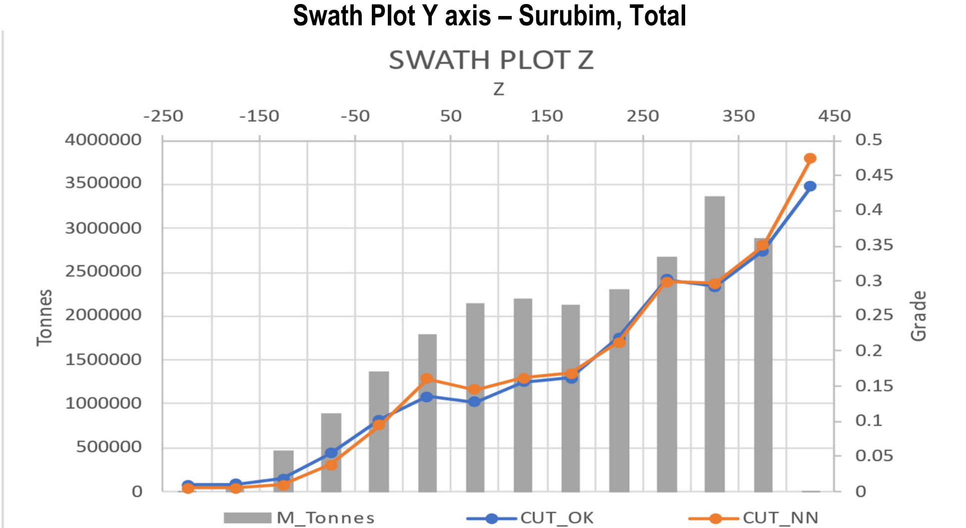


,

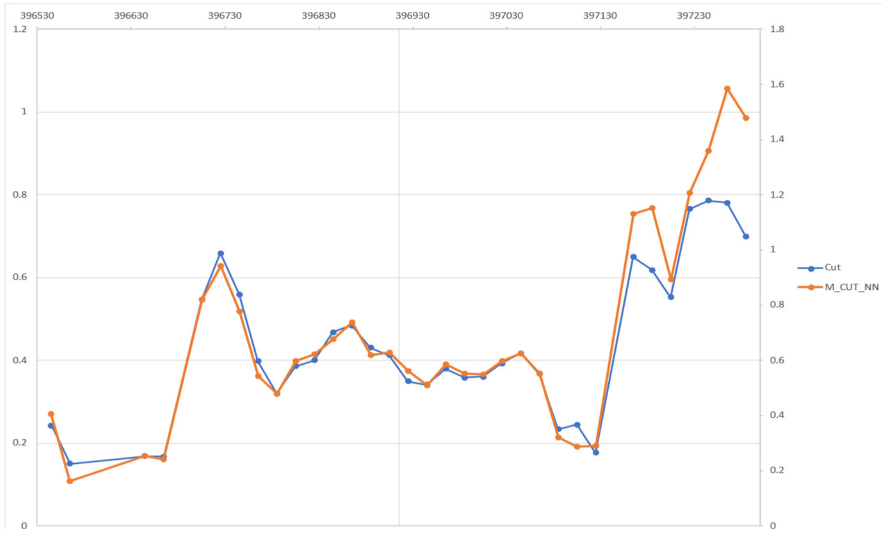
Swath Plot X axis – Surubim, Total



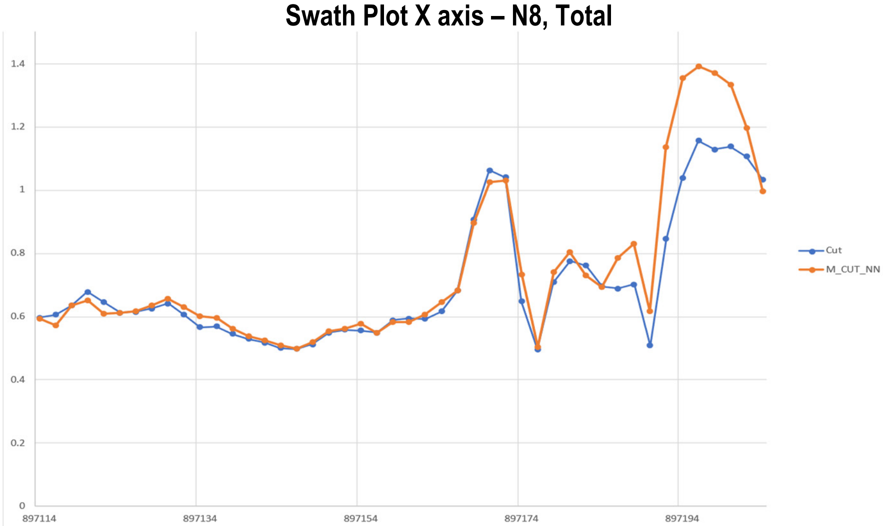
Swath Plot Y axis – Surubim, Total



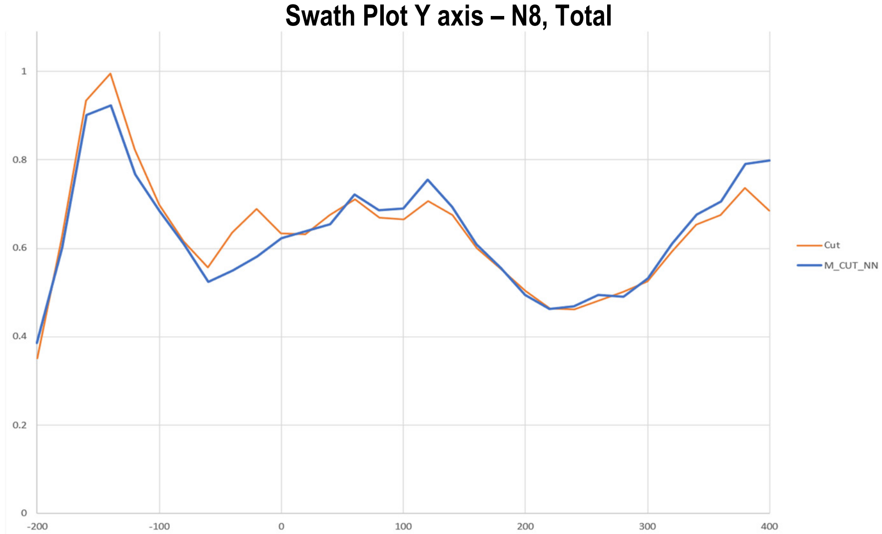
Swath Plot Z axis – Surubim, Total



Swath Plot X axis – N8, Total



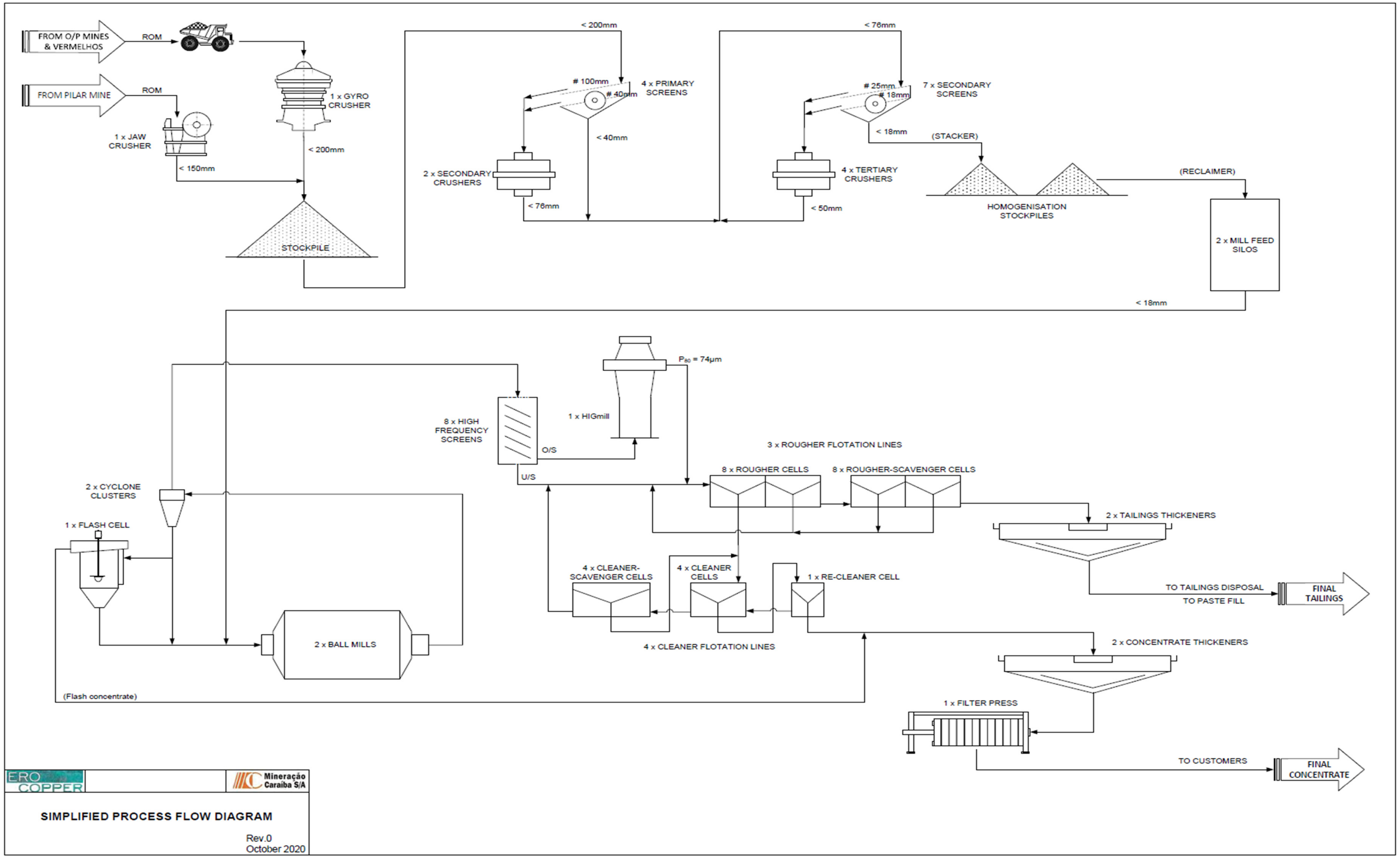
Swath Plot Y axis – N8, Total



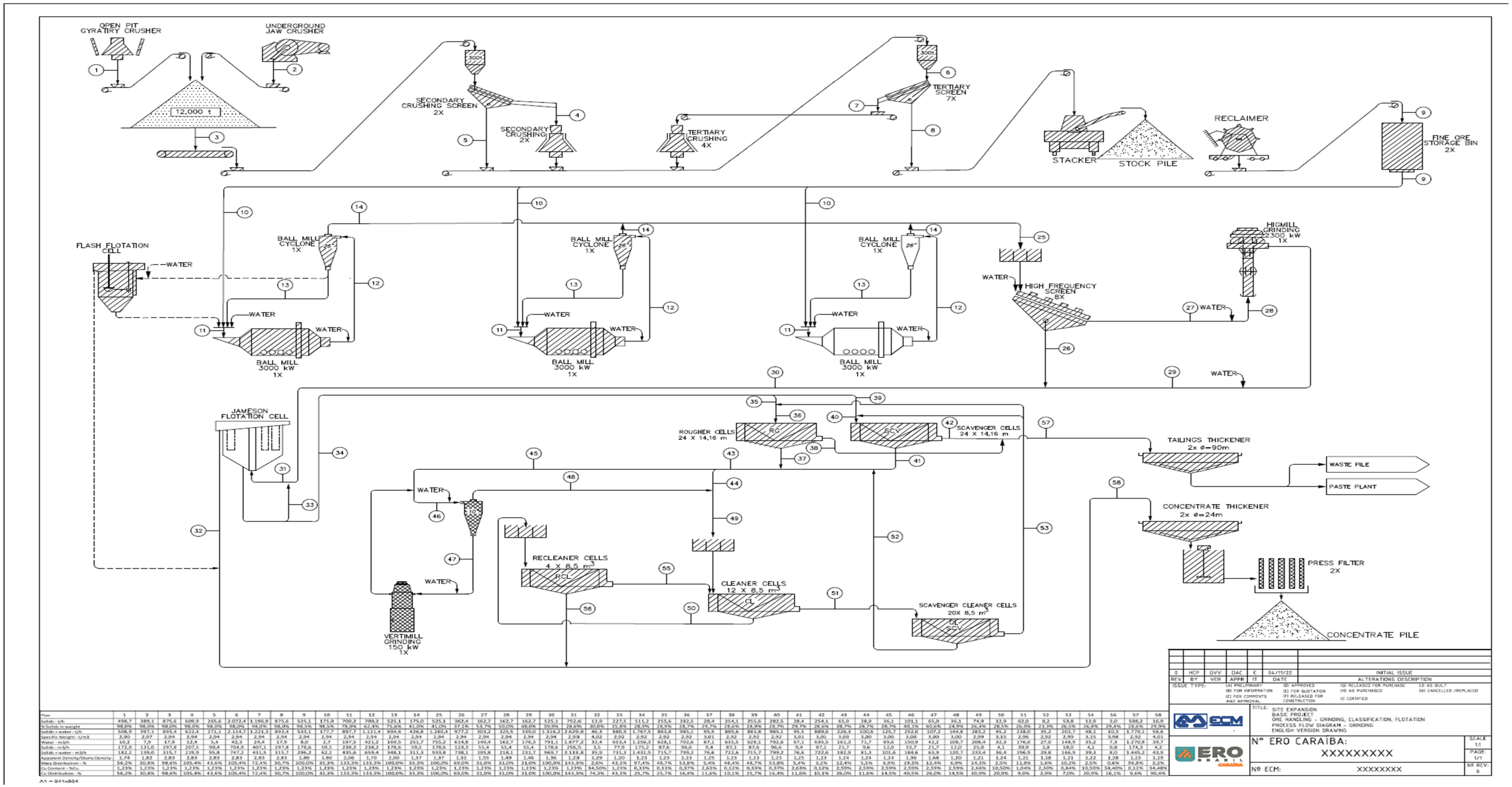
Swath Plot Z axis – N8, Total

APPENDIX C

Process Flowsheets



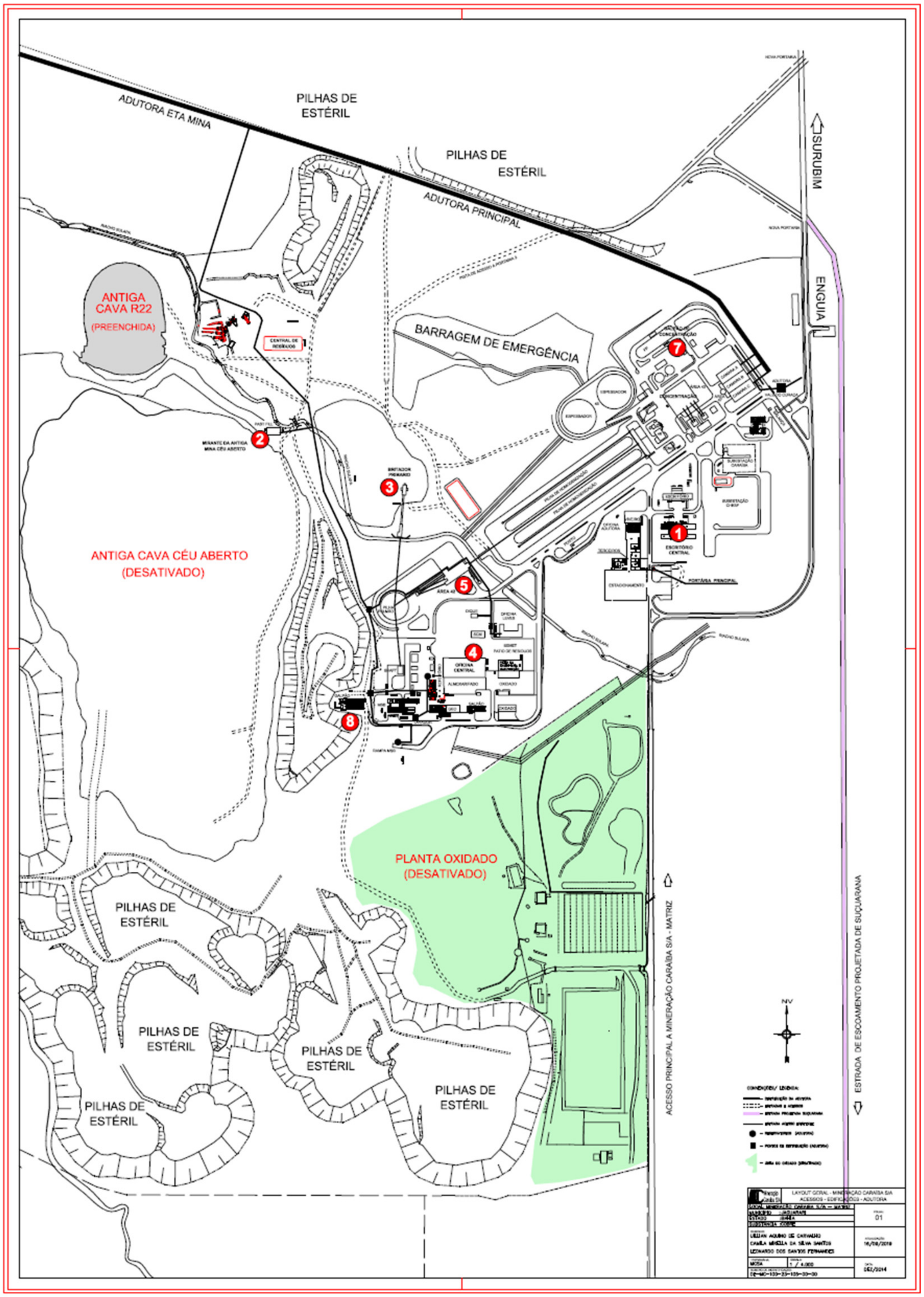
Existing Process Flowsheet (Ero Brasil, 2022)



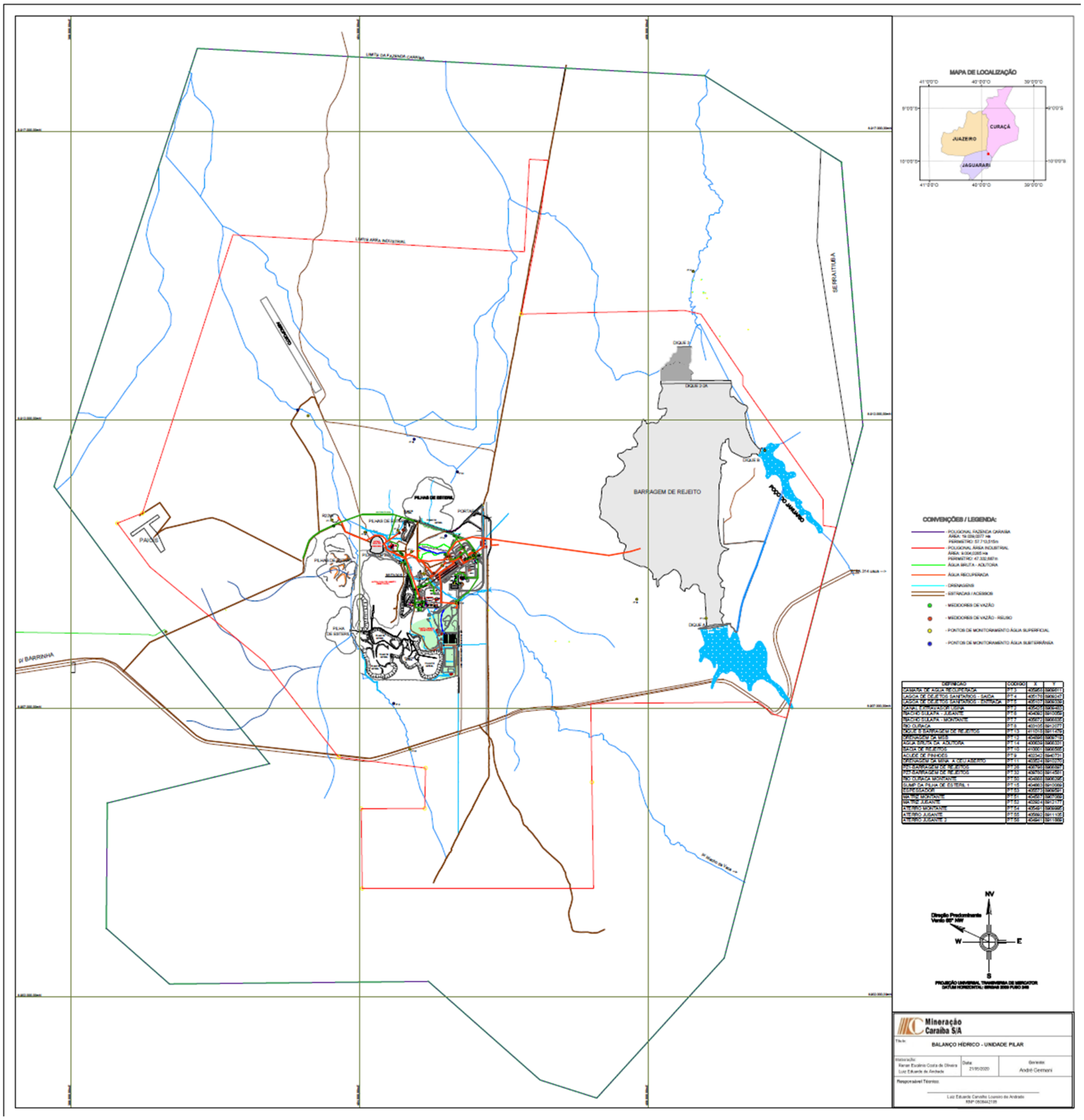
Expansion Process Flowsheet (Ero Brasil, 2022)

APPENDIX D

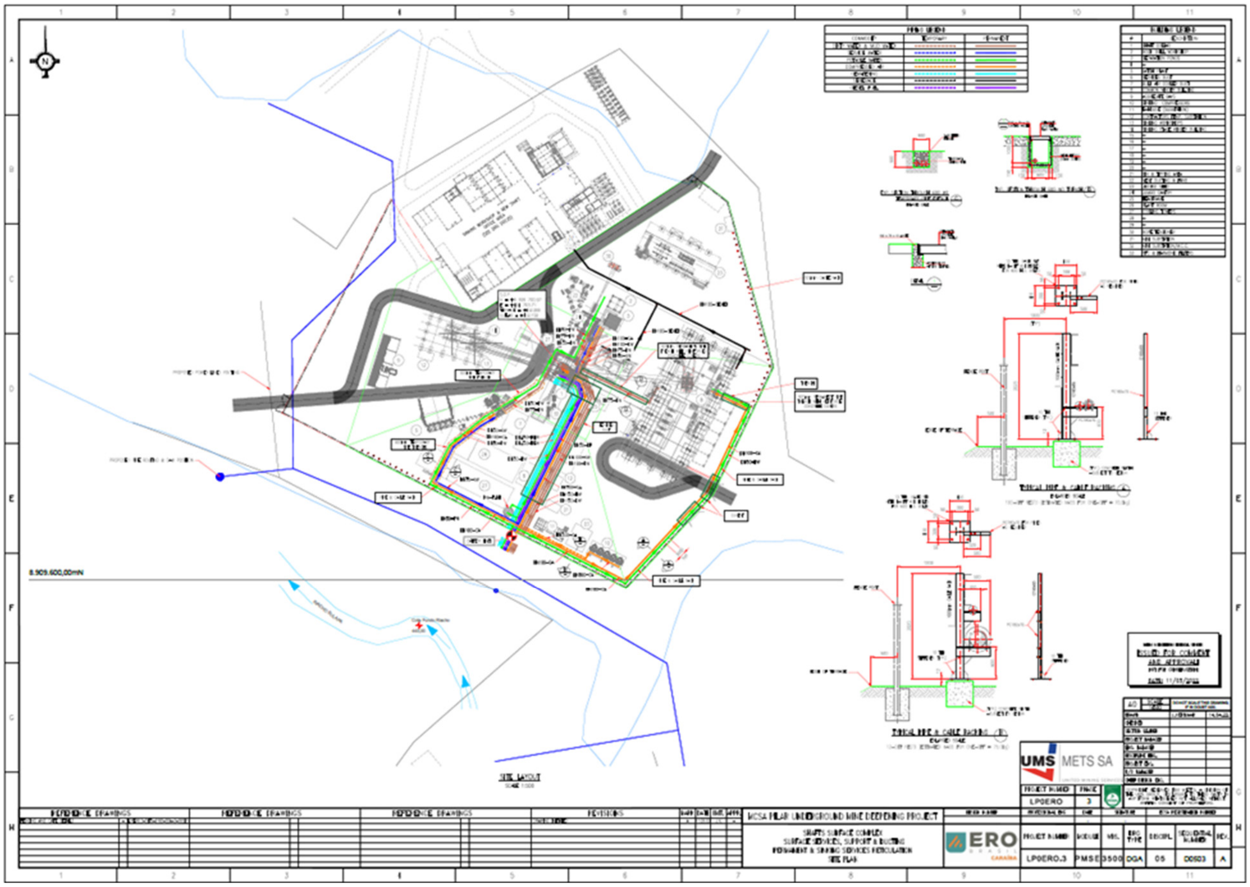
Infrastructure Maps of the Curaçá Valley



Pilar Mine & Caraíba Mill (Ero Brasil, 2022)



Pilar UG Mine, Caraiba Mill & Surrounding Infrastructure (Ero Brasil, 2022)



Deepening Project Surface Infrastructure (Ero Brasil, 2022)

APPENDIX E

Mineral Permits

ID NUMBER	PERMIT PHASE	AREA (ha)	PERMIT HOLDER	EXPIRY DATE
871937/2022	Application for Exploration Permit (pending)	711.40	Mineração Caraiba S A	-
871935/2022	Application for Exploration Permit (pending)	1552.22	Mineração Caraiba S A	-
871934/2022	Application for Exploration Permit (pending)	845.13	Mineração Caraiba S A	-
871933/2022	Application for Exploration Permit (pending)	246.38	Mineração Caraiba S A	-
871932/2022	Application for Exploration Permit (pending)	22.05	Mineração Caraiba S A	-
871315/2022	Application for Exploration Permit (pending)	218.90	Mineração Caraiba S A	-
871319/2022	Application for Exploration Permit (pending)	97.79	Mineração Caraiba S A	-
871321/2022	Application for Exploration Permit (pending)	997.19	Mineração Caraiba S A	-
871327/2022	Application for Exploration Permit (pending)	1928.25	Mineração Caraiba S A	-
871329/2022	Application for Exploration Permit (pending)	1910.32	Mineração Caraiba S A	-
871330/2022	Application for Exploration Permit (pending)	1451.48	Mineração Caraiba S A	-
871332/2022	Application for Exploration Permit (pending)	1174.74	Mineração Caraiba S A	-
871333/2022	Application for Exploration Permit (pending)	1864.52	Mineração Caraiba S A	-
871334/2022	Application for Exploration Permit (pending)	1363.14	Mineração Caraiba S A	-
871335/2022	Application for Exploration Permit (pending)	1273.33	Mineração Caraiba S A	-
871428/2022	Application for Exploration Permit (pending)	475.71	Mineração Caraiba S A	-
871429/2022	Application for Exploration Permit (pending)	529.04	Mineração Caraiba S A	-
871435/2022	Application for Exploration Permit (pending)	17.45	Mineração Caraiba S A	-
871593/2022	Application for Exploration Permit (pending)	63.65	Mineração Caraiba S A	-
871596/2022	Application for Exploration Permit (pending)	42.95	Mineração Caraiba S A	-
871597/2022	Application for Exploration Permit (pending)	63.50	Mineração Caraiba S A	-
871598/2022	Application for Exploration Permit (pending)	0.91	Mineração Caraiba S A	-
872119/2021	Application for Exploration Permit (pending)	44.71	Mineração Caraiba S A	-
870339/2009	Application Pending	1143.13	Mineração Caraiba S A	-
870340/2009	Application Pending	1999.09	Mineração Caraiba S A	-
870715/1999	Application Pending	654.84	Mineração Caraiba S A	-
870960/2003	Application Pending	619.40	Mineração Vale do Curaçá S.a.	-
871852/2008	Application Pending	999.68	Mineração Caraiba S A	-
872012/2011	Application Pending	2000.00	Mineração Caraiba S A	-
872013/2011	Application Pending	1487.44	Mineração Caraiba S A	-
873656/2011	Application Pending	1659.59	Mineração Caraiba S A	-
873660/2011	Application Pending	1496.73	Mineração Caraiba S A	-
873666/2011	Application Pending	1728.78	Mineração Caraiba S A	-

ID NUMBER	PERMIT PHASE	AREA (ha)	PERMIT HOLDER	EXPIRY DATE
874446/2007	Application Pending	1988.74	Mineração Caraiba S A	-
874449/2007	Application Pending	2000.00	Mineração Caraiba S A	-
875200/2007	Application Pending	2000.00	Mineração Caraiba S A	-
870353/2014	Apply to mine	998.73	Mineração Caraiba S A	05-Sep-2023
870003/2016	Exploration Permit	1996.71	Zeus Mineracao Ltda	01-Oct-2024
870358/2019	Exploration Permit	315.96	Mineração Caraiba S A	30-Mar-2024
870440/2022	Exploration Permit	18.14	Mineração Caraiba S A	11-Aug-2025
870585/2018	Exploration Permit	470.75	Mineração Caraiba S A	31-Jan-2023
870586/2018	Exploration Permit	1351.69	Mineração Caraiba S A	31-Jan-2023
870587/2018	Exploration Permit	1978.10	Mineração Caraiba S A	31-Jan-2023
870588/2018	Exploration Permit	886.02	Mineração Caraiba S A	31-Jan-2023
870609/2010	Exploration Permit	151.16	Mineração Caraiba S A	04-Sep-2016
870975/2019	Exploration Permit	1.86	Mineração Caraiba S A	25-Jun-2024
871115/2014	Exploration Permit	1999.99	Mineração Caraiba S A	02-May-2022
871116/2014	Exploration Permit	1365.25	Mineração Caraiba S A	02-May-2022
871117/2014	Exploration Permit	1999.11	Mineração Caraiba S A	02-May-2022
871118/2014	Exploration Permit	1997.99	Mineração Caraiba S A	02-May-2022
871119/2014	Exploration Permit	1999.14	Mineração Caraiba S A	02-May-2022
871120/2014	Exploration Permit	1493.53	Mineração Caraiba S A	02-May-2022
871121/2014	Exploration Permit	1998.16	Mineração Caraiba S A	02-May-2022
871122/2014	Exploration Permit	1371.02	Mineração Caraiba S A	02-May-2022
871123/2014	Exploration Permit	1897.40	Mineração Caraiba S A	02-May-2022
871124/2014	Exploration Permit	1999.23	Mineração Caraiba S A	02-May-2022
871125/2014	Exploration Permit	1212.26	Mineração Caraiba S A	02-May-2022
871234/2017	Exploration Permit	1991.37	Mineração Caraiba S A	30-Sep-2024
871234/2022	Exploration Permit	1548.52	Mineração Caraiba S A	14-Sep-2025
871235/2022	Exploration Permit	1397.98	Mineração Caraiba S A	14-Sep-2025
871339/2017	Exploration Permit	1376.30	Mineração Caraiba S A	19-Aug-2025
871340/2017	Exploration Permit	1997.38	Mineração Caraiba S A	30-Sep-2024
871341/2017	Exploration Permit	999.37	Mineração Caraiba S A	19-Aug-2025
871415/2020	Exploration Permit	13.41	Mineração Caraiba S A	30-Sep-2024
871427/2017	Exploration Permit	948.87	Mineração Caraiba S A	26-Sep-2025
871427/2022	Exploration Permit	6.55	Mineração Caraiba S A	25-Oct-2025
871428/2017	Exploration Permit	1999.71	Mineração Caraiba S A	26-Sep-2025
871431/2014	Exploration Permit	1998.26	Mineração Caraiba S A	18-Jul-2022
871432/2014	Exploration Permit	1999.99	Mineração Caraiba S A	18-Jul-2022
871433/2022	Exploration Permit	117.74	Mineração Caraiba S A	25-Oct-2025
871434/2022	Exploration Permit	44.52	Mineração Caraiba S A	25-Oct-2025
871497/2016	Exploration Permit	1800.01	Mineração Caraiba S A	30-Sep-2024
871502/2016	Exploration Permit	878.14	Mineração Caraiba S A	30-Sep-2024

ID NUMBER	PERMIT PHASE	AREA (ha)	PERMIT HOLDER	EXPIRY DATE
871525/2015	Exploration Permit	76.29	Mineração Caraiba S A	30-Sep-2024
871531/2015	Exploration Permit	385.86	Mineração Caraiba S A	18-Sep-2023
871719/2021	Exploration Permit	1244.82	Mineração Caraiba S A	24-Jan-2025
871720/2021	Exploration Permit	822.39	Mineração Caraiba S A	24-Jan-2025
871725/2021	Exploration Permit	1499.35	Mineração Caraiba S A	24-Jan-2025
871726/2021	Exploration Permit	874.55	Mineração Caraiba S A	24-Jan-2025
871728/2021	Exploration Permit	944.59	Mineração Caraiba S A	24-Jan-2025
871729/2021	Exploration Permit	1495.43	Mineração Caraiba S A	24-Jan-2025
871730/2021	Exploration Permit	1500.38	Mineração Caraiba S A	24-Jan-2025
871733/2018	Exploration Permit	1464.68	Mineração Caraiba S A	08-Dec-2023
871734/2018	Exploration Permit	1398.33	Mineração Caraiba S A	08-Dec-2023
871735/2018	Exploration Permit	1414.34	Mineração Caraiba S A	08-Dec-2023
871736/2018	Exploration Permit	1604.53	Mineração Caraiba S A	08-Dec-2023
871737/2018	Exploration Permit	1453.10	Mineração Caraiba S A	08-Dec-2023
871738/2018	Exploration Permit	1722.43	Mineração Caraiba S A	08-Dec-2023
871739/2018	Exploration Permit	1454.58	Mineração Caraiba S A	08-Dec-2023
871739/2021	Exploration Permit	999.74	Mineração Caraiba S A	24-Jan-2025
871740/2018	Exploration Permit	1717.79	Mineração Caraiba S A	08-Dec-2023
871740/2021	Exploration Permit	385.53	Mineração Caraiba S A	24-Jan-2025
871741/2018	Exploration Permit	1936.45	Mineração Caraiba S A	01-Dec-2023
871741/2021	Exploration Permit	1779.63	Mineração Caraiba S A	24-Jan-2025
871742/2018	Exploration Permit	1540.40	Mineração Caraiba S A	08-Dec-2023
871743/2018	Exploration Permit	1913.60	Mineração Caraiba S A	08-Dec-2023
871744/2018	Exploration Permit	1542.50	Mineração Caraiba S A	08-Dec-2023
871745/2018	Exploration Permit	1352.78	Mineração Caraiba S A	08-Dec-2023
871746/2018	Exploration Permit	1704.88	Mineração Caraiba S A	08-Dec-2023
871747/2021	Exploration Permit	635.02	Mineração Caraiba S A	24-Jan-2025
871748/2021	Exploration Permit	1994.15	Mineração Caraiba S A	24-Jan-2025
871750/2021	Exploration Permit	739.50	Mineração Caraiba S A	24-Jan-2025
871751/2021	Exploration Permit	980.70	Mineração Caraiba S A	24-Jan-2025
871753/2021	Exploration Permit	991.66	Mineração Caraiba S A	24-Jan-2025
871764/2021	Exploration Permit	999.23	Mineração Caraiba S A	24-Jan-2025
871765/2021	Exploration Permit	1285.82	Mineração Caraiba S A	24-Jan-2025
871766/2021	Exploration Permit	1999.75	Mineração Caraiba S A	24-Jan-2025
871767/2021	Exploration Permit	1272.35	Mineração Caraiba S A	24-Jan-2025
871769/2021	Exploration Permit	812.28	Mineração Caraiba S A	24-Jan-2025
871770/2021	Exploration Permit	992.11	Mineração Caraiba S A	24-Jan-2025
871772/2017	Exploration Permit	1948.39	Mineração Caraiba S A	30-Aug-2025
871773/2017	Exploration Permit	694.64	Mineração Caraiba S A	25-Oct-2025
871774/2017	Exploration Permit	1573.34	Mineração Caraiba S A	30-Aug-2025

ID NUMBER	PERMIT PHASE	AREA (ha)	PERMIT HOLDER	EXPIRY DATE
871787/2021	Exploration Permit	412.77	Mineração Caraiba S A	24-Jan-2025
871789/2021	Exploration Permit	1500.03	Mineração Caraiba S A	24-Jan-2025
871791/2021	Exploration Permit	1999.44	Mineração Caraiba S A	24-Jan-2025
871792/2021	Exploration Permit	1900.82	Mineração Caraiba S A	24-Jan-2025
871795/2021	Exploration Permit	1093.54	Mineração Caraiba S A	24-Jan-2025
871798/2021	Exploration Permit	542.93	Mineração Caraiba S A	24-Jan-2025
871799/2021	Exploration Permit	382.48	Mineração Caraiba S A	24-Jan-2025
871800/2021	Exploration Permit	998.44	Mineração Caraiba S A	24-Jan-2025
871803/2021	Exploration Permit	1796.27	Mineração Caraiba S A	24-Jan-2025
871804/2021	Exploration Permit	1166.31	Mineração Caraiba S A	24-Jan-2025
871805/2021	Exploration Permit	997.29	Mineração Caraiba S A	24-Jan-2025
871806/2021	Exploration Permit	1533.20	Mineração Caraiba S A	24-Jan-2025
871834/2016	Exploration Permit	1797.29	Mineração Caraiba S A	30-Sep-2024
871915/2018	Exploration Permit	1843.03	Mineração Caraiba S A	11-May-2024
872009/2011	Exploration Permit	1498.05	Mineração Caraiba S A	27-Aug-2017
872118/2021	Exploration Permit	8.80	Mineração Caraiba S A	16-Dec-2024
872189/2021	Exploration Permit	1747.28	Mineração Caraiba S A	24-Dec-2024
872286/2013	Exploration Permit	1637.55	Mineração Caraiba S A	18-Jul-2022
872555/2016	Exploration Permit	768.64	Mineração Caraiba S A	30-Sep-2024
872816/2016	Exploration Permit	1792.04	Mineração Caraiba S A	30-Sep-2024
872817/2016	Exploration Permit	1136.13	Mineração Caraiba S A	30-Sep-2024
873471/2011	Exploration Permit	2000.00	Mineração Caraiba S A	12-Dec-2017
873472/2011	Exploration Permit	1363.14	Mineração Caraiba S A	30-Sep-2017
874140/2011	Exploration Permit	1457.34	Mineração Caraiba S A	02-Oct-2022
874666/2011	Exploration Permit	1951.63	Mineração Caraíba S A	28-Aug-2022
874939/2011	Exploration Permit	1955.75	Mineração Caraiba S A	23-Feb-2020
874940/2011	Exploration Permit	1445.09	Mineração Caraiba S A	15-Jun-2024
874941/2011	Exploration Permit	1706.04	Mineração Caraiba S A	15-Jun-2024
874942/2011	Exploration Permit	1990.80	Mineração Caraiba S A	02-May-2022
874943/2011	Exploration Permit	1772.91	Mineração Caraiba S A	23-Feb-2020
874944/2011	Exploration Permit	1973.69	Mineração Caraiba S A	02-May-2022
874945/2011	Exploration Permit	1798.84	Mineração Caraiba S A	15-Jun-2024
874946/2011	Exploration Permit	1052.00	Mineração Caraiba S A	15-Jun-2024
874947/2011	Exploration Permit	730.71	Mineração Caraiba S A	02-May-2022
874948/2011	Exploration Permit	1913.93	Mineração Caraiba S A	02-May-2022
874949/2011	Exploration Permit	1989.80	Mineração Caraiba S A	02-May-2022
874950/2011	Exploration Permit	1914.16	Mineração Caraiba S A	02-May-2022
874951/2011	Exploration Permit	1985.89	Mineração Caraiba S A	02-May-2022
874952/2011	Exploration Permit	1827.01	Mineração Caraiba S A	02-May-2022
619/1964	Mining Permit	390.28	Mineração Caraiba S A	-

ID NUMBER	PERMIT PHASE	AREA (ha)	PERMIT HOLDER	EXPIRY DATE
737/1940	Mining Permit	400.00	Mineração Caraiba S A	-
812998/1973	Mining Permit	900.00	Mineração Caraiba S A	-
870347/1984	Mining Permit	923.50	Mineração Caraiba S A	-
871263/2011	Mining Permit	342.21	Mineração Caraiba S A	-
873648/2006	Mining Permit	343.62	Mineração Caraiba S A	-
973228/2020	Mining Permit	2955.99	Mineração Caraiba S A	-
870086/2010	Mining Permit Application	1957.62	Mineração Caraiba S A	-
870584/2018	Mining Permit Application	1549.50	Mineração Caraiba S A	-
870621/2010	Mining Permit Application	1632.39	Mineração Caraiba S A	-
872015/2011	Mining Permit Application	1996.17	Mineração Caraiba S A	-
872124/2012	Mining Permit Application	1999.77	Mineração Caraiba S A	-
874450/2007	Mining Permit Application	966.27	Mineração Caraiba S A	-
874669/2011	Mining Permit Application	419.71	Mineração Caraiba S A	-
871290/2012	Tender Process	984.91	Mineração Caraiba S A	-
870114/2010	Tender Process	1249.98	Mineração Caraiba S A	-
871853/2008	Tender Process	998.94	Mineração Caraiba S A	-
872008/2011	Tender Process	1999.42	Mineração Caraiba S A	-
872010/2011	Tender Process	871.57	Mineração Caraiba S A	-
872018/2011	Tender Process	1999.93	Mineração Caraiba S A	-
872019/2011	Tender Process	2000.00	Mineração Caraiba S A	-
872123/2012	Tender Process	334.21	Mineração Caraiba S A	-
873204/2011	Tender Process	1997.61	Mineração Caraiba S A	-
873469/2011	Tender Process	1497.52	Mineração Caraiba S A	-
873470/2011	Tender Process	1991.11	Mineração Caraiba S A	-
873518/2011	Tender Process	1956.02	Mineração Caraiba S A	-
873595/2009	Tender Process	1199.47	Mineração Caraiba S A	-
873659/2011	Tender Process	1503.42	Mineração Caraiba S A	-
873662/2011	Tender Process	842.28	Mineração Caraiba S A	-
873664/2011	Tender Process	615.98	Mineração Caraiba S A	-

APPENDIX F

Standard Certificates

Certificate of Analysis 0611

Date: 03-06-2018
Version: 02

CRM ITAK-814
Certified Reference Material
Copper Ore

Table 1 – ITAK-814 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) [a, f]	0.4507	0.0095	0.0053	0.0078	± 0.0029
Fe (%) [a, b, f]	10.14	0.20	0.10	0.17	± 0.072
S (%) [e]	0.434	0.051	0.015	0.049	± 0.020
Au (g/t) [c, d]	0.164	0.043	0.024	0.036	± 0.014
Ag (g/t) [a, f]	1.451	0.14	0.11	0.085	± 0.049

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.
[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).
[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.
[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.
[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

Table 2 – ITAK-814 – Informative Values

Element/Unit	Reference Value [6]
Ni (%) [a, b, f]	0.025
C (%) [e]	0.517
F (g/t) [g]	492
Cl (g/t) [h, i]	942

[6] These values are informative. They were calculated according to ISO Guide 35 and ISO 5725-2 from fifteen to twenty results from a varying number of laboratories.

DESCRIPTION

ITAK-814 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Midwest of Brazil in 2017.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-814 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-814.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-814 was analyzed by twelve specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-055/18 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-814 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).
- **b**: Fusion Method and determination by Atomic Emission Spectrometry (ICP).
- **c**: Fire Assay Method and determination by Atomic Absorption Spectrometry (AAS).
- **d**: Extraction and determination by Atomic Absorption Spectrometry (AAS).
- **e**: Infrared Analyzer (LECO).
- **f:** Acid digestion Method and determination by Atomic Emission Spectrometry (ICP).
- **g**: Fusion Method and determination by Ion Specific Electrode.
- **h:** Acid digestion Method and determination by Titration.
- **i**: Acid digestion Method and determination by Pontenciometry

PERIOD OF VALIDITY

This CRM certification is valid until: **March 06, 2028**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director

Certificate of Analysis 0596

Date: 02-20-2018
Version: 02

CRM ITAK-821
Certified Reference Material
Copper Ore

Table 1 – ITAK-821 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) [a]	0.3622	0.0064	0.0037	0.0052	± 0.0019
Fe (%) [a, b, f]	6.24	0.54	0.11	0.53	± 0.19
S (%) [e]	2.526	0.097	0.071	0.066	± 0.030
C (%) [e]	0.213	0.083	0.0068	0.083	± 0.041
Au (g/t) [c, d]	0.318	0.032	0.021	0.024	± 0.011
Ni (%) [a]	0.0023	0.00068	0.00026	0.00063	± 0.00049

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.
[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).
[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.
[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.
[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

Table 2 – ITAK-821 – Informative Values

Element/Unit	Reference Value [6]
Ag (g/t) [a]	1.962
F (g/t) [g]	1044

[6] These values are informative. They were calculated according to ISO Guide 35 and ISO 5725-2 from fifteen to twenty results from a varying number of laboratories.

DESCRIPTION

ITAK-821 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Midwest of Brazil in 2017.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-821 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-821.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-821 was analyzed by thirteen specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-040/18 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-821 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).
- **b**: Fusion Method and determination by Atomic Emission Spectrometry (ICP).
- **c**: Fire Assay Method and determination by Atomic Absorption Spectrometry (AAS).
- **d**: Extraction and determination by Atomic Absorption Spectrometry (AAS).
- **e**: Infrared Analyzer (LECO).
- **f:** Acid digestion Method and determination by Titration.
- **g**: Fusion Method and determination by Ion specific electrode.

PERIOD OF VALIDITY

This CRM certification is valid until: **February 20, 2028**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director

Certificate of Analysis 0578

Date: 02-06-2018

Version: 02

CRM ITAK-823

Certified Reference Material

Copper Ore

Table 1 – ITAK-823 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) [a, b]	0.874	0.025	0.010	0.023	± 0.011
S (%) [c]	0.682	0.016	0.0099	0.013	± 0.0059
Au (g/t) [d]	0.0877	0.017	0.017	0.0016	± 0.0037
Ag (g/t) [a, b]	3.455	0.37	0.36	0.090	± 0.092
Fe (%) [b]	9.59	0.44	0.072	0.43	± 0.22
Ni (g/t) [a, b]	537	21	10	18	± 8.2
F (%) [f]	0.077	0.025	0.0021	0.025	± 0.013
C (%) [c]	0.074	0.012	0.0043	0.012	± 0.0053

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.

[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).

[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.

[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.

[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

Table 2 – ITAK-823 – Informative Values

Element/Unit	Reference Value [6]
Cl (%) [e]	0.0072

[6] These values are informative. They were calculated according to ISO Guide 35 and ISO 5725-2 from ten to fifteen results from a varying number of laboratories.

DESCRIPTION

ITAK-823 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Northeast of Brazil in 2014.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-823 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-823.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-823 was analyzed by five specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-022/18 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-823 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).
- **b**: Acid digestion Method and determination by Atomic Emission Spectrometry (ICP).
- **c**: Infrared Analyzer (LECO).
- **d**: Fire Assay Method and determination by Atomic Absorption Spectrometry (AAS).
- **e**: Acid digestion Method and determination by Titration.
- **f**: Fusion Method and determination by Ion specific electrode.

PERIOD OF VALIDITY

This CRM certification is valid until: **February 06, 2028**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director

Certificate of Analysis 0577

Date: 02-05-2018

Version: 03

CRM ITAK-824
Certified Reference Material
Copper Ore

Table 1 – ITAK-824 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) a, b	2.678	0.067	0.046	0.049	± 0.024
S (%) c	2.122	0.050	0.029	0.041	± 0.019
Au (g/t) d	0.250	0.045	0.043	0.012	± 0.010
Ag (g/t) a, b	12.15	1.1	0.74	0.81	± 0.44
Ni (g/t) a, b	1268	82	25	78	± 35
F (%) g	0.055	0.017	0.0016	0.017	± 0.0086
C (%) c	0.092	0.013	0.0037	0.013	± 0.0057

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.

[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).

[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.

[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.

[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

Table 2 – ITAK-824 – Informative Values

Element/Unit	Reference Value [6]
Fe (%) [a, b]	13.39
As (g/t) [b]	< 30
Cl (g/t) [e, f]	80
Th (g/t) [b]	< 20
U (g/t) [b]	< 30

[6] These values are informative. They were calculated according to ISO Guide 35 and ISO 5725-2 from ten to twenty results from a varying number of laboratories.

DESCRIPTION

ITAK-824 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Northeast of Brazil in 2014.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-824 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-824.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-824 was analyzed by five specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-021/18 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-824 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).
- **b**: Acid digestion Method and determination by Atomic Emission Spectrometry (ICP).
- **c**: Infrared Analyzer (LECO).
- **d**: Fire Assay Method and determination by Atomic Absorption Spectrometry (AAS).
- **e**: Acid digestion Method and determination by Titration.
- **f**: Neutron Activation Method.
- **g**: Acid digestion Method and determination by Ion specific electrode.

PERIOD OF VALIDITY

This CRM certification is valid until: **February 05, 2028**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director

Certificate of Analysis 0581

Date: 02-06-2018
Version: 02

CRM ITAK-825
Certified Reference Material
Copper Ore

Table 1 – ITAK-825 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) a, b, e	5.76	0.11	0.041	0.10	± 0.032
S (%) c, g	3.96	0.16	0.042	0.15	± 0.044
Au (g/t) d, h, i	0.210	0.035	0.031	0.017	± 0.0069
Ag (g/t) a, b	6.98	0.43	0.25	0.35	± 0.14
Fe (%) b, e, j	13.36	0.30	0.15	0.25	± 0.092
Ni (%) a, b	0.1298	0.0088	0.0020	0.0085	± 0.0030
F (g/t) f, k	806	188	35	185	± 66
C (%) c	0.077	0.011	0.0025	0.010	± 0.0036
Cl (g/t) e, k	83	28	6	28	± 12

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.

[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).

[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.

[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.

[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

Table 2 – ITAK-825 – Informative Values

Element/Unit	Reference Value [6]
As (g/t) [b]	< 30
Th (g/t) [b]	< 20
U (g/t) [b]	< 30

[6] These values are informative. They were calculated according to ISO Guide 35 and ISO 5725-2 from ten to fifteen results from a varying number of laboratories.

DESCRIPTION

ITAK-825 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Northeast of Brazil in 2014.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-825 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-825.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-825 was analyzed by sixteen specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-025/18 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-825 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).
- **b**: Acid digestion Method and determination by Atomic Emission Spectrometry (ICP).
- **c**: Infrared Analyzer (LECO).
- **d**: Fire Assay Method and determination by Atomic Absorption Spectrometry (AAS).
- **e**: Acid digestion Method and determination by Titration.
- **f**: Fusion Method and determination by Ion specific electrode.
- **g**: Acid digestion Method and determination by Gravimetry.
- **h**: Fire Assay Method and determination by Atomic Emission Spectrometry (ICP).
- **i**: Extraction and determination by Atomic Absorption Spectrometry (AAS).
- **j**: Fusion Method and determination by Atomic Emission Spectrometry (ICP).
- **k:** Acid digestion method and determination by Potentiometry.

PERIOD OF VALIDITY

This CRM certification is valid until: **February 06, 2028**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director

Certificate of Analysis 0582

Date: 02-06-2018
Version: 01

CRM ITAK-833
Certified Reference Material
Copper Ore

Table 1 – ITAK-833 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) a, b, e	1.571	0.038	0.032	0.021	± 0.0085
S (%) c, g	18.86	0.65	0.24	0.60	± 0.27
Au (g/t) d, h, i	1.83	0.10	0.031	0.096	± 0.043
Ag (g/t) a, b	5.2	1.2	0.48	1.1	± 0.52
Fe (%) a, b, e, j	19.31	0.59	0.40	0.44	± 0.18
F (g/t) f	579	52	41	32	± 18
C (%) c	0.048	0.012	0.0032	0.011	± 0.0056

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.
[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).
[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.
[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.
[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

Table 2 – ITAK-833 – Informative Values

Element/Unit	Reference Value [6]
Ni (g/t) [a, b]	48.3
SiO_2 (%) [g, j]	36.7

[6] These values are informative. They were calculated according to ISO Guide 35 and ISO 5725-2 from ten to fifteen results from a varying number of laboratories.

DESCRIPTION

ITAK-833 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Northeast of Brazil in 2016.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-833 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-833.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-833 was analyzed by thirteen specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-026/18 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-833 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).
- **b**: Acid digestion Method and determination by Atomic Emission Spectrometry (ICP).
- **c**: Infrared Analyzer (LECO).
- **d**: Fire Assay Method and determination by Atomic Absorption Spectrometry (AAS).
- **e**: Acid digestion Method and determination by Titration.
- **f**: Fusion Method and determination by Ion specific electrode.
- **g**: Acid digestion Method and determination by Gravimetry.
- **h**: Fire Assay Method and determination by Atomic Emission Spectrometry (ICP).
- **i**: Extraction and determination by Atomic Absorption Spectrometry (AAS).
- **j**: Fusion Method and determination by Atomic Emission Spectrometry (ICP).

PERIOD OF VALIDITY

This CRM certification is valid until: **February 06, 2028**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director

ITAK

Certificate of Analysis 0683

Date: 06-04-2018
Version: 01

CRM ITAK-842
Certified Reference Material
Copper Ore

Table 1 – ITAK-842 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) [a]	1.562	0.028	0.018	0.021	± 0.0086
Ni (%) [a]	0.0458	0.0026	0.0021	0.0015	± 0.00067

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.

[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).

[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.

[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.

[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

DESCRIPTION

ITAK-842 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Northeast of Brazil in 2018.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-842 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-842.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-842 was analyzed by eight specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-127/18 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-842 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).

PERIOD OF VALIDITY

This CRM certification is valid until: **June 04, 2028**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director

CRM ITAK-843
Certified Reference Material
Copper Ore

Table 1 – ITAK-843 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) [a]	0.796	0.019	0.010	0.016	± 0.0064
Ni (%) [a]	0.0770	0.0027	0.00084	0.0026	± 0.0010

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.

[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).

[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.

[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.

[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

DESCRIPTION

ITAK-843 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Northeast of Brazil in 2018.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-843 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-843.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-843 was analyzed by eight specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-128/18 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-843 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).

PERIOD OF VALIDITY

This CRM certification is valid until: **June 04, 2028**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director

Certificate of Analysis 0685

Date: 06-04-2018
Version: 01

CRM ITAK-844
Certified Reference Material
Copper Ore

Table 1 – ITAK-844 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) [a]	0.323	0.012	0.0032	0.012	± 0.0044
Ni (%) [a]	0.0393	0.0021	0.00054	0.0021	± 0.00079

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.

[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).

[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.

[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.

[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

DESCRIPTION

ITAK-844 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Northeast of Brazil in 2018.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-844 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-844.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-844 was analyzed by eight specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-129/18 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-844 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).

PERIOD OF VALIDITY

This CRM certification is valid until: **June 04, 2028**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director

Certificate of Analysis 0723

Date: 10-10-2018
Version: 01

CRM ITAK-847
Certified Reference Material
Copper Ore

Table 1 – ITAK-847 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) [a, b]	0.4221	0.0074	0.0045	0.0059	± 0.0024
Ni (%) [a, b]	0.0486	0.0025	0.0013	0.0021	± 0.00090

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.
[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).
[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.
[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.
[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.
Note: The letters in front of the elements are codes for Analytical Methods used.

DESCRIPTION

ITAK-847 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Northeast of Brazil in 2018.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-847 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-847.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-847 was analyzed by eight specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-166/18 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-847 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).
- **b**: Acid digestion Method and determination by Atomic Emission Spectrometry (ICP).

PERIOD OF VALIDITY

This CRM certification is valid until: **October 10, 2028**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director

Certificate of Analysis 0724

Date: 10-10-2018
Version: 01

CRM ITAK-848
Certified Reference Material
Copper Ore

Table 1 – ITAK-848 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) [a, b]	0.6358	0.0077	0.0074	0.0020	± 0.0016
Ni (%) [a, b]	0.0626	0.0035	0.0011	0.0033	± 0.0015

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.
[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).
[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.
[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.
[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

DESCRIPTION

ITAK-848 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Northeast of Brazil in 2018.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-848 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-848.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-848 was analyzed by eight specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-167/18 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-848 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).
- **b**: Acid digestion Method and determination by Atomic Emission Spectrometry (ICP).

PERIOD OF VALIDITY

This CRM certification is valid until: **October 10, 2028**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director

Certificate of Analysis 0725

Date: 10-10-2018

Version: 01

CRM ITAK-849
Certified Reference Material
Copper Ore

Table 1 – ITAK-849 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) [a, b]	1.062	0.016	0.013	0.0088	± 0.0043
Ni (%) [a, b]	0.1072	0.0031	0.0015	0.0027	± 0.0013

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.
[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).
[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.
[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.
[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

DESCRIPTION

ITAK-849 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Northeast of Brazil in 2018.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-849 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-849.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-849 was analyzed by eight specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-168/18 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-849 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).
- **b**: Acid digestion Method and determination by Atomic Emission Spectrometry (ICP).

PERIOD OF VALIDITY

This CRM certification is valid until: **October 10, 2028**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
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Certificate of Analysis 0726

Date: 10-10-2018
Version: 01

CRM ITAK-850
Certified Reference Material
Copper Ore

Table 1 – ITAK-850 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) [a, b]	3.554	0.063	0.054	0.033	± 0.015
Ni (%) [a, b]	0.0720	0.0026	0.0012	0.0023	± 0.0010

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.
[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).
[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.
[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.
[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

DESCRIPTION

ITAK-850 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Northeast of Brazil in 2018.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-850 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-850.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-850 was analyzed by eight specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-169/18 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-850 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).
- **b**: Acid digestion Method and determination by Atomic Emission Spectrometry (ICP).

PERIOD OF VALIDITY

This CRM certification is valid until: **October 10, 2028**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director

Certificate of Analysis 0727

Date: 10-10-2018
Version: 01

CRM ITAK-851
Certified Reference Material
Copper Ore

Table 1 – ITAK-851 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) [a, b]	6.98	0.29	0.12	0.26	± 0.094
Ni (%) [a, b]	0.1003	0.0050	0.0014	0.0048	± 0.0021

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.
[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).
[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.
[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.
[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

DESCRIPTION

ITAK-851 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Northeast of Brazil in 2018.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-851 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-851.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-851 was analyzed by eight specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-170/18 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-851 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).
- **b**: Acid digestion Method and determination by Atomic Emission Spectrometry (ICP).

PERIOD OF VALIDITY

This CRM certification is valid until: **October 10, 2028**.

CERTIFICATE REPRODUCTION

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Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director

Certificate of Analysis Nº 0266 - S

ITAK 809 CRM

Certified Reference Material – Copper Ore

This Certified Reference Material (CRM) is presented as a fine powder. This CRM is a standard for assessment and traceability of chemical analytical methods and instrumental analysis. CRM can also be used in QA/QC programs for drilling and mineral prospecting.

Natural Copper Ore has been used in the preparation of this CRM. This CRM was dried, crushed and pulverized.

Lab[1]	Cu (%)	Fe (%)	S (%)	Au (g/t)	Ag (g/t)	Ni [6] (%)	F [6] (g/t)	Cl [6] (g/t)	C [6] (%)
Certified Value[2]	0.359	4.60	0.70	0.247	2.43	0.004	1666.8	37.15	0.41
s[3]	0.010	0.23	0.070	0.023	0.29	---	---	---	---
μ[4]	0.020	0.46	0.14	0.050	0.63	---	---	---	---
UL[5]	0.379	5.06	0.84	0.297	3.05	---	---	---	---
LL[5]	0.339	4.14	0.55	0.197	1.80	---	---	---	---
Analytical Methods	a, b, c, d	a, b, d	g	e, f	a	a, d	h, i	b, h	g

Legend:

[1] The values on the table above represent the average of up to twelve samples of CRM ITAK 809 analyzed by up to nine specialized laboratories.

[2] The Certified Value is the average of the results of the interlaboratorial study.

[3] Estimated Standard Deviation.

[4] Estimated Uncertainty (α = 5%, n=1).

[5] **UL**: Upper Limit; **LL**: Lower Limit. Confidence Limits were calculated within 95% confidence (as per ISO Guide 35:1989 – Certification of Reference Materials – General and Statistical Principles – International Organization for Standardization).

[6] Informative Values.

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BS Technology Ltda
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João Monlevade - MG - Brazil.

Analytical Methods:

[a] Atomic Absorption Spectrometry (AAS)
[b] Titrimetric Method.
[c] Electrogravimetric Method.
[d] Inductively Coupled Plasma Optical Emission Spectrometry (ICP - OES).
[e] Fire Assay Method / Atomic Absorption Spectrometry.
[f] Fire Assay Method / Gravimetric Method.
[g] Infrared Analyzer (Leco)
[h] Potenciometric Determination
[i] Spectrometric Determination

PLANNING. PREPARATION AND ANALYSIS

This CRM was crushed, pulverized and tested for homogeneity by the INSTITUTO DE TECNOLOGIA AUGUST KEKULÉ – ITAK.

The preparation of this CRM (including drying, comminution, homogenization and quartering) was coordinated by the Chemist Smarck de Jesus Lelis, B.Sc., *Technical Director*. The statistical evaluations were coordinated by the Chemist Bráulio de Freitas Pessoa B.Sc., *Innovation and Technology Director*, both being aided by the ITAK Certified Reference Materials Production Department Technical Team.

CRM registered in Technical Report: RT-005/13 STD.

This certificate may only be reproduced in its entirety and without change.

This certificate of this CRM is valid until: **January 16, 2023**

João Monlevade. January 16, 2013.

Bráulio de Freitas Pessoa
Innovation and Technology Director
Instituto de Tecnologia August Kekulé
Chemist – CRQ 02.202.008

Smarck de Jesus Lelis
Technical Director
Instituto de Tecnologia August Kekulé
Chemist – CRQ 02.100.694

Certificate of Analysis 0928

Date: 05-16-2022
Version: 01

CRM ITAK-876
Certified Reference Material
Copper Ore

Table 1 – ITAK-876 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) [a]	0.182	0.011	0.0050	0.0099	± 0.0037
Ni (%) [a]	0.0635	0.0073	0.0017	0.0071	± 0.0027

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.

[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).

[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.

[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.

[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

DESCRIPTION

ITAK-876 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Northeast of Brazil in 2022.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-876 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-876.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-876 was analyzed by eight specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-024/2022 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-876 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).

PERIOD OF VALIDITY

This CRM certification is valid until: **May 16, 2032**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director

CRM ITAK-877
Certified Reference Material
Copper Ore

Table 1 – ITAK-877 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) [a]	0.562	0.016	0.015	0.0031	± 0.0030
Ni (%) [a]	0.0662	0.0090	0.0018	0.0088	± 0.0034

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.

[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).

[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.

[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.

[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

DESCRIPTION

ITAK-877 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Northeast of Brazil in 2022.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-877 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-877.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-877 was analyzed by eight specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-025/2022 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-877 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).

PERIOD OF VALIDITY

This CRM certification is valid until: **May 16, 2032**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director

CRM ITAK-878
Certified Reference Material
Copper Ore

Table 1 – ITAK-878 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) [a]	0.365	0.018	0.016	0.0067	± 0.0035
Ni (%) [a]	0.0241	0.0018	0.00075	0.0016	± 0.00065

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.

[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).

[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.

[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.

[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

DESCRIPTION

ITAK-878 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Northeast of Brazil in 2022.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-878 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-878.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-878 was analyzed by eight specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-026/2022 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-878 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).

PERIOD OF VALIDITY

This CRM certification is valid until: **May 16, 2032**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director

Certificate of Analysis 0931

Date: 05-16-2022

Version: 01

CRM ITAK-879
Certified Reference Material
Copper Ore

Table 1 – ITAK-879 – Certified Values

Element/Unit	Certified Value [1]	s [2]	s_r [3]	s_L [4]	U [5]
Cu (%) [a]	1.033	0.025	0.015	0.020	± 0.0088
Ni (%) [a]	0.0531	0.0038	0.0010	0.0037	± 0.0014

[1] The Certified Value was calculated according to ISO Guide 35 and ISO 5725-2.

[2] The standard deviation for proficiency assessment was calculated according to ISO 13528 and 5725-2. This standard deviation can be used for control charts for individual analysis (*n=1*).

[3] The within-laboratory standard deviation was calculated according to ISO 5725-2.

[4] The between-laboratory standard deviation was calculated according to ISO 5725-2.

[5] The extended standard uncertainty of the mean (α=5%) was calculated according to ISO Guide 35.

Note: The letters in front of the elements are codes for Analytical Methods used.

DESCRIPTION

ITAK-879 was prepared from a sample of Copper Ore donated by a Copper Mining Company from the Northeast of Brazil in 2022.

This Certified Reference Material (CRM) is presented as a fine powder.

INTENDED USE AND INSTRUCTIONS

ITAK-879 provides an important control in analytical data from exploration and can be used as a tool for grade control in routine mining and laboratory operations.

This Certified Reference Material can be used for calibration of analytical equipment, assess and develop new methods, validation of analytical methods, and arbitration – proficiency testing for example.

The bottles/sachets content should be thoroughly mixed before taking samples of ITAK-879.

The Certified Reference Material should be used without pre-treatment. ITAK is not responsible for any changes occurring after opening said bottles/sachets.

The Certified Reference Material should be stored in a dry place and without contact with excessive heat or moisture.

CERTIFICATION AND STATISTICAL EVALUATION OF ANALYTICAL DATA

ITAK-879 was analyzed by eight specialized laboratories. The statistical evaluation was carried out according to ISO GUIDE 35 and ISO 5725-2, using: identification and treatment of outliers, stragglers and technically invalid data, certified value calculation, standard deviation calculation, and extended standard uncertainty calculation.

The Technical Report: RT-027/2022 STD contains full details of all phases of manufacturing, certifying results, participating laboratories, and the statistical evaluation.
Note: This report is available on the ITAK database for CRM users.

ANALYTICAL METHODS

The methods used on the certification of CRM ITAK-879 are mentioned as follows:

- **a**: Acid digestion Method and determination by Atomic Absorption Spectrometry (AAS).

PERIOD OF VALIDITY

This CRM certification is valid until: **May 16, 2032**.

CERTIFICATE REPRODUCTION

This certificate must not be modified and may only be reproduced in its entirety and without change.

Bráulio de Freitas Pessoa
Chemist – CRQ 02.202.008
Technical Director