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PAN AMERICAN SILVER

TECHNICAL REPORT FOR THE HUARON PROPERTY, PASCO, PERU

In accordance with the requirements of National Instrument 43-101 "Standards of Disclosure for Mineral Projects" of the Canadian Securities Administrators

Effective date: October 30, 2022

Prepared By:
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1 SUMMARY

1.1 Introduction

This Technical Report has been prepared by Pan American Silver Corp. (Pan American or PAS), in accordance with the disclosure requirements of National Instrument 43-101 *Standards of Disclosure for Mineral Projects* (NI 43-101), to disclose relevant information about the Huaron property (the Property or Huaron). The report is an update to, and replaces, the "Technical Report for the Huaron Property, Pasco, Peru", with an effective date of June 30, 2014, prepared by Pan American (2014 PAS Technical Report). The main purpose of this report is to give an update on the Property, the Huaron mine operation and report the current Mineral Resources and Mineral Reserves.

The effective date of this Technical Report is October 30, 2022 and the effective date of the Mineral Resources and Mineral Reserves which were depleted for mining at that time is June 30, 2022.

1.2 Property description and ownership

This Technical Report refers to the Property, an underground silver-copper-lead-zinc mine located in the Huayllay district of the province of Pasco in the Central Highlands of Peru. Pan American is the 100% owner of Huaron and the mining concessions, through its wholly-owned subsidiary, Pan American Silver Huaron S.A.

1.3 Geology and mineralization

The Property is located within the Western Cordillera of the Andes Mountains and the regional geology is dominated by Cretaceous aged Machay Group limestones and Tertiary aged Pocobamba continental sedimentary rocks, which are referred to as the Casapalca Red Beds.

These groups have been deformed by the Huaron anticline, the dominant structural feature of the local area. The limestones and sedimentary rocks are strongly folded and intruded by quartz monzonite and quartz monzonite dikes with associated fracturing. Following the intrusion of the dikes, the sedimentary rocks were further compressed and fractured, and subsequently altered and mineralized by hydrothermal fluids forming the Huaron deposit on the Property.

Huaron is a hydrothermal polymetallic deposit of silver, lead, zinc, and copper mineralization hosted within structures likely related to the intrusion of monzonite dikes, principally located within the Huaron anticline. Mineralization is encountered in veins parallel to the main fault systems, in replacement bodies known as "mantos" associated with the calcareous sections of the conglomerates and other favourable stratigraphic horizons, and as dissemination in the monzonitic intrusions at vein intersections.

1.4 Status of exploration, development, and operations

The central part of the mineralization at Huaron is well defined by over 2,275 drillholes and has been the subject of prior Mineral Resource and Mineral Reserve estimates. Typical near mine exploration takes place on an annual basis, including testing of the open regions of the deposit at depth and along strike as well as infill drilling to upgrade the confidence categories of Mineral Resource and Mineral Reserve estimates.

The underground mine, mill, and supporting villages at Huaron were originally built in 1912 and operated until 1998, when a portion of the bed of a nearby lake collapsed and flooded the neighbouring underground mine. Through interconnected tunnels, the lake water entered and flooded the Huaron mine as well, causing its closure.

After the 1998 flooding, the Huaron mine operations were shut down and work was undertaken to clean up the flood damage, drain the workings, and prepare for an eventual mine re-opening. The water level in the lake, which provided the source of floodwater, is currently maintained well below the level where it flooded into the old workings and no further flooding is expected.

Pan American acquired a majority interest in Huaron from Mauricio Hochschild & Cía Ltda. (Hochschild) in 2000 and began full scale operations in 2001. Production rates vary, but over the past several years the Huaron processing plant has processed between 900,000 to 1,000,000 tonnes of ore annually, producing copper, lead, and zinc concentrates containing approximately 3.7 million ounces (Moz) of silver, 6,000 tonnes of copper, 8,500 tonnes of lead, and 18,000 tonnes of zinc. Pan American expects to process approximately one million tonnes per annum (Mtpa) over the course of the remaining life-of-mine (LOM).

Studies for expansion of the existing tailings storage facility are currently underway including engineering design for a filtered-stacked tailings which is expected to be constructed in 2023 pending permitting approval. The filtered-stacked tailings facility will provide additional tailings storage capacity to the existing conventional pulp tailings storage facility.

No economic analyses or other engineering studies are currently underway.

1.5 Mineral Resources

Pan American updates Mineral Resource estimates on an annual basis following reviews of metal price trends, operational performance and costs experienced in the previous year, and forecasts of production and costs over the LOM. Infill and near-mine drilling is conducted as required through the year. The drillhole data cut-off date for the commencement of the current geological interpretation was April 30, 2022 and the effective date of the Mineral Resource estimate is June 30, 2022.

The Mineral Resource estimates for the Property were prepared by Pan American staff under the supervision of, and reviewed by Christopher Emerson, FAusIMM, Vice President, Business Development and Geology of Pan American, who is a “Qualified Person” as that term is defined by NI 43-101 (QP). They have been estimated in accordance with the CIM Estimation of Mineral Resources and Mineral Reserves, Best Practice Guidelines (2019), and reported according to the CIM Definition Standards (2014).

Mineralization domains representing vein structures were defined in Leapfrog Geo software, while sub-block model estimates were completed within Datamine software, using capped composites and a multi-pass Ordinary Kriging (OK) or inverse distance squared (ID^2) interpolation approach. Blocks weren´t classified, the mined panels were classified considering local drillhole spacing and proximity to existing development.

Wireframe and block model validation procedures including wireframe to block volume confirmation, statistical comparisons with composite and swath plots, visual reviews in three-dimensional (3D), longitudinal, cross section, and plan views, as well as cross software reporting confirmation were completed for all structures.

A summary of the Mineral Resource estimates as of June 30, 2022, for the Property are presented in Table 1.1, and is prepared in accordance with NI 43-101 definitions.

Table 1.1 Summary of Mineral Resources as at June 30, 2022

Classification	Tonnes Mt	Ag g/t	Ag contained metal Moz	Cu %	Pb %	Zn %
Measured	2.08	163	10.88	0.42	1.58	3.05
Indicated	2.37	166	12.69	0.40	1.71	2.92
Measured + Indicated	**4.46**	**165**	**23.57**	**0.41**	**1.65**	**2.98**
Inferred	**7.25**	**155**	**36.13**	**0.26**	**1.47**	**2.73**

Notes:
- CIM Definition Standards (2014) were used for reporting the Mineral Resources.
- Mineral Resources exclude those Mineral Resources converted to Mineral Reserves.
- Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.
- Mineral Resource estimates were prepared under the supervision of or were reviewed by Christopher Emerson, FAusIMM, Vice President, Business Development and Geology of Pan American.
- The Mineral Resource estimates are based on an incremental cut-off value of $80.59/t.
- Metal prices used are $19 per ounce of silver, $7,000/t for copper, $2,000/t for lead, and $2,600/t for zinc.
- The value per tonne (VPT) used to determine cut-off is based on a combination of metal price and individual metal recoveries which are variable throughout the deposit, and smelter considerations.
- Mineral Resources were constrained to conform with “reasonable prospects for eventual economic extraction” (RPEEE).
- The drillhole database was closed at April 30, 2022.
- Totals may not add up due to rounding.

1.6 Mineral Reserves

Mineral Reserve estimates were prepared by Pan American technical staff under the supervision of and reviewed by Martin Wafforn, P.Eng., Vice President, Technical Services of Pan American, who is a QP.

Mineral Reserve estimates are based on assumptions that included mining, metallurgical, infrastructure, permitting, taxation, and economic parameters. Increasing costs and taxation and lower metal prices will have a negative impact on the quantity of Mineral Reserve estimates. There are no other known factors that may have a material impact on the Mineral Reserve estimates at Huaron.

Mineral Reserves for Huaron as of June 30, 2022, comprising material classified as Proven and Probable Reserves using metal prices of $19 per ounce of silver, $2,000 per tonne of lead, $2,600 per tonne of zinc, and $7,000 per tonne of copper, are given in Table 1.2.

Table 1.2 Summary of Huaron Mineral Reserves as of June 30, 2022

Classification	Tonnes Mt	Ag g/t	Ag contained metal Moz	Cu %	Pb %	Zn %
Proven	7.02	169	38.1	0.54	1.51	2.97
Probable	3.93	167	21.1	0.30	1.63	2.97
Proven + Probable	**10.95**	**168**	**59.2**	**0.45**	**1.55**	**2.97**

Notes:
- CIM Definition Standards (2014) were used for reporting the Mineral Reserves.
- Mineral Reserves are classified as Proven or Probable depending on the resource classification.
- Totals may not compute exactly due to rounding.
- Cut-off values are based on a silver metal price of $19/oz, lead metal price of $2,000/t, zinc metal price of $2,600/t, and $7,000 /t of copper.
- Metallurgical recoveries are based on feed grades, routine metallurgical testing results and historical recoveries.
- Mining recoveries for sub-level long hole stoping (SLOS) and cut and fill (C&F) are 93% and 95%, respectively.
- Unplanned mining dilution for SLOS is 7%, and the planned internal mining dilution is from 9% to 36% for SLOS. C&F has unplanned mining dilution of 5%, and the planned internal dilution varies from 18% to 31%. The average planned internal dilution for the LOM is 25%.

- Mineral Reserve estimates were prepared under the supervision of or were reviewed by Martin Wafforn, P.Eng., Vice President, Technical Services of Pan American.
- Mr. Wafforn, P.Eng. is the Qualified Person for the Mineral Reserve estimates.
- Mineral Reserves are in addition to Mineral Resources.

1.7 Mining

Mechanized longitudinal C&F is used in areas where the development of an access ramp can be economically justified. This is typically the case where the orebody is moderately dipping (<55°), sufficiently wide (up to 10 metres (m)) and economic veins are present, or where the north-south striking and east-west striking vein sets cross and provide additional mining faces. Drilling is undertaken with electric hydraulic jumbo drills and the broken ore is removed using scoop trams.

C&F mining at Huaron commences once the decline (spiral ramps) reaches the footwall (FW) drive or level access elevation of the orebody, usually midway along its strike length (see representative C&F sequence sketch in Figure 16.3). C&F is an overhand mining method, and the stope sequence begins with the lowest 3.5 m high lift. Then each subsequent lift requires the back of the level access to be slashed down ('take down-back' or TDB) to reach the next lift. There are typically four or five lifts between levels for a total rise of 15.0 m to 17.5 m from each access.

1.8 Mineral processing and recovery methods

The Huaron mine operation is a 3,200 tonnes per day (tpd) mill with froth induced flotation to produce silver in copper, lead, and zinc concentrates. The mill flowsheet consists of three-stage crushing, ball mill grinding, and selective flotation of the ore to concentrates, followed by thickening and filtering of the concentrates. A portion of the tailings from the process are cycloned to produce sands for backfill material for the underground mining operation, and the fines and rest of tailings are deposited into a tailing impoundment facility.

1.9 Infrastructure

The mine infrastructure comprises the underground mine workings, processing facilities, existing tailing impoundments, effluent management and treatment systems, waste rock storage facilities, maintenance shops and warehouses laboratories, storage facilities, offices, drill core and logging sheds, water and power lines, access roads, and the worker's camp and recreational facilities. The primary source of power for the mine is the Peruvian national power grid which is sufficient for the mine's current requirements. The power consumption is approximately 66 million kilowatt hours per year.

The operating mine is mature and site infrastructure including site roads are fully developed to support the existing mine production of one Mtpa.

1.10 Environmental

The most significant environmental issue currently associated with the mine is treatment of the waters discharged from the mine and localized areas of acid rock drainage from historic tailings below the mine's tailings deposit. All waters are captured and treated in a treatment plant near the exit of the Paul Nevejans drainage tunnel to achieve compliance with discharge limits. There are no known environmental or social issues that could materially impact the mine's ability to extract the Mineral Resources and Mineral Reserves.

A full suite of environmental baseline and impact assessment studies were completed by Pan American for an update and tailings facility expansion Environmental Impact Assessment (EIA). The studies performed include surface water, groundwater, biodiversity, seismic hazards, soils, geomorphology, air quality, and climate. No material issues were identified in any environmental studies and the EIA was approved by the Peruvian Ministry of Energy and Mines in 2010. Pan American is planning to commence new baseline studies, which will supplement the regular environmental monitoring, for a modification to the Huaron EIA in mid-2022.

Huaron participates in the Mining Association of Canada's "Towards Sustainable Mining" program and has achieved Level A on environmental protocols.

1.11 Capital and operating costs

Since the mine is in operation, any sustaining capital expenditures are justified on an on-going basis based on actual experience at the mine. Sustaining capital expenditures during 2022 primarily for mine development, diamond drilling, tailings facility expansions and mine infrastructure are estimated to total $17.5 million. The main mobile mining equipment is leased, and new leases will be undertaken throughout the mine life to ensure that the mining fleet maintains a high availability. Operating lease expenditures in 2022 are expected to total $2.7 million. The amount of diamond drilling conducted to extend the mine life beyond the existing Mineral Reserves forming the basis of the current LOM plan will be at the discretion of Pan American and may depend on the success of exploration and diamond drilling programs, if any, and prevailing market conditions.

1.12 Conclusions and recommendations

Pan American has been operating Huaron since 2001 and expects to process approximately one Mtpa over the course of the remaining LOM.

Pan American conducts infill and near-mine drilling through much of the year and updates Mineral Resource and Mineral Reserve estimates on an annual basis following reviews of metal price trends, operational performance and costs experienced in the previous year, and forecasts of production and costs over the LOM.

There are no known environmental, permitting, legal, title, taxation, socio-economic, marketing, political, or other factors or risks that could materially affect the development of the Mineral Resources. Mineral Reserve estimates are based on assumptions that include mining, metallurgical, infrastructure, permitting, taxation, and economic parameters. Increasing costs and taxation and lower metal prices will have a negative impact on the quantity of Mineral Reserve estimates. There are no other known factors that may have a material impact on the Mineral Reserve estimates at Huaron.

Huaron is a producing mine. Studies for expansion of the existing tailings storage facility are currently underway including engineering design for filtered-stacked tailings. The authors of this report have no further recommendations to make at this time.

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ABBREVIATIONS AND ACRONYMS

Abbreviations & acronyms	Description
$	United States dollar
$/oz	Dollar per ounce
$/t	Dollar per tonne
%	Percentage
°	Degree
°C	Degree Celsius
µm	Micron
3D	Three-dimensional
AMC	AMC Mining Consultants (Canada) Ltd.
ANFO	Ammonium nitrate fuel oil
C&F	Cut and fill
cm	Centimetre
COG	Cut-off grade
EAU	Economic Administrative Unit
EIA	Environmental Impact Assessment
FW	Footwall
g	Gram
g/cm^3	Gram per cubic centimetre
g/t	Grams per tonne
G&A	General and Administration
ha	Hectare
Hochschild	Mauricio Hochschild & Cía Ltda.
HW	Hangingwall
ID^2	Inverse distance squared
INGEMMET	Institute of Geology, Mining, and Metallurgy
kg	Kilogram
km	Kilometre
km^2	Squared kilometre
kV	Kilovolt
LDL	Lower limit of analytical detection
LOM	Life-of-mine
m	Metre
m^2	Squared metre
m^3	Cubic metre
m^3/hr	Cubic metre per hour
m^3/s	Cubic metre per second
MEM	Ministry of Energy and Mines
mm	Millimetre
Moz	Million ounces
Mt	Million tonnes
MTPD	Metric tonnes per day
Mtpa	Million tonnes per annum
MW	Megawatt

Abbreviations & acronyms	Description
NI 43-101	National Instrument 43-101
NSR	Net Smelter Return
OK	Ordinary kriging
oz	ounce
P_{80}	80% Passing
PAS, Pan American	Pan American Silver Corp.
Penarroya	French Penarroya Company
ppm	Parts per million
Property	Huaron Property
QA/QC	Quality assurance and quality control
QP	Qualified Person
RPD	Relative paired difference
RPEEE	Reasonable prospects for eventual economic extraction
SD	Standard deviation
SEIN	National Interconnected Electrical System
SLOS	Sub-level open stoping
SMT	Special Mining Tax
SRM	Standard reference material
t	Tonne
TDB	Take-down-back
TMF	Tailings Management Facility
tpd	Tonnes per day
VPT	Value per tonne

2 INTRODUCTION

2.1 General and terms of reference

This Technical Report has been prepared by Pan American, in accordance with the disclosure requirements of NI 43-101, to disclose relevant information about the Property. The report is an update to, and replaces, the 2014 PAS Technical Report, with an effective date of June 30, 2014, prepared by Pan American. The main purpose of this report is to give an update on the Property, the Huaron mine operation, and report the current Mineral Resources and Mineral Reserves.

The effective date of this Technical Report is October 30, 2022. The effective date of the Mineral Resource and Mineral Reserve estimates are June 30, 2022. No new material information has become available between these dates and the signature date given on the certificate of the QPs.

2.2 The Issuer

Pan American is a silver mining and exploration company listed on the Toronto (TSX:PAAS) and NASDAQ (NASDAQ:PAAS) stock exchanges. It has a diversified portfolio of mining and exploration assets located throughout the Americas, which includes 10 operating mines.

2.3 Report authors

The names and details of persons who prepared this Technical Report, are QPs and are not independent of Pan American. The responsibilities of each QP are provided in Table 2.1.

Table 2.1 Responsibilities of each qualified person

Qualified Persons responsible for the preparation and signing of this Technical Report						
Qualified Person	**Position**	**Employer**	**Independent of Pan American**	**Date of last site visit**	**Professional designation**	**Sections of report**
Martin Wafforn	Senior Vice President, Technical Services and Process Optimization	Pan American Silver Corp.	No	October 27 2021	P.Eng.	2 - 5, 15, 16, 19 - 22, 24 - 26 and 1.1, 1.7, 1.8, 1.11, 1.12, 12.2
Christopher Emerson	Vice President, Business Development and Geology	Pan American Silver Corp.	No	October 27 2021	FAusIMM	6 - 11, 14, 23, 27 and 1.2, 1.3, 1.4, 1.6, 12.1
Americo Delgado	Vice President, Mineral Processing, Tailings and Dams	Pan American Silver Corp.	No	September 21 - 23, 2021	P.Eng.	13, 17, 18, and 1.5, 1.9, 1.10, 12.3

Those who have assisted the QPs in its preparation, are also listed in Table 2.2.

Table 2.2 Responsibilities of those assisting each qualified person

Other experts who have assisted the QPs					
Expert	**Position**	**Employer**	**Independent of Pan American**	**Visited site**	**Sections of report**
Mo Molavi	Director / Principal Mining Engineer	AMC	Yes	No	All
Mort Shannon	General Manager / Principal Geologist	AMC	Yes	No	2 - 12, 14.
Paul Salmenmaki	Principal Mining Engineer	AMC	Yes	No	15, 16,
Carlos Manchego	Senior Manager Mineral Resources	Pan American Silver Corp.	No	Yes	14
Sam Coronado	Mine Geology Director	Pan American Silver Corp	No	Yes	7 - 12
Brian Brodsky	Director of Geology	Pan American Silver Corp.	No	Yes	6 - 12
Mathew Andrews	Vice President, Environment	Pan American Silver Corp.	No	Yes	4, 5, 20
Carl Defilippi	Engineering Manager	KCA	Yes	Yes	13, 17
Caleb Cook	Project Engineer/ Project Manager	KCA	Yes	No	13, 17

Note: AMC refers to AMC Mining Consultants (Canada) Ltd. KCA refers to Kappes, Cassiday & Associates.

2.4 Sources of information

Unless otherwise stated, information, data, and illustrations contained in this report or used in its preparation have been provided by Pan American for the purpose of this report. The most recent prior Technical Report is the 2014 PAS Technical Report, with an effective date of June 30, 2014, prepared by Pan American.

2.5 Other

Inspections of the Property are carried out regularly by the QPs. The most recent visits are discussed below.

Mr. Wafforn visits the Property two or three times annually as part of his duties with Pan American. His most recent site visits were on January 21, 2021 and October 27, 2021. During these visits, Mr. Wafforn reviewed the operational mine plan, actual mine operation data, the development advance and plans for the underground mine, consultant’s geotechnical reports, mine budget plans, reserve to grade control to actual reconciliations, the site layout and logistics for mining and processing, safety protocols and indicators, the environmental layout, and general business performance.

Mr. Emerson most recently visited the Property on October 27, 2021. During the visit Mr. Emerson reviewed the exploration drilling, sampling, and sample security protocols, drill core and the core cutting and storage facilities, bench and surface mapping, cross sections, the operational mine plan, actual mine operation data, grade control protocols, mining leases, site access, surface rights information, and general business performance.

Mr. Delgado makes regular visits and most recently visited the Property on September 21-23, 2021. During the visit Mr. Delgado reviewed the processing and tailings storage facilities, tailings management system, mineral processing parameters, metallurgical balances, consultant’s geotechnical designs and reports, operational practices and data, and general business performance.

Unless otherwise stated, all units are in metric and currencies are expressed in United States dollars.

This report has an effective date of October 30, 2022.

3 RELIANCE ON OTHER EXPERTS

The QPs responsible for this report have relied on the following internal expert within the organization for input to certain sections of this report for which they do not have specific expertise and have taken appropriate steps, in their professional judgement, to ensure that the work, information, or advice that they have relied upon is sound:

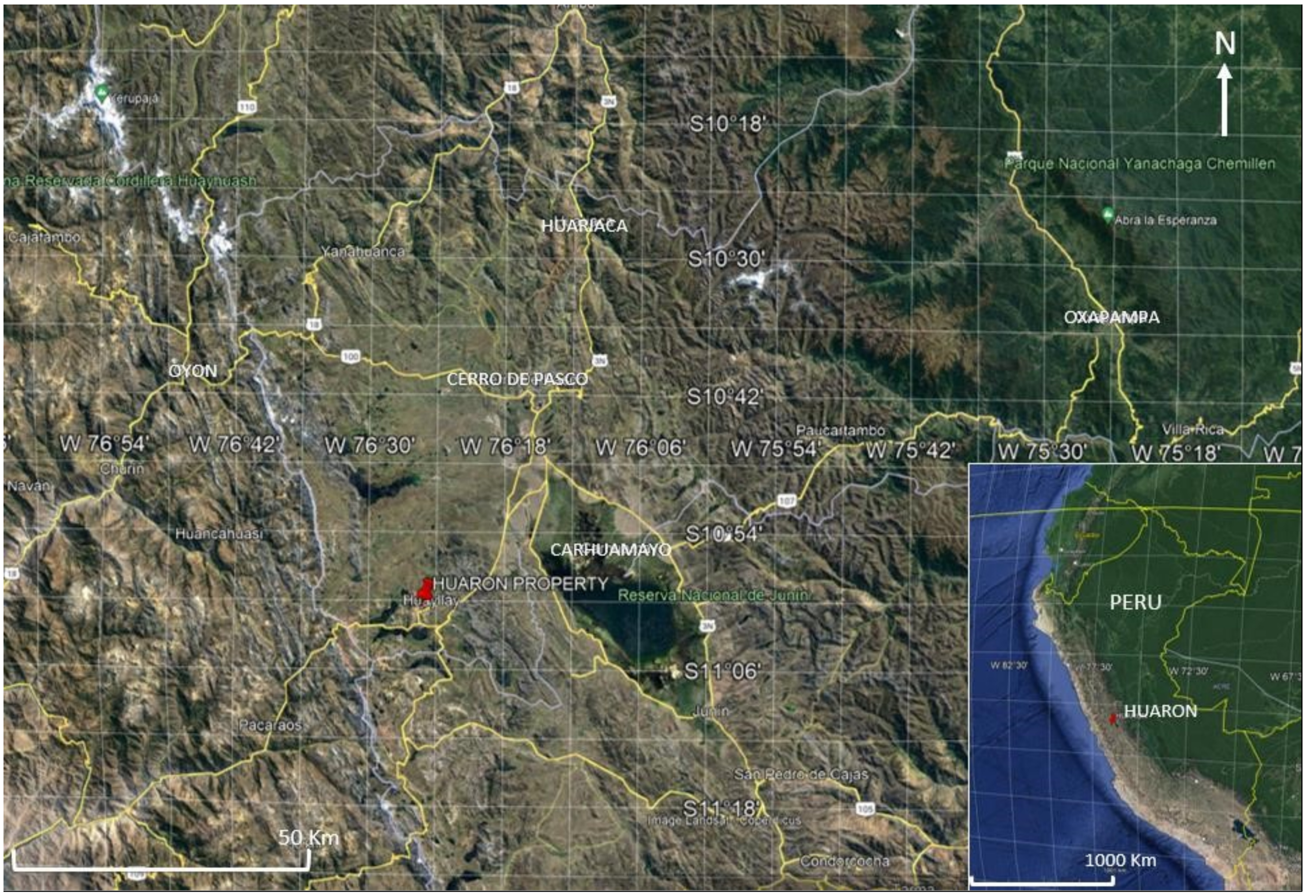
Mathew Andrews, Vice President Environmental, Pan American has contributed to Sections 4.4, 4.5, and 20 by providing information and opinions relating to environmental details that are described in those sections. The information and opinions are believed to be current, accurate and complete as of the effective date of this report.

4 PROPERTY DESCRIPTION AND LOCATION

4.1 Location, issuer's interest, mineral tenure, and surface rights

The Property within which the Huaron underground polymetallic silver mine is located, is in the Huayllay district of the province of Pasco in the Central Highlands of Peru. It is located at a latitude of 11°00'S and a longitude of 76°25'W. The nearest city of Cerro de Pasco is a major mining centre and the capital of the region, with a population of approximately 70,000. A map of the Property location is shown in Figure 4.1.

Figure 4.1 Property location map



Source: Google Earth Pro (2021).

4.2 Mineral tenure and title

Pan American is the 100% owner of Huaron and the mining concessions, through its wholly-owned subsidiary, Pan American Silver Huaron S.A. The mineral rights are held on 171 mining concessions with a combined area of 15,576.31 hectares (ha), covering all of the Mineral Resources and Mineral Reserves, and surface infrastructure, as well as one processing concession. The concessions are permanently granted provided that the holder complies with an annual payment to the Institute of Geology, Mining, and Metallurgy (INGEMMET), which is a branch of the Peruvian Ministry of Energy and Mines. Pan American makes the required annual payments to maintain the mining concessions and has agreements in place granting surface rights and legal access to the mining operations. To Pan American's knowledge, all obligations required for the conduct of mining operations at Huaron are currently in good standing.

There are three types of concessions present on the Property, including mining concessions, which grant holders of the concessions the right to explore and exploit the Mineral Resources within the concession;

processing concessions, which grant the right to process minerals, and concessions which grant the right to provide auxiliary services to the mining concessions and lie outside the Economic Administrative Units (EAUs). Details of the 171 mining concessions and the processing concession are given in Table 4.1. Other than the Processing concession, which is not assigned an area, 121 of the mining concessions are concessions required by the mine operations and cover 4668.82 ha, and the remaining 48 mining concessions are outside of the EAUs and cover 10,807.50 ha. This gives a total area of 15,476.31 ha for the total concession area.

Table 4.1 Mining concession details

Number	Name	Area (ha)	Number	Name	Area (ha)
Processing concession					
P0100085	Concentradora Francois	N/A			
Mining concessions					
04003370Y01	ABUNDANCIA	0.1603	04002451Y01	CONSTANCIA	1.0825
0403370AY01	ABUNDANCIA-A	0.0486	0402451AY01	CONSTANCIA-A	0.0739
04013287X01	ACUMULACION HUARON - 4	96.6606	04008037X01	CORDOBA	0.9554
04013289X01	ACUMULACION HUARON 6	251.6261	04012511X01	DARDANELOS	0.1982
04013284X01	ACUMULACION HUARON-1	795.6725	04003615X01	DIECINUEVE DE SETIEMBRE	0.5719
04013285X01	ACUMULACION HUARON-2	540.4909	04013463X01	DON JUAN Nº 2-88	687.5424
04013286X01	ACUMULACION HUARON-3	534.3813	04004653X01	DON PABLO	0.0464
04013290X01	ACUMULACION HUARON-7	787.1053	04003023X01	EL RAYO	0.2082
04002265Y01	ALIANZA Y FIRMEZA	0.0639	04003024X01	EL TRUENO	0.0741
0402265AY01	ALIANZA Y FIRMEZA-A	0.0169	04008033X01	ESPAÑA	0.1120
04004655X01	ALICIA	0.7654	04006692X01	FARALLON	7.9860
04002572X01	ALPAMINA	0.0506	04008586X01	FLORENCIA	0.1164
0402572AX01	ALPAMINA-A	0.8525	0403093AY01	FLORENCIA-A	0.2448
04000997X01	ANIMAS	0.1872	04004527X01	GAVIOTA	0.9225
04003431X01	APURO	0.3709	0404527AX01	GAVIOTA-A	1.8589
04000466X01	BALCON DE JUDAS	17.9689	04008276X01	GRANADA	5.5781
04001000X01	BALSAMO	1.9965	04004591X01	GUILLERMO BILLINGHURST	0.2760
04013394X01	C.M.H. Nº 101	0.5690	04002568X01	HUALGAYOC	0.0451
04013495X01	C.M.H. Nº 102	1.1554	04002567X01	HUANCAVELICA	0.0314
04013496X01	C.M.H. Nº 103	0.1834	04006355X01	HUAROCHIRI	0.5925
04010514X01	C.M.H. Nº 15	125.7841	010250094	HUARON 1	211.6553
04008913X01	C.M.H. Nº 16	0.7284	010250194	HUARON 2	1.6569
04008319X01	C.M.H. Nº 2	0.9388	010250294	HUARON 3	180.9170
04009299X01	C.M.H. Nº 25	21.6565	010250394	HUARON 4	127.5334
04009300X01	C.M.H. Nº 27	2.7139	010250494	HUARON 5	29.6580
04009301X01	C.M.H. Nº 28	29.6141	04008295X01	JUANA	0.0437
04008320X01	C.M.H. Nº 3	0.5161	04002211Y01	LA ALIANZA	11.9792
04009303X01	C.M.H. Nº 30	0.3297	04001001X01	LA CENTRAL	1.9966
04009433X02	C.M.H. Nº 33	1.7925	04006749X01	LA HUACA	0.7078
04009435X01	C.M.H. Nº 35	0.2543	0403589AY01	LA HUACA-A	0.0883
0403885AY01	C.M.H. Nº 3-A	0.7375	0403589BY01	LA HUACA-B	0.0486
04009481X01	C.M.H. Nº 44	0.8016	04004599X01	LA PEDRERA	0.5145
04008593X01	C.M.H. Nº 5	0.2413	04000099X01	LA PROVIDENCIA	0.0114
04009488X01	C.M.H. Nº 51	0.1332	04000998X01	LA TAPADA	3.9931

Number	Name	Area (ha)	Number	Name	Area (ha)
04009495X01	C.M.H. Nº 52	0.8838	04770771X01	LABOR Y CONSTANCIA	23.9590
04009581X01	C.M.H. Nº 57	0.0967	04001486X01	MANLINCHER	5.9959
04009589X01	C.M.H. Nº 65	0.0837	04006337X01	MARIA	0.0836
04009591X01	C.M.H. Nº 67	0.0288	04000632X01	MARTE	0.0798
04008823X01	C.M.H. Nº 7	0.1435	04008014X01	MAX	0.0627
04009595X01	C.M.H. Nº 71	7.6848	04008013X01	MICHEL	0.5375
04009596X01	C.M.H. Nº 72	9.3854	04002570X01	MOROCOCHA	0.0677
04009843X01	C.M.H. Nº 74	26.1679	04007963X01	NUESTRA SEÑORA DEL MILAGRO	11.9793
04009844X01	C.M.H. Nº 75	0.2346	04002435Y01	NUESTRA SEÑORA DEL ROSARIO	0.1614
04009846X01	C.M.H. Nº 76	0.1020	04002617X01	OLVIDO	2.4026
04010746X01	C.M.H. Nº 79	0.5570	04000999X01	ORACULO	3.9930
04010978X01	C.M.H. Nº 84-DOS	0.9983	04006436X01	PACHITEA	0.7729
04007533X01	C.P.H. Nº 1	0.0601	04007960X01	PANDORA	1.9966
04007547X01	C.P.H. Nº 15	0.0100	04000811X01	PLANETA	1.9965
0407533AX01	C.P.H. Nº 1-A	0.1651	04001253Y01	ROSARIO	2.1132
04007534X01	C.P.H. Nº 2	0.0226	04007524X01	ROSARIO NUMERO CINCO	0.0100
04007555X01	C.P.H. Nº 23	0.5511	04008019X01	ROSARIO NUMERO CUATRO	0.0246
04007556X01	C.P.H. Nº 24	0.8570	04001130X01	SACERDOTIZA	0.1416
0407534AX01	C.P.H. Nº 2-A	0.3778	04004654X01	SANTIAGO	0.0341
04007536X01	C.P.H. Nº 4	0.0459	04008039X01	SEVILLA	0.0608
04007594X01	C.P.H. Nº 55	0.0642	04012512X01	TEUTONIA 79	0.0425
0403659AY01	C.P.H. Nº 55-A	0.3420	04012513X01	TEUTONIA DOS-79	3.5061
04007538X01	C.P.H. Nº 6	0.4477	04012514X01	TEUTONIA TRES-79	0.0100
04000874X01	CAGLIOSTRO	1.2773	010346806	UNION 7	44.2112
04003371Y01	CATORCE DE ABRIL	0.0853	04004857X01	VEINTE DE FEBRERO	0.1448
04000832X01	COMETA	15.9727	04002221Y01	VENUS	1.2216
04002573X01	CONCHUCOS	0.6759	**Total**	**Mining Concessions**	**4,668.8189**
Mining concessions outside the EAUs					
0413290AX01	ACUMULACION HUARON-7-A1	7.9708	010235798	HORIZONTE 4	1000.0000
010480708	BUEN PASO	97.3932	010242598	HORIZONTE 68	386.0870
04009964X01	C.M.H. CHASQUI-HUASI	32.0003	010250194A	HUARON 2A	85.3000
04009995X01	C.M.H. CHASQUIHUASI NUMERO DOS	15.9997	010250294A	HUARON 3-A1	31.2087
07000365X01	C.M.H. LIMONITA NORTE	56.0001	0410353AX01	LA ESPERANZA DE CARHUAMAYO	15.0000
07000367X01	C.M.H. LIMONITA SUR	39.9995	0410129AX01	LA VERDAD	15.0000
0403998AY01	C.M.H. N° 28-A1	1.0184	010610407	LIMONITA 1	148.7534
04008978X01	C.M.H. Nº 18	7.9999	010610307	LIMONITA 2	88.6498
04009045X01	C.M.H. Nº 19	16.0000	010127509	LIMONITA TRES	100.0000
04009911X01	C.M.H. TIPISH	60.0003	04012743X01	RELAVE FRANCOIS-1	60.0000
07000366X01	CMH CUESTAS	17.9997	04009440X01	SAN ANDRES NUMERO UNO	8.0000
04013464X01	DON JUAN Nº 4-88	239.9996	04012993X01	SAN CARLOS 79	181.9998
04008809X01	EL TRIUNFO	8.0000	07000131X01	SAN JORGE II	40.0000

Number	Name	Area (ha)	Number	Name	Area (ha)
010188012	GATITA 02-A	200.0000	07000132X01	SAN JORGE III	32.0001
010644507	HERBERT 1	19.7756	07000130X01	SAN JORGE IV	49.9998
010644207	HERBERT 2	23.7851	07000146X01	SAN JORGE IX	47.9999
010644407	HERBERT 3	464.4003	07000017X01	SAN JORGE Nº 1	120.0007
010644307	HERBERT 4	446.2397	07000133X01	SAN JORGE V	32.0003
010236398	HORIZONTE 10	500.0000	07000134X01	SAN JORGE VI	72.0003
010236498	HORIZONTE 11	992.0001	07000135X01	SAN JORGE VII	35.9997
010236698	HORIZONTE 13	699.2807	07000145X01	SAN JORGE VIII	29.9999
010236798	HORIZONTE 14	947.6313	07001624X01	SAN JORGE X	324.0018
010237398	HORIZONTE 20	1000.0000	04010668X01	SANTA LUISA N° 1	10.0000
010237498	HORIZONTE 21	1000.0000	010409797	VITACANCHA-R	1000.0000
			010113722	AMELIA 2022	100.0000
Total	**Non mining (EAU) concessions**	**10,907.4955**	**Grand total**	**All concessions**	**15,576.3144**

4.3 Royalties, back-in rights, payments, agreements, and encumbrances

The principal taxes of Peru affecting Huaron include income tax, an employee profit sharing tax, annual fees for holding mineral properties, various payroll and social security taxes, a refundable value added tax, a mining royalty tax, and a Special Mining Tax (SMT). The royalty is applied on a company's operating income and is based on a sliding scale with marginal rates ranging from 1% to 12% with a minimum royalty rate of 1% of sales regardless of its profitability.

There are no known back-in rights, payments, agreements, or encumbrances on the Huaron concessions.

4.4 Environmental liabilities

The environmental liabilities at Huaron are typical of an operating mine. Huaron received approval of the mine's environmental liabilities plan in 2009, which was successfully executed and concluded in 2012. From that date Pan American has continually monitored the physical stability of reclaimed mine waste and tailings facilities, hydrological, and biological factors, as well as social commitments. These factors are reported semi-annually to the Peruvian Evaluation and Environmental Control Agency, which demonstrate the reintegration of the surrounding area to its natural landscape. The post closure phase is expected to last for five years, after which environmental certification of closure will be processed.

The most significant environmental issue currently associated with the mine is relatively high metal concentrations in the waters discharged from the mine and localized areas of acid rock drainage from the mine's tailings deposit areas. All waters are captured and treated in a treatment plant near the exit of the Paul Nevejans drainage tunnel to achieve compliance with discharge limits. Peruvian legislation sets out the progressive implementation of new, stricter water quality limits both for discharges and receiving waters by the end of 2015. An "Adaption Plan" which sets out a program of baseline monitoring and data collection to evaluate future compliance of Huaron with the new limits was presented to the Ministry of Energy and Mines (MEM) in September 2012. The plan is still under evaluation and the schedule for implementation of new guideline limits is not yet confirmed.

There are no known environmental or social issues that could materially impact the mine's ability to extract the Mineral Resources and Mineral Reserves.

4.5 Permits

Pan American holds all the necessary environmental and operating permits for the development and operation of the existing mine and is in compliance with Peruvian law. The MEM has provided approval for Environmental Compliance and Management, the Special Program for Environmental Management, and Environmental Impact Studies.

Pan American has obtained other permits necessary for normal operations of the mine, including permits for water use, re-use of treated domestic wastewater, treated industrial and domestic wastewater disposal, mine closure plans, tailings facility growth schedules, the use and storage of explosives, and facilities for liquid fuel.

4.6 Significant factors and risks

There are no known significant factors or risks that may affect access, title, or the right or ability to conduct mining, processing, and exploration activities at Huaron.

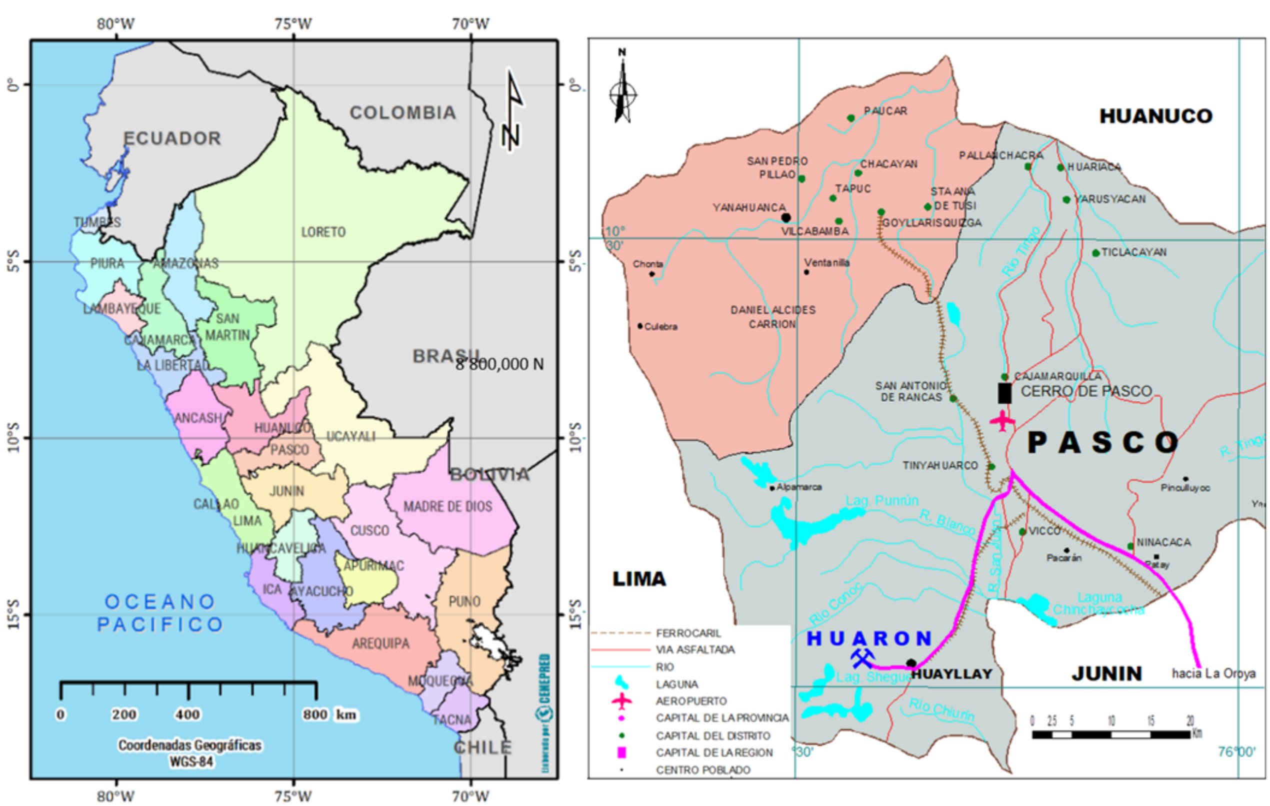
5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE, AND PHYSIOGRAPHY

5.1 Access, transport, and population centre

Access to Huaron is by a continuously maintained 285 kilometres (km) paved highway between Lima and Unish and a 35 km mostly paved road between Unish and Huaron. Access is also possible by two other longer and more difficult gravel roads. There is a light aircraft strip at the town of Vicco, which is located approximately 30 minutes flying time from Lima, at which point an additional 30 minutes of driving is required to reach Huaron.

The nearest city is Cerro de Pasco, a major historical mining center with a population of approximately 70,000 people, which is connected to Lima 320 km to the southwest by road and rail. The nearby town of Huayllay also provides workers, lodging, and supplies. Experienced mining personnel from the region commute to the Property via company sponsored buses, company vehicles, or privately owned vehicles. Materials, fuel, and produced metal concentrates are transported to their destinations by road. Concentrates may also be transported by rail which is in close proximity to the site, as seen Figure 5.1.

Figure 5.1 Huaron location map



Source: Ministerio de Transportes y Comunicaciones Perú (2022).

5.2 Climate, length of operating season, and physiography

The climate at the mine site is classified as “cold climate” or “boreal” with average annual temperatures ranging from 3°Celsius (C) to 10°C. Huaron operates throughout the entire year. The topography at the mine site is hilly with locally steep slopes, at elevations ranging from 4,250 m to 4,800 m above sea level. Natural vegetation consists mainly of grasses forming meadows which have permitted development of varied livestock operations.

5.3 Surface rights, land availability, infrastructure, and local resources

Surface rights for mining operations are sufficient and secure. The known mineralized zones, Mineral Resources and Mineral Reserves, mine workings, the processing plant, existing tailing impoundments, effluent management and treatment systems, and waste rock storage facilities are located within 119 of the 171 concessions. The mine is authorized to use up to 10.11 million cubic metres (M^3) per annum of water obtained from a system of nearby lakes for mining activities through payment of a water use permit. This volume of water is more than sufficient for the mine’s requirements. The primary source of power for the mine is the Peruvian national power grid and is sufficient for the mine’s current requirements. The power consumption is approximately 66 million kilowatt hours per year. An overview of the site infrastructure and footprint is shown in Figure 5.2.

Figure 5.2 Huaron site overview

Source: PAS (2022) after Google Earth Pro.

6 HISTORY

6.1 Ownership

The underground mine, mill, and supporting villages at Huaron were originally built in 1912 by a subsidiary of the French Penarroya Company (Penarroya). In 1987 the mine was sold to Hochschild. In April 1998, a portion of the bed of the nearby Lake Naticocha collapsed and flooded the neighbouring underground mine. Through interconnected tunnels, the lake water entered and flooded the Huaron mine as well, causing its closure.

After the April 1998 flooding, the Huaron mine operations were shut down, the labour force was terminated, the camp closed, and work was undertaken to clean up the flood damage, drain the workings, and prepare for an eventual mine re-opening. The water level in the lake, which provided the source of floodwater, is currently maintained well below the level where it flooded into the old workings and no further flooding is expected. In September 2000, the Animon mine, in accordance with a settlement agreement reached with Cía Ltda. Minera Huaron S.A., constructed a channel to route water around the lake to provide water for the Huaron mine operation and to reduce the water in upstream lakes in order to prevent agricultural flooding, which had created local social pressures.

Pan American acquired a majority interest in Huaron from Hochschild in 2000 and fast-tracked the re-opening project through feasibility, financing, and construction to begin full scale operations in 2001. Pan American subsequently acquired the remaining interest and now holds 100% of the Property.

6.2 Work carried out

There is no available exploration data collected by previous operators other than diamond drilling. Channel samples were taken by Penarroya and by Hochschild, but no details on the nature and extent of the samples are available, and none of the channel samples collected by previous owners are used in the Mineral Resource and Mineral Reserve estimates.

6.3 Mineral Resource and Mineral Reserve estimates

The historical exploration work was carried out in the form of underground drifting and mining, and no historical Mineral Resource and Mineral Reserve estimates were completed or published.

6.4 Production

Prior to Pan American's acquisition of the Property, approximately 22 million tonnes (Mt) of silver-rich base metal sulphide ore was produced from the mine. Silver made up about 49% of historic sales value, with zinc, lead, and copper contributing 33%, 15%, and 3% respectively of the remaining portion. Ore from the mine was processed on site by crushing, grinding, and flotation to produce silver-rich copper, lead, and zinc concentrates, as it is today.

7 GEOLOGICAL SETTING AND MINERALIZATION

7.1 Regional and district geology

The Property is located within the Western Cordillera of the Andes Mountains and the regional geology is dominated by Cretaceous aged Machay Group limestones and Tertiary aged Pocobamba continental sedimentary rocks, which are referred to as the Casapalca Red Beds.

These groups have been deformed by the Huaron anticline, the dominant structural feature of the local area. The limestones and sedimentary rocks are strongly folded and intruded by quartz monzonite and quartz monzonite dikes with associated fracturing. Following the intrusion of the dikes, the sedimentary rocks were further compressed and fractured, and subsequently altered and mineralized by hydrothermal fluids forming the Huaron deposit on the Property.

Minor intrusives have been recognized between the Western and Eastern Cordillera, which have an average size of up to four square kilometres. These are irregularly distributed as high-level stocks that generally intrude Paleogene rocks. Intrusives are porphyritic with (1 to 2 cm) plagioclase phenocrysts and quartz. Biotite and hornblende are common in some areas. Compositionally, the intrusives are recognized as Monzogranite.

The lithostratigraphic column of the district is comprised of sandstones, marls, conglomerates, calcareous chert, andesites, ignimbrites, breccias, and tuffs, which are described below from bottom to top. The stratigraphic column for the region is shown in Figure 7.1.

7.1.1 MESOZOIC: Upper Cretaceous

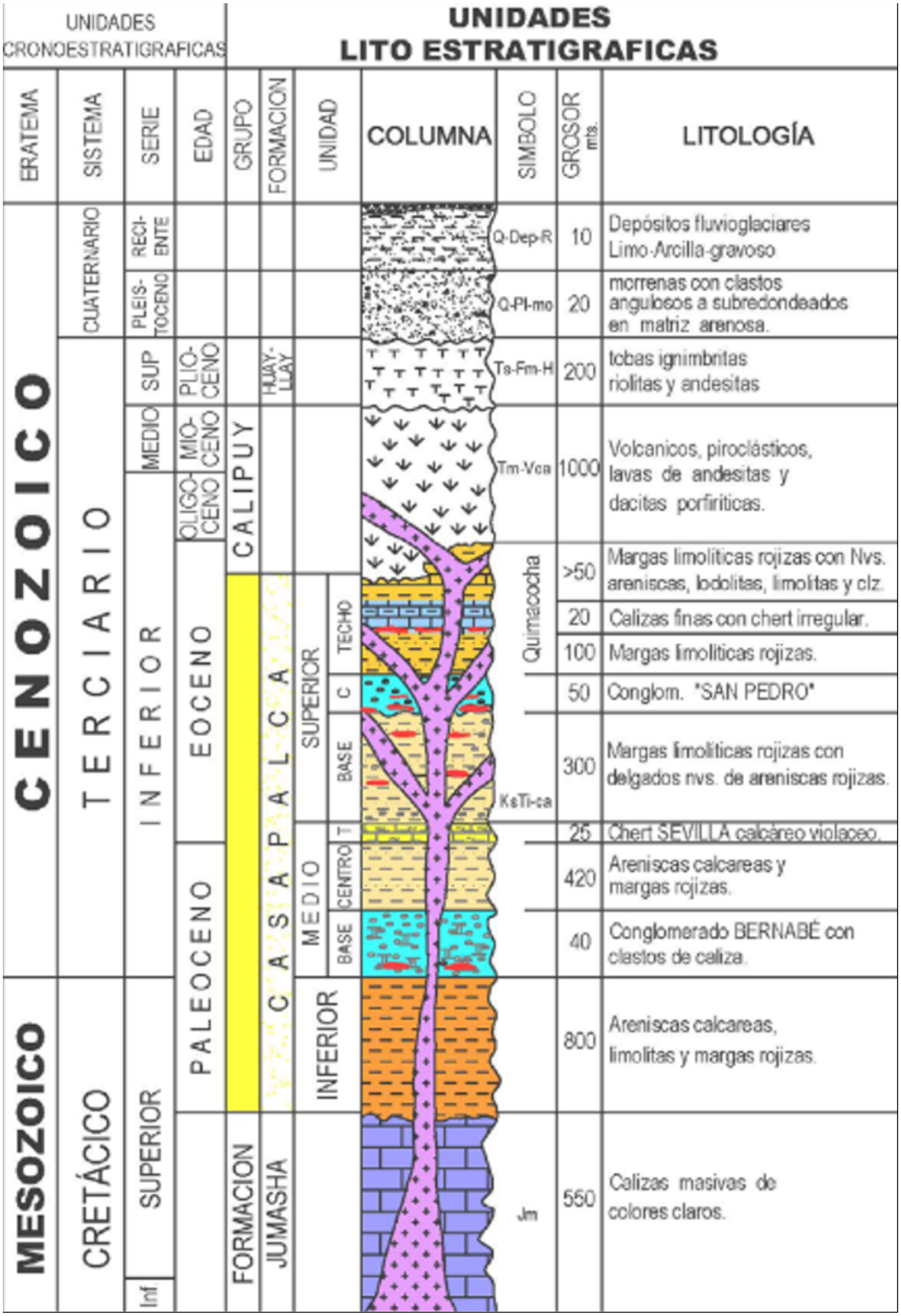
Casapalca Formation

This formation outcrops discordantly on the Marañón geoanticline, with an average thickness of more than 1,000 metres. The lithology consists of brownish red shales, siltstones, and sandstones. Towards the base it consists of conglomerates with limestone clasts, red sandstones, intrusives, and subangular schists; whitish limestone with intercalations of reddish conglomeratic sandstone dominate towards the top. It is subdivided into three members:

- **Lower Member**: Several layers of red shales, grayish-green to reddish semi-consolidated sandstones, conglomerates, and limestone lenses. Estimated thickness is 300 m to 330 m.
- **Shuco Conglomerate Member**: Consists of resistant conglomerates, with clasts of limestone, quartzite, chert, red sandstone and phyllite; embedded in a calcareous, brecciated matrix. The fragments are subangular in variable sizes. Estimated thickness is 150 m to 200 m.
- **Calera Member**: Thinly bedded marl and shale, grading to limestone and dolomite with chert nodules, with an approximate thickness of 60 m to 65 m forms a basal unit. The middle unit is composed of limestone and marl with intercalations of thinly bedded shale, with a thickness of 53 m. Limestone and dolomite with chert nodules comprise the top unit.

Based on stratigraphic relationships, this formation is considered to have been deposited from the Cretaceous to the early Paleogene followed by folding and development of the unconformity surface during the Paleocene (lower Paleogene).

Figure 7.1 Regional stratigraphic column



Source: Geology Department Huaron (2022).

7.1.2 CENOZOIC: Paleogene - Neogene - Quaternary

Calipuy Group

The Calipuy group unconformably overlies the Casapalca Formation. The Calipuy group comprises pyroclastic rocks, lavas, ignimbrites, tuffs, basalts, rhyolites, and dacites that were deposited after the period of folding, erosion and uplift of the Casapalca Formation.

At the regional level, four units are recognized:

- **Yantac Formation Unit**: A volcanic-sedimentary sequence, also known as the variegated series, made up of clastic and pyroclastic rocks, conglomerates, brownish gray sandstones, sandy limestone, siltstones, and shales of variegated colors (green to brown, purple, pink, gray, white and brown). Intercalations of tuffs, tuffaceous breccias, some levels of agglomerates with andesitic lava spills form at the top of the unit. Estimated thickness is 60 m to 150 m. Age dating places the sequence between the Paleocene to Eocene.
- **Carlos Francisco Volcanic Unit**: Consists of porphyritic andesitic sills occasionally intercalated with massive porphyry and volcanic breccia flows. Its thickness varies from 400 m to 1,000 m. Correlation dating places it between the Eocene and Oligocene age.
- **Colqui Volcanic Unit**: Consists of andesitic sills with some interbedded fine tuffs, lapillis, and agglomerates. Also contains thin layers of tufaceous sandstone and limestone for a total thickness of 200 m. Age dating places it between Eocene and the Oligocene age.
- **Millotingo Volcanic Unit**: Made up of andesitic to rhyodacitic (occasionally trachyandesitic) lava flows. Its average thickness is 180 m and dating places it between the Upper Oligocene and the Lower Miocene.

Rumillana Volcanics

Sequence of volcanoclastic rocks known as Rumillana agglomerate and Unish tuff. The Rumillana agglomerate is composed of angular and sub-angular fragments of limestone, phyllite, chert and strongly altered porphyritic igneous rock. The Unish tuffs are made up of pyroclasts and lavas. Total thickness of the volcanic unit is 150 m with dating placing it as Upper Miocene in age.

Pacococha Volcanics

Comprised of andesitic and basalt volcanic flows with intercalations of volcanic breccia flows and thin layers of whitish tuffs. Its thickness is 150 m and dating places it between Miocene and Pliocene age.

Huayllay Formation

Andesitic lava flows interspersed with pyroclastic rocks that formed after the last Andean Tectonic phase filling the erosion surfaces. Its radiometric dating places it as Pliocene in age.

7.1.3 Quaternary deposits

Unconsolidated cover is irregularly distributed. Pleistocene alluvial deposits, moraine deposits, fluvioglacial deposits, peat deposits, colluvial deposits and alluvial deposits have been mapped in the area.

All formations have been deformed by the Huaron anticline, the dominant structural feature in the local area. The limestones and sedimentary rocks are strongly folded and intruded by quartz monzonite and quartz monzonite dikes with associated fracturing. Following the intrusion of the dikes, the sedimentary rocks were further compressed and fractured, and subsequently altered and mineralized by hydrothermal fluids.

7.2 Property geology

The main lithology in the area of Huaron is a sequence of continental redbeds of the Casapalca Formation which unconformably overlie massive marine limestones. A series of andesites and dacites outcrop to the west of the mine. North-south trending sub-vertical porphyritic quartz monzonite dykes crosscut the mine stratigraphy.

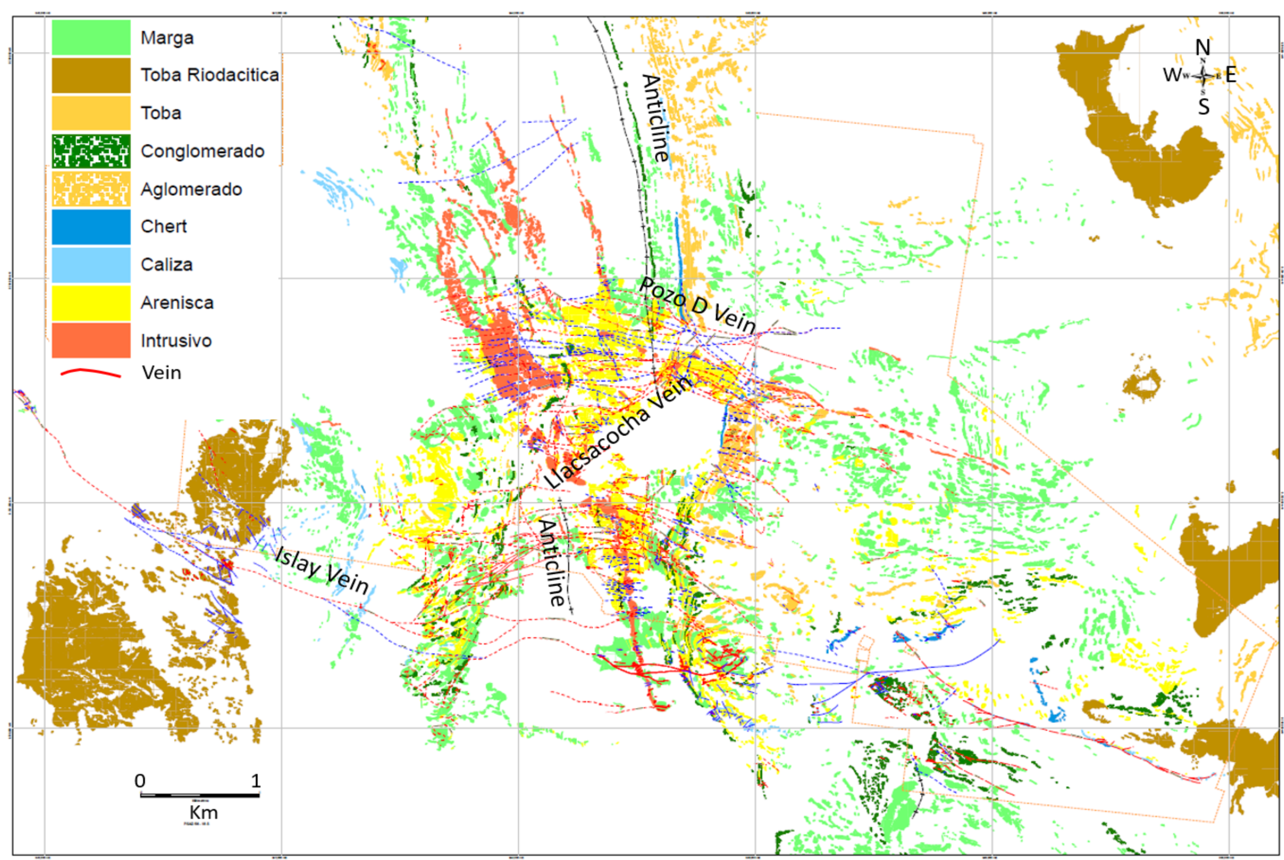
Thinly bedded marls and sandstones known as the lower redbeds are present in the central part of the mine and at lower elevations. The upper redbeds are present on the eastern side of the mine, and are comprised of calcareous chert overlying sandstone and marls, in turn overlying the Barnabe quartzite conglomerate at the base of the sequence. On the western side of the mine, the stratigraphy consists of a series of interbedded conglomerates and sandstones.

The Huaron deposit is located within an anticline formed by east-west compressional forces. The axis of the anticline strikes approximately north-south and plunges gently to the north. There are two main fault systems. One system comprises north-south striking thrust faults, parallel to the axis of the anticline, and the other comprises east-west striking tensional faults.

In the Huaron area, an elongated monzonite dike outcrops and is emplaced in the Casapalca Formation and Calipuy Volcanics. It has a tabular form in outcrop and trends north-south with a thickness that varies from tens of metres to 100 m. Dating assumes that these intrusives are of Paleogene age.

A schematic local surface geologic map is shown in Figure 7.2.

Figure 7.2 Schematic view of local geology



Source: Geology Department Huaron (2022).

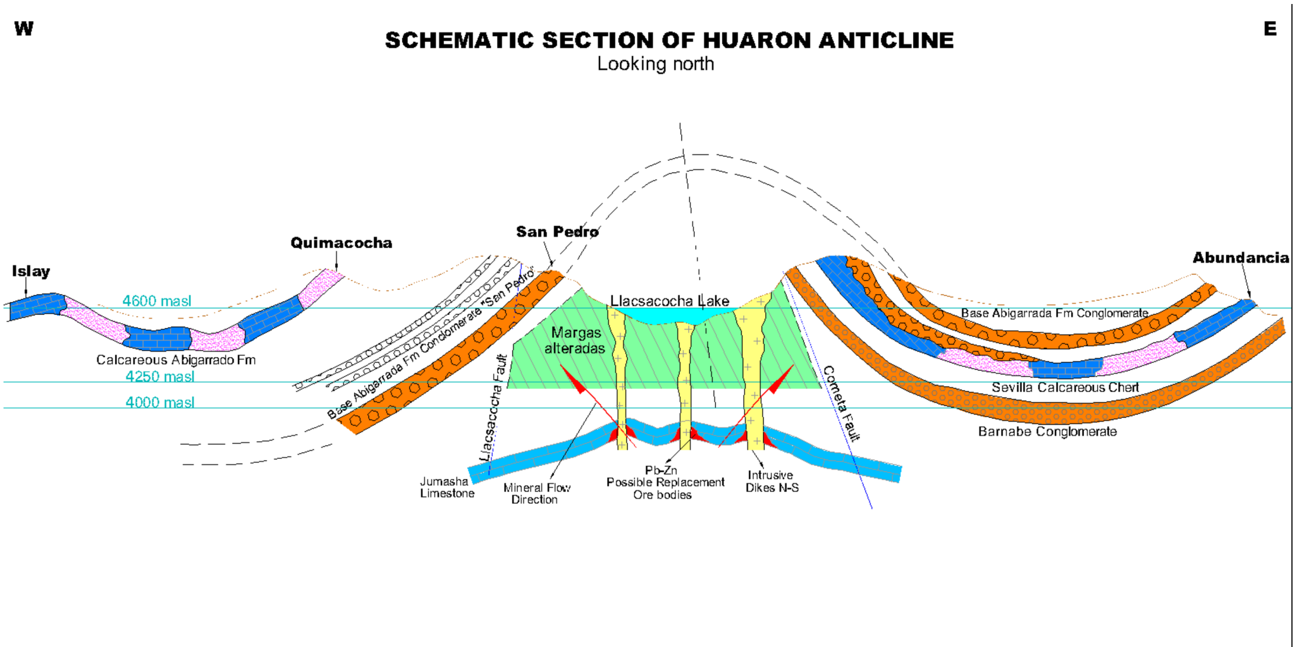
7.3 Structure

7.3.1 Folding

Folding occurred during the Paleogene, possibly during the Inca orogeny. During the deposition of the Calipuy, an additional deformation occurred during the Quechua orogeny. These two phases are present in the Huarón area, with the sequence of folded Casapalca formation forming an anticline, and the sequence of the Calipuy Group forming a slightly asymmetric open anticline.

Figure 7.3 is a schematic section which is not to scale showing the Huaron anticline and the rocks at Huaron.

Figure 7.3 Cross section showing anticlinal structure



Source: Geology Department Huaron (2018).

7.3.2 Faulting

There are large dislocations accompanied by secondary faults in the region. These faults are represented in the Huarón area by the Huaychao - Cometa north-south fault and the Llacsacocha Fault. Both faults divide the deposit into four sectors. Local faults recognized only in the Huaron mine are the Shiusha Fault (related to the Pozo D Fault) and the Tapada Fault (related to the Anteabigarrada Fault). Horst-type movement occurred between the Shiusha Fault and the Tapada Fault zones.

7.3.3 Unconformity

An unconformity has recently been defined on each flank of the anticline throughout the property. The unconformity occurs at the contact between the Casapalca Formation and the Calipuy Group and provides control to mineralization.

7.4 Alteration

Dominant hydrothermal alteration of the enclosing rocks are argilization - silicification (associated with the copper trend), potassic alteration (associated with the Lead - Zinc zone), epidote-pyrite (associated with the silicified zone) and chlorite - magnetite (throughout the entire deposit).

7.5 Mineralization

The Huaron mine is a producer of silver, zinc, lead, and copper. Ore mineralogy is made up of tetrahedrite - tenantite (gray copper), sphalerite, galena, and chalcopyrite - enargite as the most abundant ore minerals; gangue minerals mainly represented include quartz, rhodochrosite, rhodonite, manganocalcite, and alabandite.

Research has shown the presence of three different stages of mineralization and related to high temperatures (milky quartz, pyrite, tetrahedrite), intermediate temperatures (milky quartz, pyrite, brown sphalerite, and galena) and low temperatures (barite, siderite, dolomite, blonde sphalerite, galena, argentiferous tetrahedrite, polybasite, chalcopyrite, rhodochrosite, quartz, and calcite). Huarón mineralization is assumed to be of Pliocene age.

The first pulse of mineralization was associated with the emplacement of intrusive bodies and the subsequent opening of structures, as zinc, iron, tin, and tungsten minerals were deposited. This was followed by a copper, lead, and silver rich stage, and finally by an antimony / silver phase associated with quartz.

The most important economic minerals are tennantite-tetrahedrite (containing most of the silver), sphalerite, and galena, though more than 90 other minerals have been identified. The principal gangue minerals are pyrite, quartz, calcite, and rhodochrosite. Enargite and pyrrhotite are common in the central copper core of the mine and zinc oxides and silicates are encountered in structures with deep weathering. Silver is also found as pyrargyrite, proustite, polybasite, and pearceite.

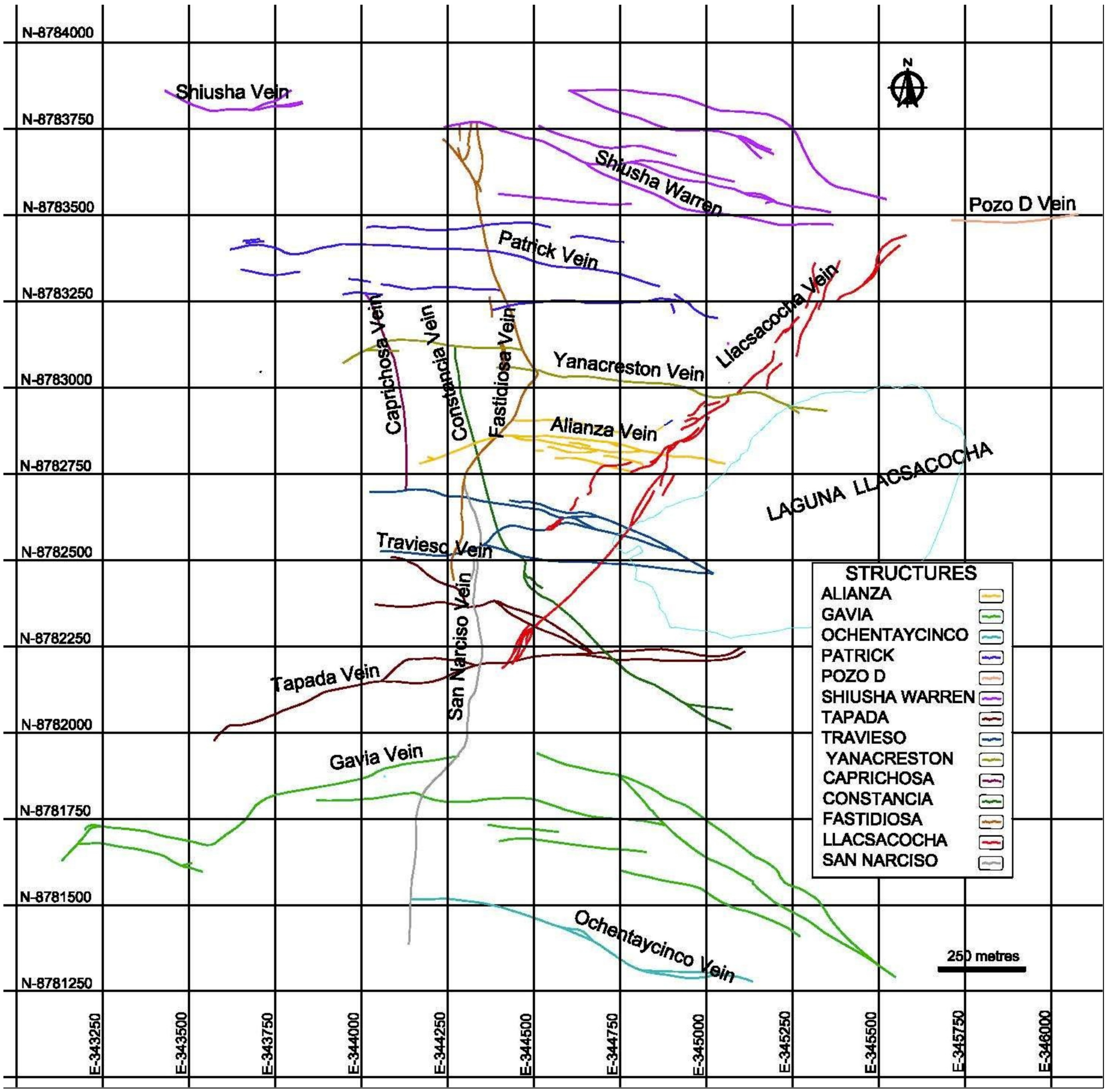
There is a definite mineral zoning at Huaron. A central copper core contains enargite as the principal economic mineral with copper, pyrite and quartz in structures. This area was extensively mined by previous operators but metal grades and prices were overshadowed by the negative impact of high arsenic and antimony content and poor metal recoveries. To the east and west of the central core silver, lead, and zinc minerals are associated with calcite and rhodochrosite. Areas to the north of the central core contain silver, lead, and zinc minerals associated with pyrite. Sphalerite and sulfosalts with rhodochrosite follow a narrow band running north-south along the general axis of the anticline.

Huaron is a hydrothermal polymetallic deposit of silver, lead, zinc, and copper mineralization hosted within structures likely related to the intrusion of monzonite dikes, principally located within the Huaron anticline. Mineralization occurs in veins parallel to the main fault systems, in replacement bodies known as “mantos” associated with the calcareous sections of the conglomerates and other favorable stratigraphic horizons, and as dissemination in the monzonitic intrusions at vein intersections. The mineralization controls recognized in the deposit are structural, lithological, and stratigraphic.

The types of mineralized bodies present in Huarón are veins, mantos, and stockworks.

- **Veins:** The mineralized veins vary from a few cm to up to 10 m wide, and may extend along strike for up to 1,800 m. Most of the structures show open mineralization at depth and along strike and have excellent exploration potential. Vein orientations vary but generally trend east-west or north-south. The deposit consists of 96 different structures which have been grouped into 13 families of mineralized trends according to location and orientation (Figure 7.4).
- **Mantos:** Mantos are gently dipping structures located on the western flank of the anticline.
- **Stockworks:** Stockwork zones have been mined with mechanized methods and high productivity. Stockwork zones occur at the intersection of veins, where veins intersect conglomerate beds (causing replacements), and also at the intersection of veins with calcareous sandstone strata (causing disseminations). Stockwork-like bodies related to the intrusive-sandstone contact are rarely recognized.

Figure 7.4 Plan of mineralized trends



Source: PAS (2022).

8 DEPOSIT TYPES

Huaron is a hydrothermal polymetallic silver-copper-lead-zinc deposit likely related to Miocene aged intrusive monzonite dikes within the Huaron anticline. Exploration for economic veins, mantos and disseminated mineralization styles similar to those present on the Property is conducted using a combination of underground diamond drilling and channel sampling from drifts excavated along the mineralized zones.

9 EXPLORATION

Huaron is an active mining operation with ongoing exploration conducted using a combination of underground diamond drilling and channel sampling from drifts excavated along the mineralized zones. Generally, underground drillholes that intersect promising economic grade mineralization are followed up by drifting towards and then along the vein zone.

As underground drifting advances for mining, channel samples are routinely collected in drifts that are used for Mineral Resource and Mineral Reserve estimates. Channel samples are collected every 4 m across the vein in stoping areas, every 2 m across the vein in sublevels and drifts, and every 1 m in vertical development raises. Each channel sample weighs between 4 kilograms (kg) and 6 kg and is taken perpendicular to the structure after the face has been cleaned with a water hose or hard brush to reduce the risk of sample contamination. Samples are selected according to geological intervals and according to the width of the intersection with the vein which vary between 0.1 m and 1.5 m in length. Since the beginning of 2014 to May 31 2022, Pan American has collected 86,811 samples, including a total of 260,125 samples since 2001. The results of these samples are loaded in to the Datamine FusionTM (Fusion) database. The number of samples taken by year is shown in Table 9.1.

Table 9.1 Summary of channel samples

Year	Number of channels	Number of samples	Comments
2001	3,795	Not known	Information from monthly reports Oct to Dec 2001 only
2002	19,398	Not known	Information from monthly reports
2003	22,445	Not known	Information from monthly reports
2004	33,242	Not known	Information from monthly reports
2005	37,349	Not known	Information from monthly reports
2006	13,417	23,382	Information recorded in Fusion database
2007	16,221	30,094	Information recorded in Fusion database
2008	10,015	18,924	Information recorded in Fusion database
2009	13,629	28,359	Information recorded in Fusion database
2010	8,512	16,856	Information recorded in Fusion database
2011	7,691	16,950	Information recorded in Fusion database
2012	9,465	19,723	Information recorded in Fusion database
2013	9,118	19,026	Information recorded in Fusion database
2014	4,959	9,393	Information recorded in Fusion database
2015	6,605	11,806	Information recorded in Fusion database
2016	7,002	10,047	Information recorded in Fusion database
2017	7,863	11,970	Information recorded in Fusion database
2018	6,816	11,268	Information recorded in Fusion database
2019	6,381	11,992	Information recorded in Fusion database
2020	3,292	6,144	Information recorded in Fusion database
2021	5,622	9,918	Information recorded in Fusion database
To May 2022	2,462	4,273	Information recorded in Fusion database
Total	**255,299**	**260,125**	

Channel sampling generally provides reliable data for the Mineral Resource and Mineral Reserve estimates, provided that appropriate measures are taken to prevent sample contamination to ensure an unbiased, representative sample. The channel samples are taken at regular spacing in drifts above and below the Mineral Reserve volumes, assuring they are as spatially representative as possible. There are no known issues that could materially impact the reliability of the sampling results.

10 DRILLING

10.1 Drilling summary and database

Huaron's long mine life has provided for extensive diamond drillhole coverage from the underground workings. There are no available details on the nature of drilling undertaken by previous operators; therefore, the following descriptions represent only Pan American's practices.

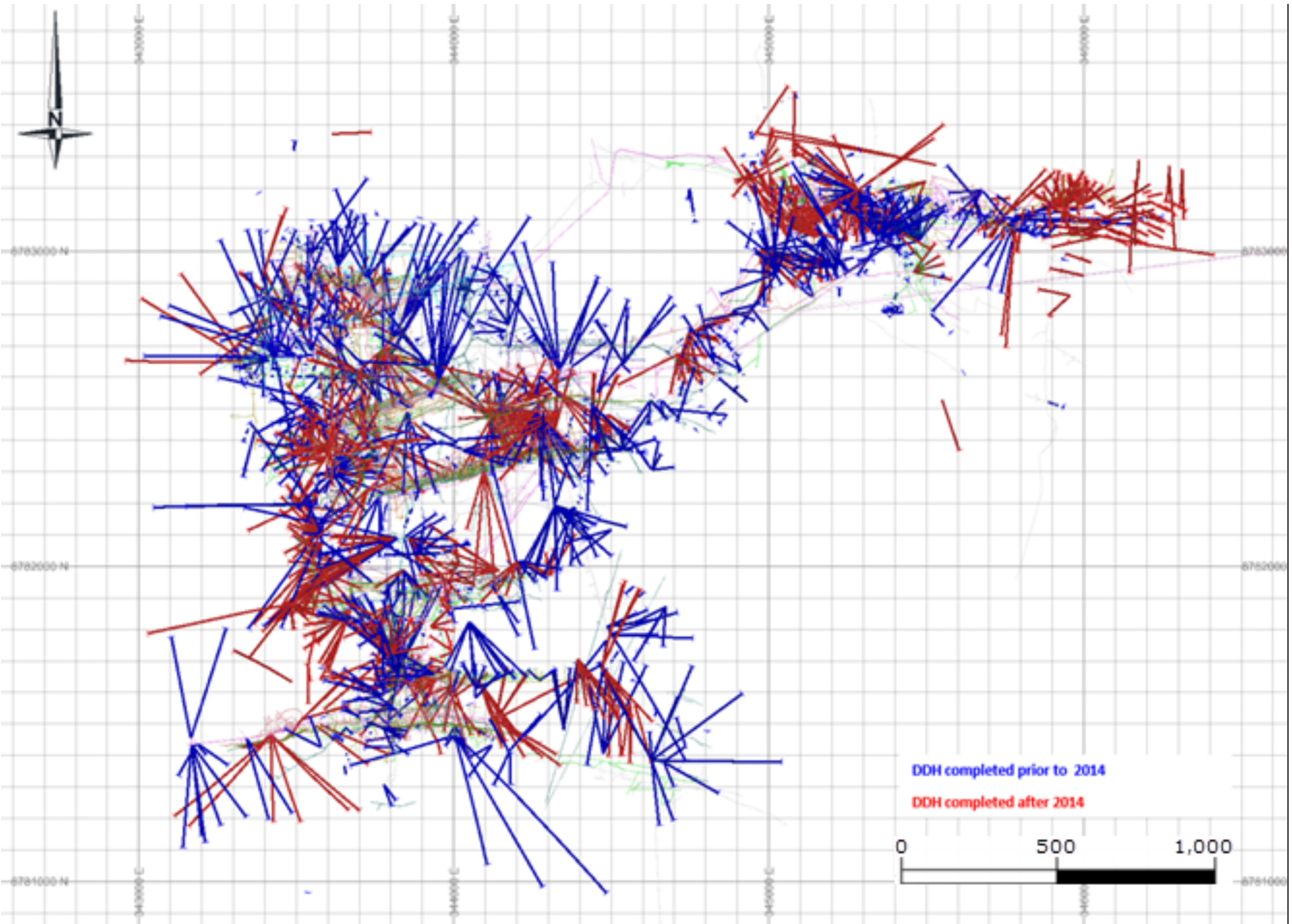
Most of the drilling centres over the strike length of the currently defined Mineral Resources and Mineral Reserves. A summary of the drillholes completed on the Property by all operators up to the end of May, 2022 is shown in Table 10.1. This includes the drillholes described in Section 10.3 and listed in Table 10.2.

Table 10.1 Drillhole summary

Year	Company	# of drillholes	Metres
2003	Pan American	92	10,000
2004	Pan American	68	15,002
2005	Pan American	88	8,147
2006	Pan American	87	11,647
2007	Pan American	117	15,046
2008	Pan American	118	18,507
2009	Pan American	46	5,431
2010	Pan American	87	16,107
2011	Pan American	113	25,104
2012	Pan American	177	33,437
2013	Pan American	155	26,003
2014	Pan American	231	45,068
2015	Pan American	118	22,276
2016	Pan American	209	36,276
2017	Pan American	310	57,086
2018	Pan American	139	20,645
2019	Pan American	128	19,238
2020	Pan American	37	6,103
2021	Pan American	90	19,239
To May 2022	Pan American	21	4,893
Total		**2,432**	**415,294**

Diamond drillholes are orientated to intersect the targeted vein as close to perpendicular as possible and are spaced as regularly as possible to ensure representative sample coverage. Nominal spacing is planned for pierce points on vein at 50 m - 60 m apart. A plan showing the location of the drillholes is given in Figure 10.1.

Figure 10.1 Huaron drillhole location map



Source: PAS (2022).

10.2 Drilling procedures

All underground holes are drilled by an external drilling contractor under Pan American supervision. Drilling is carried out using industry standard underground diamond drill rigs capable of drilling BQ, NQ, and HQ diameter core. The collar coordinates and bearing and dip are surveyed with a total station instrument and the drillhole deviation is measured regularly using a down hole survey instrument.

Drilling programs have been carried out by REDRILSA using a Boart Longyear LM-75 drill. The core size is HQ and NQ diameter core and core recovery is generally above 95%. The holes collars are surveyed, and downhole surveys measured drillhole deviation with a Core Tech CHAMP PILOT survey tool.

10.3 Exploration drilling

10.3.1 Summary

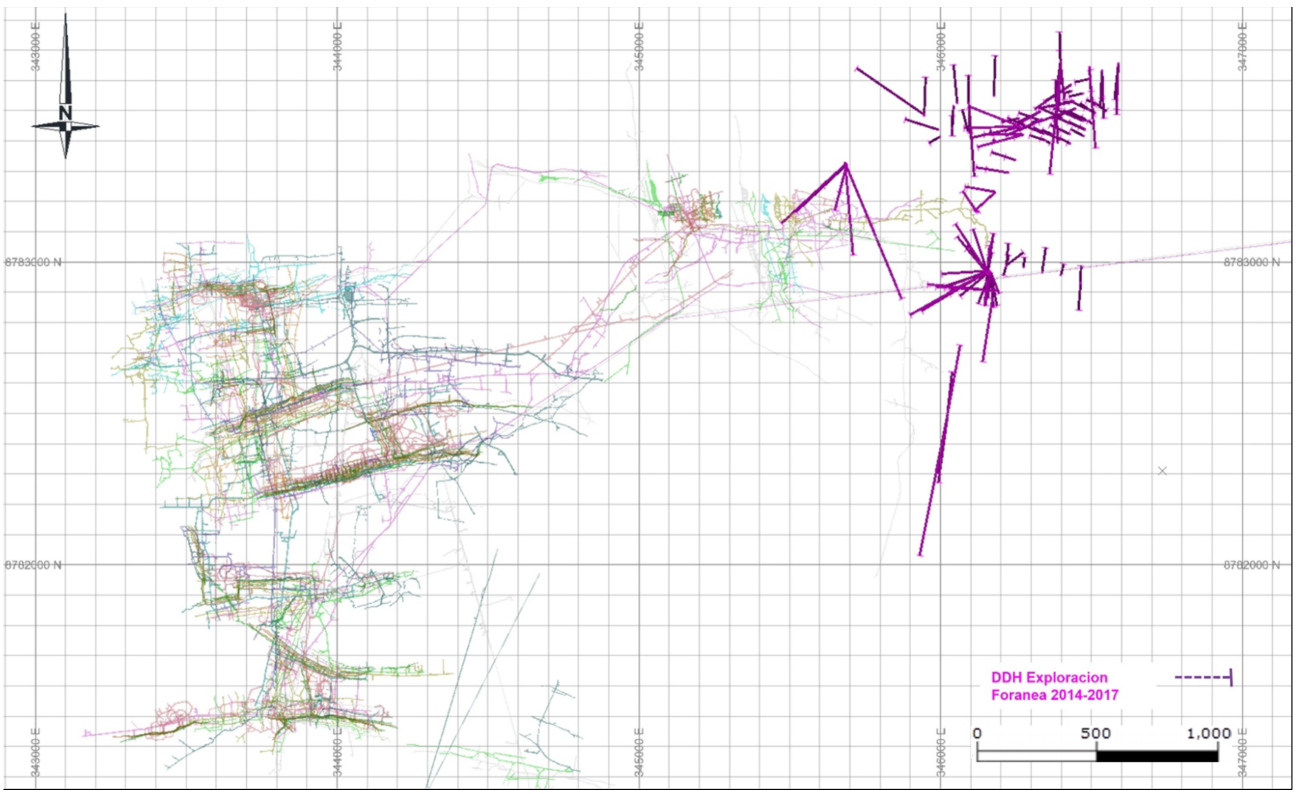
Drilling regarded as exploration drilling or greenfield drilling was carried out by Pan American from 2014 to 2017. During the period of activity, a total of 39,824 m was completed in 145 drillholes. The following targets were investigated: Shiusha Warren, Chert Sevilla-Sevilla Este, Chosica-Chosica Sur, Salpo, Patrick, and Rey. The locations of the drillholes are shown in Figure 10.2.

Table 10.2 Greenfield drilling 2014 to 2017

Summary of greenfield exploration drilling					
Year	2014	2015	2016	2017	Total
Number of drillholes	59	21	23	42	145
Meters drilled	12,352	5,477	7,989	14,006	39,824

The location of drillholes or drillhole fans is shown in Figure 10.2.

Figure 10.2 Location map of exploration drilling



Source: PAS (2022).

10.3.2 Exploration drilling programs

The "Seville - Seville East" target was evaluated in 2014. The target is located within the local unit known as "Chert Sevilla". The unit contains a high silica (particles of shells and siliceous grains) horizon that is deemed a mineralization target due to strong fracturing associated with the brittle silicate horizon.

In 2015 the continuation the extension of mineralization to the south was evaluated, taking into account the influence of the west-northwest to east-southeast striking "Chosica" intrusive sill and the "vein 16" which is spatially associated with the intrusive.

During 2016, the vein system associated with the Shiusha Warren structure was evaluated. This structure is considered to have been reactivated during multiple stages of district mineralization.

In 2017, exploration focused on the Shiusha Warren and Chosica-Chosica Sur targets as well as the smaller Salpo, Patrick, and Rey vein systems.

10.4 Concluding statement

Diamond drilling at Huaron generally provides reliable data for the Mineral Resource and Mineral Reserve estimates, provided appropriate measures are taken to minimize sample material loss, to prevent sample contamination, and to ensure an unbiased, representative sample is taken. Ground conditions for diamond drilling at Huaron are generally good, resulting in high drill core recovery, and measures are taken to minimize potential contamination. There are no known drilling, sampling, or recovery factors that could materially impact the accuracy and reliability of the results.

11 SAMPLE PREPARATION, ANALYSES, AND SECURITY

11.1 Sampling method

Drill cores are placed in corrugated plastic core boxes and transported to the core logging facility on site. The boxes are marked and numbered by the drill crews and tags are inserted between drill core runs to indicate the drill depths. Diamond drillhole samples are split in half with a diamond bladed saw after the core has been logged and the sample intervals have been marked by the geologist. Downhole intervals are logged for fracture density and core recovery to determine the rock quality, and for lithology, structure, and alteration types.

Channel samples are collected with a hammer and chisel every 4 m across the vein in stoping areas, every 2 m across the vein in sublevels and drifts, and every 1 m in vertical developments. Each channel sample weighs between 4 kg and 6 kg and is taken perpendicular to the structure after the face has been cleaned with a water hose or hard brush to reduce the risk of sample contamination.

Samples from both channel samples and diamond drillholes are selected according to geological intervals and the width of the intersection with the vein and vary between 0.1 m and 1.5 m in length.

Drillholes: Unmineralized hangingwall (HW) and footwall (FW) host rocks are sampled generally over 3 m beyond visible mineralization. Internal unmineralized material located between mineralized intersections is sampled over the entire length.

UG Channel samples: Unmineralized HW and FW host rocks are not sampled.

The rock mass is generally of good quality and there have been few issues regarding sample loss or contamination during sample collection and splitting. There are no known drilling, sampling, or recovery issues that could materially impact the reliability of the results.

Both channel and drill core samples are placed in new, clean plastic bags with two sample number tags on the inside and one number and barcode tag on the outside. The bags are sealed with a metal strip prior to transmission to the on-site laboratory.

11.2 Sample storage and security

No specific security measures are taken with the samples, but as the samples are prepared and analyzed within the confines of the general mine security enclosures, there is no reason to believe that the validity and integrity of the samples have been compromised.

11.3 Sample preparation and analysis

Channel and the underground diamond drillhole samples are sent to the Huaron on-site laboratory. The laboratory is not certified by any standards association but is managed and operated by SGS, the international commercial laboratory firm (Certifications: ISO 14001, OHSAS 18001, NTP-ISO/IEC 17020, NTP-ISO/IEC 17025 AND NTP-ISO/IEC 17065) until June 2021 and Inspectorate Bureau Veritas (Certifications: ISO 9001, ISO 17025, ISO 45001 and ISO 14001) after June 2021.

Samples received at the prep laboratory facility are verified and coded prior to drying in a drying oven with a calibrated digital thermometer at a temperature of 120°C +/- 10°C.

Samples are pulverized through a primary jaw crusher reducing plus 3-inch material to +/- ¼ inch. Secondary crushing further reduces material size to +/- 2 millimetres (mm) (≥ 80% passing at 10 mesh). Verification and recording of sample granulometry and sample weight loss is carried out on 2% of the total number of samples in each sample batch. Strict protocols are implemented to clean sample preparation equipment with compressed air and barren silica sand.

The crushed sample is homogenized and separated through a riffle splitter to an approximate 150-gram sample that is subsequently pulverized to a pulp sample >95% at – 140 mesh. 2% of the total pulp samples per batch are weighed to calculate sample weight loss.

Assays are performed using acid digestion and atomic absorption spectroscopy, and analyzed for silver, zinc, lead, and copper content by the SGS managed onsite laboratory.

11.4 Bulk density determinations

Since 2018 density samples are taken from both underground channels and diamond drillhole core. Density measurements are generated from 10 cm diameter sample plugs using the Paraffin method for compacted samples and Pycnometer for fractured samples. This is further discussed in Section 14.8.

11.5 Quality Assurance and Quality Control (QA/QC)

11.5.1 Overview

The on-site laboratory conducts its own routine internal quality assurance and quality control (QA/QC) program. For each batch of 20 samples at least one duplicate sample and one certified standard is submitted by the laboratory. The laboratory information management system, LIMS software, which connects with Datamines' Fusion ensures that the results are saved directly in the geological database without data transcription errors.

A QA/QC program independent of the on-site laboratory and supervised by the geology department is also employed. This involves the submission of one Standard Reference Material (SRM) and one blank on a daily basis to the onsite laboratory. Duplicate samples comprising one quarter of the second half of the diamond drill core and duplicate samples obtained by collecting a sample of equal weight from the same channel sample location as the original are also submitted, both to the onsite laboratory (Inspectorate Bureau Veritas) and to an external laboratory (ACTLABS, Inspectorate Bureau Veritas Lima, Peru. Certifications: ISO 9001, ISO 14025, ISO 45001 and ISO 14001) to act as a check on the onsite laboratory. A system is in place to ensure that any failed QA/QC samples are identified and that the required corrective action is taken in a timely manner, which usually involves a review of procedures to ensure that the established sample preparation and analysis protocols are being followed.

Table 11.1 and Table 11.2 list the number and rates of the submission of QA/QC samples of all types for 2015 to the end of May 2022.

Table 11.1 Summary of all QA/QC samples 2015 – May 2022

Year	SRMs	Blanks	Coarse duplicates	Field duplicates	Umpire samples	Comments
2015	323	394	247	153	472	Certified standard used
2016	577	303	310	274	514	Certified standard used
2017	882	705	331	389	290	Certified standard used
2018	790	654	314	199		Certified standard used
2019	468	559	340	115	1	Certified standard used
2020	465	224	158	20	1	Certified standard used
2021	1,397	610	452	92	2	Certified standard used
To May 2022	468	192	177	25	2	Certified standard used
Total	**5,370**	**3,641**	**2,329**	**1,267**	**1,282**	

Table 11.2 Summary of QA/QC sample submission rates 2015 – May 2022

Year	SRMs	Blanks	Coarse duplicates	Field duplicates	Umpire samples
2015	2.26%	2.76%	1.73%	1.07%	3.30%
2016	3.83%	2.01%	2.06%	1.82%	3.41%
2017	4.61%	3.69%	1.73%	2.03%	1.52%
2018	4.52%	3.74%	1.79%	1.14%	
2019	2.79%	3.33%	2.03%	0.69%	0.01%
2020	6.26%	3.01%	2.13%	0.27%	0.01%
2021	10.33%	4.51%	3.34%	0.68%	0.01%
To May 2022	7.59%	3.11%	2.87%	0.41%	0.03%

As can be seen from Table 11.1 and Table 11.2, the total number of control samples submitted has increased over time, particularly for the SRMs and blanks. A submission rate of 4 - 5% (relative to total samples analyzed) for each QA/QC sample type is considered ideal. For future QA/QC programs, the QP will address the low submission rate of duplicate samples.

11.5.2 Standard Reference Material

SRMs contain standard, predetermined concentrations of material (silver, and gold, etc.) which are inserted into the sample stream to check the analytical accuracy of the laboratory. SRMs should be monitored on a batch-by-batch basis and remedial action taken immediately if required. For each economic mineral it is recommended the use of at least three SRMs with values:

- At the approximate cut-off grade (COG) of the deposit.
- At the approximate expected grade of the deposit.
- At a higher grade.

Control charts are commonly used to monitor the analytical performance of an individual SRM over time. SRM assay results are plotted in order of analysis along the X-axis. Assay values of the SRM are plotted on the Y-axis. Control lines are also plotted on the chart for the expected value of the SRM, two standard deviations above and below the expected value (defining a warning threshold), and three standard deviations above and below the expected value (defining a fail threshold). Control charts show analytical drift, bias, trends, and irregularities occurring at the laboratory over time.

All SRMs are made from the mine's own material, analyzed in six laboratories, and finally certified by those laboratories. These insertions allow the behavior of each dispatched batch to be evaluated, identify failures, and take corrective action. When a failure is noted, the entire batch is sent for repeat analysis.

11.5.2.1 Standard Reference Material Performance 2006 - 2013

Between April 2006 and December 2013, nearly 2,900 samples from three different standard samples were submitted to the laboratory with the drill core and channel samples.

The majority of the failures were associated with a SRM that was in use from April 2006 until the stocks of that standard were depleted in November 2011. The standard performed relatively normally between April 2006 and May 2009, at which point unusual low-grade values are observed in the results. The lower grade standard showed no systematic bias while the higher-grade standard showed a slight high bias of a magnitude within the first standard deviation. There is evidence of standard and blank identification labelling errors, but overall, the results were acceptable and indicate reasonable accuracy at the laboratory.

Table 11.3 Summary of SRM performance – 2006 - 2013

	Bajo (low)	Medio (medium)	Alto (high)
Count	1,450	443	1,006
Fail +1 SD	136	11	1
Fail -1 SD	739	12	2
% Fail 1 SD	60	5	0
Fail + 2 SD	22	1	1
Fail - 2 SD	313	3	2
% fail 2 SD	23	1	0
Fail +3 SD	5	1	1
Fail -3 SD	89	3	2
% Fail 3 SD	6	1	0

11.5.2.2 Standard Reference Material Performance 2015 – May 2022

From 2015 through to May 2022, approximately 5,370 SRM samples from eight different SRMs were submitted to the laboratory with the drill core and channel samples. Table 11.4 lists the SRMs used from 2015 to May 2022 with their statistics and Table 11.5 shows the numbers submitted for each by year.

Table 11.4 SRMs submitted 2015 – May 2022

SRM	Expected value				Standard deviation			
(internal name)	Ag (g/t)	Cu (%)	Pb (%)	Zn (%)	Ag (g/t)	Cu (%)	Pb (%)	Zn (%)
STD-MEDIO	173	0.49	1.22	3.11	4	0.051	0.04	0.07
ESTANDAR ALTO	242	1.16	1.47	4.20	2	0.009	0.01	0.03
STD-1	179	0.15	2.4	3.18	4	0.002	0.05	0.03
STD-BAJO	132	0.84	1.92	3.97	4	0.016	0.027	0.077
ESTANDAR MEDIO	143	0.48	1.38	3.14	2	0.004	0.018	0.034
STD-ALTO	240	2.14	2.36	3.51	3	0.026	0.076	0.07
STD-2	174	0.73	1.12	2.54	4	0.02	0.02	0.06
STD-5	232	1.33	4.01	3.85	3	0.01	0.04	0.04

Table 11.5 Summary of SRMs submitted for analysis – 2015 – May 2022

SRM name	2015	2016	2017	2018	2019	2020	2021	2022	Total
STD-MEDIO					468	229	218		915
ESTANDAR ALTO		110	446	392					948
STD-1	7								7
STD-BAJO							387	139	526
ESTANDAR MEDIO		63	436	398					897
STD-ALTO						236	611	66	913
STD-2	316	404							720
STD-5							181	263	444
Total	**323**	**577**	**882**	**790**	**468**	**465**	**1,397**	**468**	**5,370**

Table 11.6 summarizes the SRM performance for all SRMs submitted between 2015 and May 2022. As discussed, previously a failure was defined where the analyzed value was ±3 standard deviations (SD) from the expected SRM value.

Table 11.6 Summary of SRM failures – 2015 – May 2022

SRM	Ag % Fail	Cu % Fail	Pb % Fail	Zn % Fail
STD-MEDIO	0.4	0.1	0.3	1.2
ESTANDAR ALTO	0.6	19.0	7.8	6.4
STD-1	0.0	0.0	0.0	0.0
STD-BAJO	0.0	0.6	0.3	0.1
ESTANDAR MEDIO	0.6	9.8	0.7	0.6
STD-ALTO	0.4	0.1	0.0	0.1
STD-2	0.1	1.3	1.9	2.5
STD-5	0.0	2.0	1.1	1.7

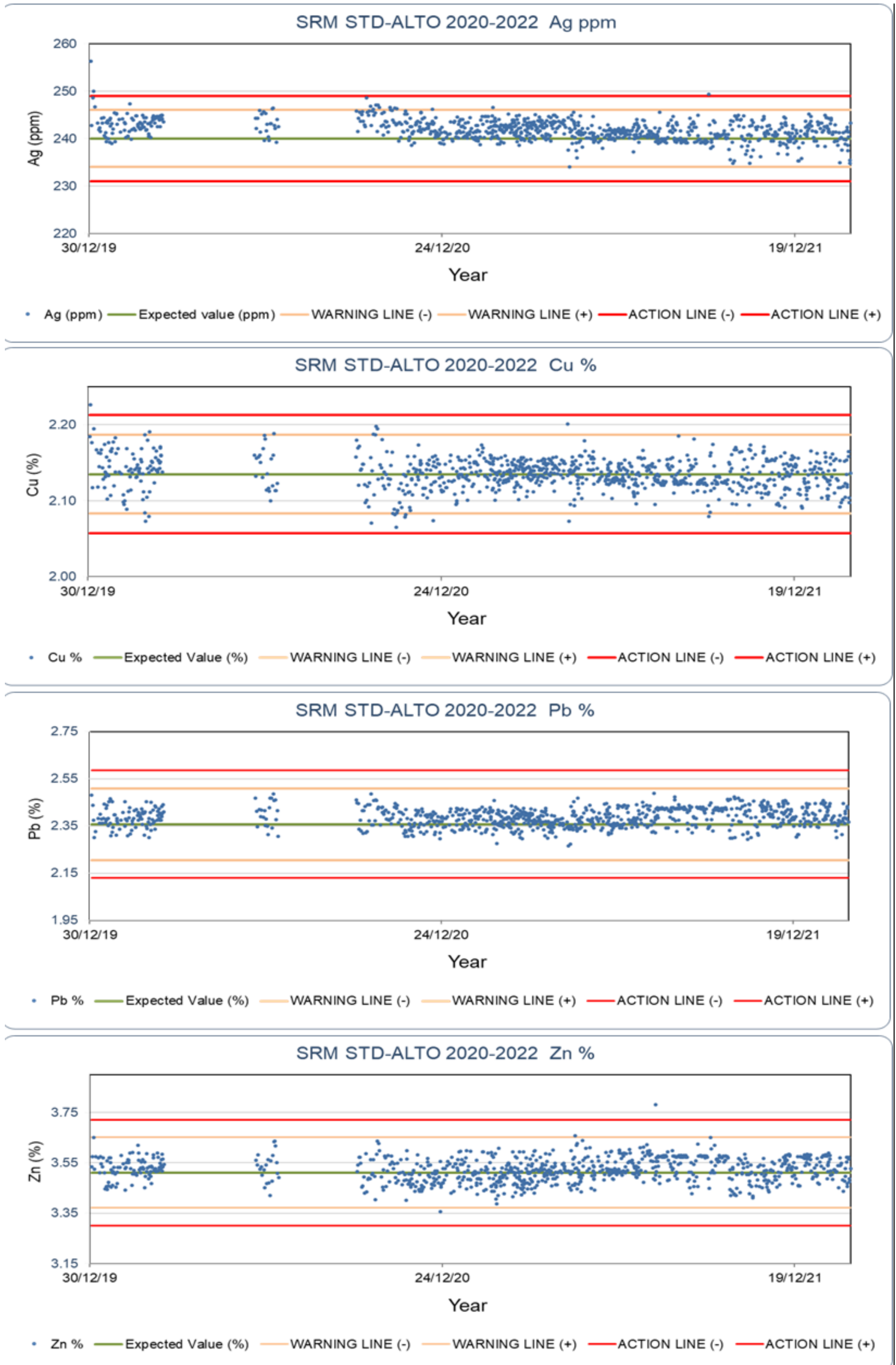
The failures for SRM ESTANDER ALTO were seen in the control chart and the majority of these relate to 2016 samples when the SRM was first introduced. The failures for ESTANDER MEDIO occurred in 2016 and 2017, no failures were recorded in 2018.

Figure 11.1 and Figure 11.2 show the SRM control charts for STD-MEDIO and ESTANDAR ALTO for Ag, Cu, Pb, and Zn, respectively. The STD-MEDIO SRM performed well over the entire period it was submitted. The ESTANDAR ALTO SRM performed poorly for Cu, Pb, and Zn for the 2016 samples. A correction was made for samples from 2017 onwards. For Cu and Zn, in 2017, there appears to be a low bias, which was corrected in 2018.

Figure 11.1 STD-MEDIO SRM Control Chart (Au, Ag, Pb, Zn) – 2015 - May 2022

Source: PAS (2022).

Figure 11.2 ESTANDER ALTO SRM Control Chart (Au, Ag, Pb, Zn) – 2020 - May 2022



Note: Some extreme high or low failures are excluded from the control charts for a better representation of the SRM performance.
Source: PAS (2022).

Overall, the SRMs performed well, with improvement in performance over time, with a significant improvement since mid-way through 2017. Since 2018, very few failures have occurred.

11.5.3 Blanks

Coarse blanks test for contamination during both the sample preparation and assay process. Pulp blanks test for contamination occurring during the analytical process. At Huaron, pulp blanks were submitted from 2015 to 2017 and coarse blanks have been submitted since 2018.

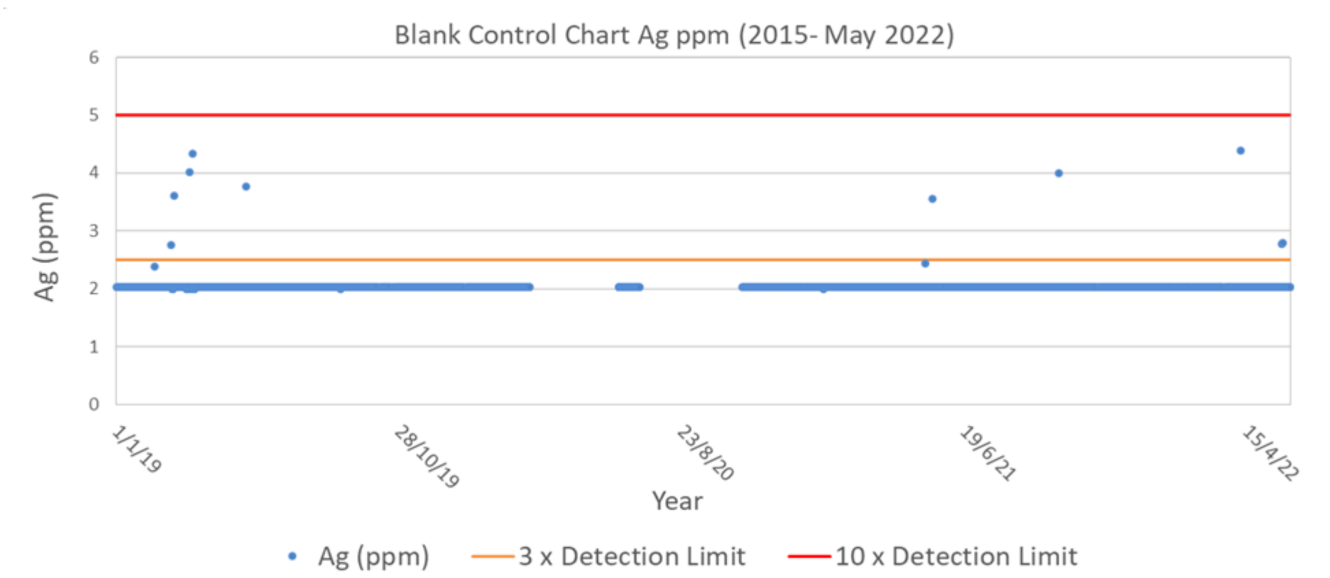
11.5.3.1 Blank performance 2006 - 2013

Between April 2006 and December 2013, approximately 1,500 samples of unmineralized “blank” material were submitted with the drill core and channel samples to the onsite laboratory to assess for sample grade contamination during sample preparation and analysis. No significant failures were noted for samples that were assayed.

11.5.3.2 Blank performance 2015 – May 2022

Figure 11.3 shows the blank control chart for Ag. The red line represents 10x the detection limit, blanks occurring above this value are considered failures.

Figure 11.3 Ag blank control chart – 2015 - May 2022



Source: PAS (2022).

Table 11.7 summarizes the pass rate of blanks by year over the period from 2015 to the end of May, 2022. The blank performance indicates that there are no laboratory hygiene issues.

Table 11.7 Summary of coarse blank performance 2015 - May 2022

Year	Ag pass rate (%)	Cu pass rate (%)	Pb pass rate (%)	Zn pass rate (%)
2015	100.0	99.5	100.0	100.0
2016	100.0	100.0	100.0	100.0
2017	99.7	100.0	100.0	100.0
2018	100.0	100.0	100.0	100.0
2019	100.0	100.0	100.0	100.0
2020	100.0	100.0	100.0	100.0
2021	100.0	100.0	100.0	100.0
To May 2022	100.0	100.0	100.0	100.0

11.5.4 Duplicate samples

Duplicate samples should be selected over the entire range of grades seen at the project to ensure that the geological heterogeneity is understood, however, the majority of duplicate samples should be selected from zones of mineralization. Unmineralized or very low-grade samples should not form a significant portion of duplicate sample programs as analytical results approaching the stated limit of lower detection are commonly inaccurate, and do not provide a meaningful assessment of variance.

Field duplicates monitor sampling variance, sample preparation variance, analytical variance, and geological variance. Coarse reject samples monitor sub-sampling variance, analytical variance, and geological variance. Pulp duplicates monitor analytical and geological variance. Umpire laboratory duplicates are pulp samples sent to a separate laboratory to assess the accuracy of the primary laboratory (assuming the accuracy of the umpire laboratory). Umpire duplicates measure analytical variance and pulp sub-sampling variance.

Duplicate data can be assessed using a variety of approaches. The QP typically assesses duplicate data using scatter plots and relative paired difference (RPD) plots. These plots measure the absolute difference between a sample and its duplicate. For field duplicates it is desirable to achieve 80 to 85% of the pairs having less than 30% RPD between the original assay and check assay, for coarse and pulp duplicates this is reduced to 20 and 10%, respectively. In these analyses, pairs with a mean of less than 15 times the lower limit of analytical detection or lower detection limit (LDL), are excluded. Removing these low values ensures that there is no undue influence on the RPD plots due to the higher variance of grades expected near the LDL, where precision becomes poorer (Long et al. 1997).

11.5.4.1 2006 - 2013 duplicate performance

Between April 2006 and December 2013, approximately 2,500 duplicate samples were submitted with the drill core and channel samples to the onsite laboratory, as well as to independent external laboratories including Acme(ISO 9001, ISO 17025), ALS Chemex (ISO 17020, ISO 17025), Certimin (ISO 9001, ISO/IEC 17025) and Actlabs Skyline(ISO 9001, ISO/IEC 17025) all located in Lima

Field duplicates

Between April 2006 and December 2013, 875 field duplicates were submitted. The results of precision pairs may be assessed using a ranked absolute relative difference plot, with acceptable results corresponding to ±30% agreement on 90% of field duplicate pairs.

Table 11.8 Summary of field duplicate performance – 2006 - 2013

Laboratory	Sample numbers	Duplicate sample type	± Agreement %	Bias
SGS – Huaron	875	Field	26	Duplicates have slightly lower grades

Coarse duplicates

No coarse duplicates were submitted between April 2006 and December 2013.

Pulp duplicates

The results of precision pairs may be assessed using a ranked absolute relative difference plot, with acceptable results corresponding to ±10% agreement on 90% of pulp duplicate pairs when using the ranked half absolute relative difference plot.

Table 11.9 Summary of pulp duplicate performance – 2006 - 2013

Laboratory	Sample Numbers	Duplicate sample type	± Agreement %	Bias
Certimin	609	Pulp	94	Duplicates have slightly lower grades
ALS Chemex	1,115	Pulp	92	Duplicates have lower grade above the 97.5th percentile
Acme	1,337	Pulp	94	None

Umpire (check-lab) duplicates

No umpire duplicates were submitted between April 2006 and December 2013.

11.5.4.2 2015 – May 2022 duplicate performance

A total 4,878 duplicate samples were sent for analysis during 2015 - May 2022. This consisted of field, coarse and umpire duplicates. A summary of their performance is outlined below.

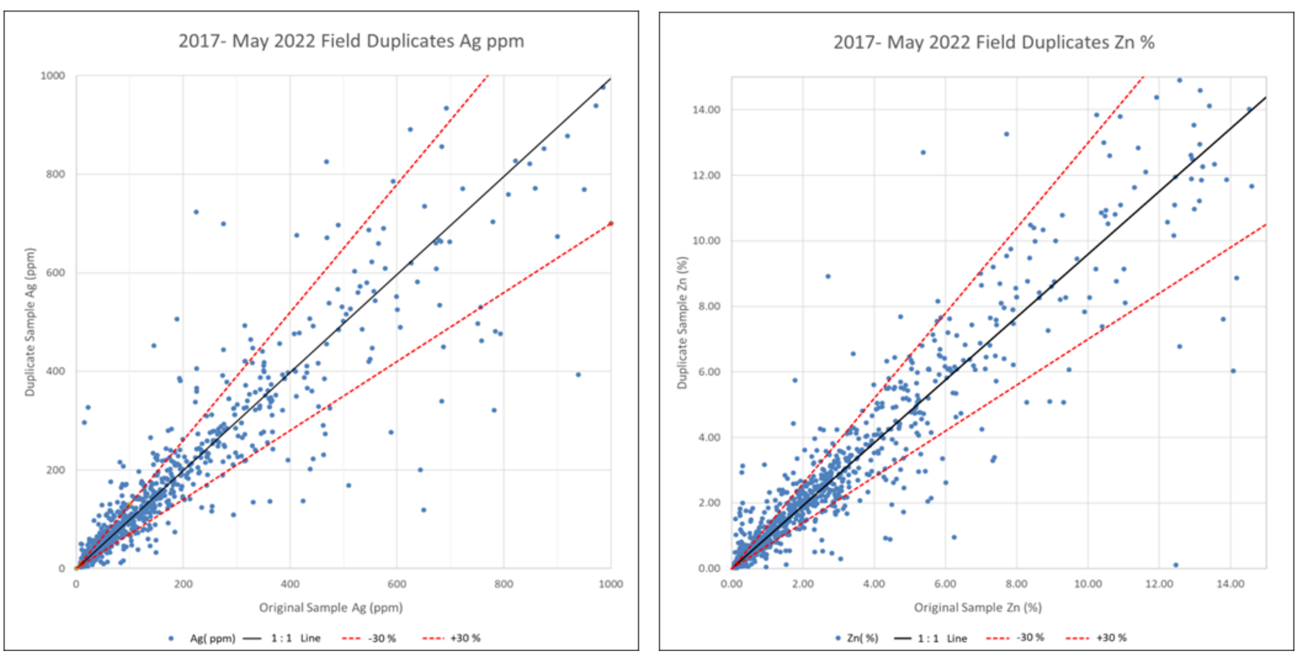
Field duplicates

A total of 1,267 field duplicates were submitted from diamond drill core samples between 2015 - May 2022. Table 11.10 summarizes the field duplicate performance by year for Ag, Cu, Pb, and Zn for field duplicate samples submitted between 2017 - May 2022. An LDL of 0.5 Ag parts per million (ppm) and 0.005% Cu, Pb, and Zn was used. The bias is measured based on the mean grade of the original sample dataset versus the duplicate sample dataset. A positive bias result indicates the overall the original samples are returning higher values than the duplicate samples. Figure 11.4 shows the RPD and scatter plot for Ag including field duplicates from 2017 - May 2022.

Table 11.10 Summary of field duplicate performance Ag, Cu, Pb, and Zn – 2017 - May 2022

Element	Year	2017	2018	2019	2020	2021	May 2022	2017 - 2022
Ag	Field sample pairs (Pairs > 15 x LDL)	388 (307)	199 (172)	115 (113)	20 (19)	92 (91)	25 (23)	839 (725)
	Field sample pairs < 30% RPD	126	50	22	7	24	6	235
	Bias (%)	3	-9	10	-2	-2	12	1
Cu	Field sample pairs (Pairs > 15 x LDL)	388 (100)	199 (92)	115 (83)	20 (18)	92 (43)	25 (14)	839 (350)
	Field sample pairs < 30% RPD	136	65	20	8	24	11	264
	Bias (%)	-1	-1	7	-1	-4	18	0
Pb	Field sample pairs (Pairs > 15 x LDL)	388 (270)	199 (155)	115 (104)	20 (18)	92 (84)	25 (23)	839 (654)
	Field sample pairs < 30% RPD	147	69	29	61	28	7	288
	Bias (%)	-1	8	11	7	1	-7	3
Zn	Field sample pairs (Pairs > 15 x LDL)	388 (338)	199 (179)	115 (110)	20 (20)	92 (87)	25 (24)	839 (758)
	Field sample pairs < 30% RPD	133	61	21	68	25	8	254
	Bias (%)	2	-2	-1	-2	-2	8	0

Figure 11.4 RPD and scatter plot of field duplicates for Ag – 2017 – May 2022



Note: Scatterplot is limited to 1,000 Ag ppm.
Source: PAS (2022).

The field duplicate performance is reasonable. The performance has improved over time. Ag and Cu performed the best and overall meet the assessment criteria for field duplicate performance. Pb and Zn just fall sort of the assessment criteria, however, the results are deemed acceptable.

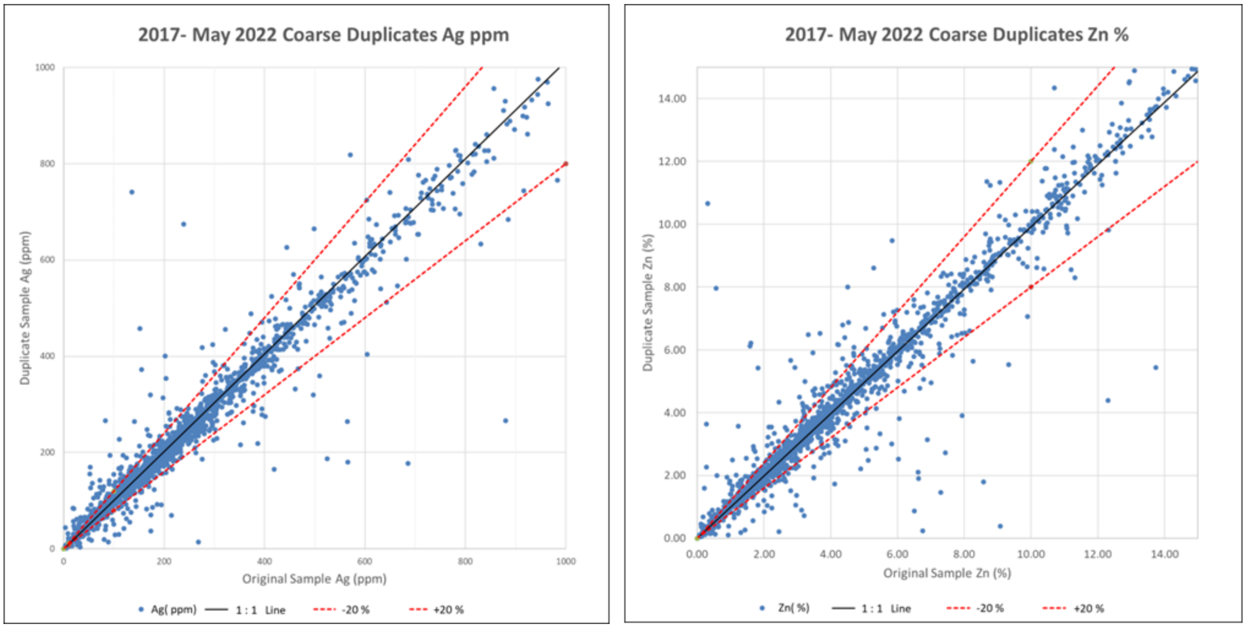
Coarse duplicates

A total of 1,772 coarse duplicates were submitted between 2015 - May 2022. Table 11.11 summarizes the coarse duplicate performance by year for Ag, Cu, Pb, and Zn for coarse duplicate samples submitted between 2017 - May 2022. An LDL of 0.5 Ag ppm and 0.005% Cu, Pb, and Zn was used. The bias is measured based on the mean grade of the original sample dataset versus the duplicate sample dataset. A positive bias result indicates the overall the original samples are returning higher values than the duplicate samples. Figure 11.5 shows the scatter plot for Ag and Zn including coarse duplicates from 2017 - May 2022.

Table 11.11 Summary of coarse duplicate performance Ag, Cu, Pb, and Zn – 2017 –May 2022

Element	Year	2017	2018	2019	2020	2021	2022	2017 - 2022
Ag	Coarse sample pairs (Pairs > 15 x LDL)	331 (329)	314 (313)	340 (340)	158 (158)	453 (450)	176 (176)	1,772 (1,766)
	Coarse sample pairs < 20% RPD	92	11	7	2	10	5	127
	Bias (%)	5	0	0	0	-1	1	1
Cu	Coarse sample pairs (Pairs > 15 x LDL)	331 (256)	314 (249)	340 (268)	158 (136)	453 (334)	176 (143)	1,772 (1,386)
	Coarse sample pairs < 20% RPD	104	28 95	22	7	26	5	192
	Bias (%)	-11	-1	2	-1	1	1	-2
Pb	Coarse sample pairs (Pairs > 15 x LDL)	331 (307)	314 (300)	340 (328)	158 (149)	453 (430)	176 (169)	1,772 (1,683)
	Coarse sample pairs < 20% RPD	102	15	7	2	19	13	158
	Bias (%)	-3	-1	1	1	-1	0	0
Zn	Coarse sample pairs (Pairs > 15 x LDL)	331 (328)	314 (314)	340 (336)	158 (158)	453 (449)	176 (172)	1,772 (1,757)
	Coarse sample pairs < 20% RPD	103	11	9	1	17	3	144
	Bias (%)	1	0	1	0	0	0	0

Figure 11.5 RPD and scatter plot of coarse duplicates for Ag – 2017 - May 2022



Note: Scatterplot is limited to 1,000 Ag ppm and 15% Zn.
Source: PAS (2022).

The coarse duplicates performed very well for all elements. There is a noticeable improvement in precision after the 2017 program. The coarse duplicates have performed consistently well over the period 2017 - May 2022.

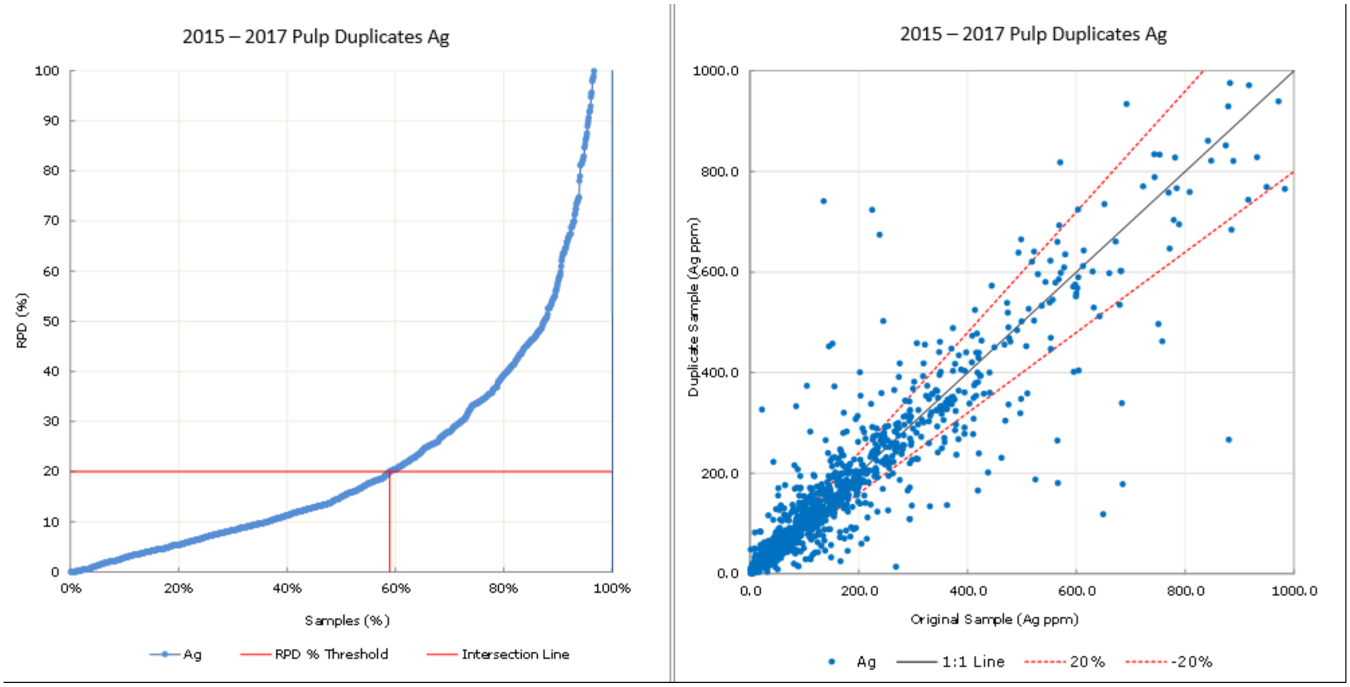
Pulp duplicates

A total of 1,353 pulp duplicates were submitted between 2015 - 2017. Table 11.12 summarizes the performance by year for Ag, Cu, Pb, and Zn for pulp duplicate samples submitted between 2015 - 2017. An LDL of 0.5 Ag ppm and 0.005% Cu, Pb, and Zn was used. The bias is measured based on the mean grade of the original sample dataset versus the duplicate sample dataset. A positive bias result indicates the overall the original samples are returning higher values than the duplicate samples. Figure 11.6 shows the RPD and scatter plot for Ag including coarse duplicates from 2015 - 2017.

Table 11.12 Summary of pulp duplicate performance Ag, Cu, Pb, and Zn – 2015 - 2017

Element	Year	2015	2016	2017	2015 - 2017
Ag	Pulp sample pairs (Pairs > 15 x LDL)	373 (346)	576 (518)	377 (345)	1,326 (1,209)
	Pulp sample pairs < 20% RPD	58	58	61	59
	Bias (%)	2	0	-3	0
Cu	Pulp sample pairs (Pairs > 15 x LDL)	373 (183)	576 (302)	377 (167)	1,326 (652)
	Pulp sample pairs < 20% RPD	69	58	69	64
	Bias (%)	-11	-5	3	-6
Pb	Pulp sample pairs (Pairs > 15 x LDL)	373 (335)	576 (475)	377 (307)	1,326 (1,117)
	Pulp sample pairs < 20% RPD	58	54	59	57
	Bias (%)	4	3	2	3
Zn	Pulp sample pairs (Pairs > 15 x LDL)	373 (358)	576 (533)	377 (353)	1,326 (1,244)
	Pulp sample pairs < 20% RPD	56	58	61	58
	Bias (%)	6	0	-2	1

Figure 11.6 RPD and scatter plot of pulp duplicates for Ag – 2015 - 2017



Source: PAS (2022).

The pulp duplicates from 2015 - 2017 performed below expectation.

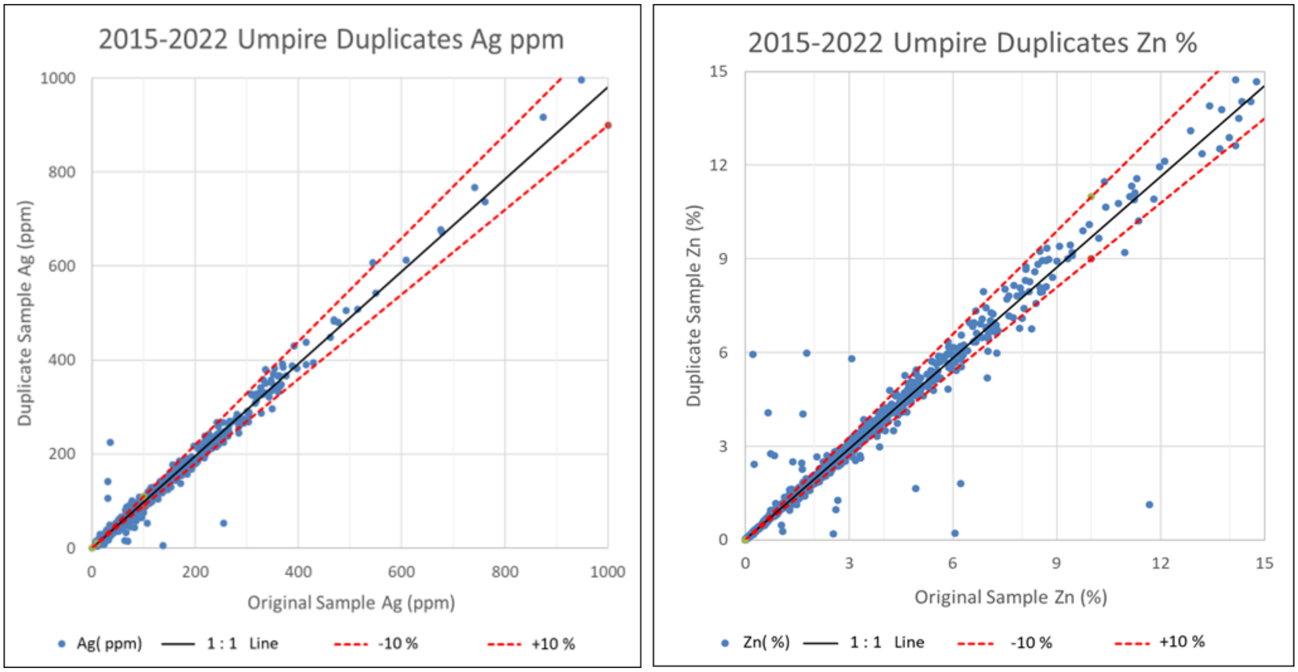
11.5.5 Umpire samples

A total of 1,282 umpire duplicates were submitted between 2015 - May 2022. Three external laboratories were used; in 2015 it was a combination of MINLAB (ISO 9001, ISO/IE 17025), CERTMIN (ISO 9001, ISO/IEC 17025), and ACTLAB (ISO 9001, ISO/IEC 17025). In 2016 to 2022 only ACTLABS (ISO 9001 and ISO/IEC 17025) was used as the external laboratory. For the purposes of assessing the performance, all umpire duplicates were considered together. Table 11.13 summarizes the performance by year for Ag, Cu, Pb, and Zn for umpire duplicate samples submitted between 2015 - May 2022. An LDL of 0.5 Ag ppm and 0.005% Cu, Pb, and Zn was used. The bias is measured based on the mean grade of the original sample dataset versus the duplicate sample dataset. A positive bias result indicates that overall, the SGS Huaron samples are returning higher values than the duplicate samples. Figure 11.76 shows the RPD and scatter plot for Ag including umpire duplicates from 2015 - May 2022.

Table 11.13 Summary of umpire duplicate performance Ag, Cu, Pb, and Zn – 2015 - May 2022

2015 – May 2022	Ag	Cu	Pb	Zn
Umpire sample pairs (Pairs > 15 x LDL)	1282 (1253)	1282 (709)	1282 (1132)	1282 (1243)
Umpire sample pairs < 10% RPD	383	225	338	166
Bias (%)	-3	3	-2	-2

Figure 11.7 RPD and scatter plot of umpire duplicates for Ag – 2015 - May 2022



Source: PAS (2022).

The umpire samples for Cu and Zn performed well. The umpire samples for Ag and Pb performed below the assessment criteria for umpire duplicates, however the QP considers them to be reasonable. The QP notes that the QA/QC performance has improved since 2017 and that umpire duplicates should be inserted in future QA/QC programs.

11.6 Summary statement

The QP considers the sampling methods, security, and analytical procedures to be adequate. The QA/QC performance indicates reasonable levels of accuracy and precision, with performance improving over time. This is shown in the low failure rate of the SRMs and the good performance of the field and coarse duplicates, especially after 2017. There is some variation in performance between elements, with Ag and Cu generally performing best. Laboratory hygiene is confirmed by the good results of the coarse blank samples.

The QP notes the absence of pulp duplicates and lack of submission of umpire duplicates since 2017. Submission of pulp duplicates and umpire duplicates will be addressed by the QP in future QA/QC programs.

Based on the QA/QC sample performance, the QP considers the assay results are suitable for inclusion in the Mineral Resource estimates.

12 DATA VERIFICATION

12.1 Geology data reviews

On an annual basis, the QP reviews the diamond drilling plans and the Mineral Resource estimate procedures including the vein interpretations, treatment of extreme sample grade values, and the estimate of tonnes and grade. The reconciliation between the mine plan and the processing plant are reviewed quarterly, and the drillhole vein intersection width and grade results and QA/QC results are reviewed monthly. During mine visits, the exploration drilling, sample, and security protocols are reviewed, along with the operational mine plan, actual mine operation data, and grade control protocols.

Interpreted veins / structures using wireframes constructed on site with Leapfrog software are validated by senior personnel under the QP's supervision. Wireframe construction using vein / structures codes, channel samples, diamond drill samples and marginal cut-off values are all verified. The objective of the review is to verify the coded data in the wireframes that are used to run the resource estimation.

In the opinion of the QP, the data used for the Mineral Resource and Mineral Reserve estimates are sufficiently reliable for those purposes.

12.2 Mine engineering data reviews

The QP undertakes regular reviews of the mine engineering data, including the mining fleet and mine operational and production data, grade control data including dilution and ore loss, geotechnical and hydrological studies, waste disposal requirements, environmental and community factors, the processing data, the development of the LOM plan including production and recovery rates, capital and operating costs estimates for the mine and processing facilities, transportation, logistics, and power and water consumption and future requirements, taxation and royalties, and the parameters and assumptions used in the economic model.

In the opinion of the QP, the data and assumptions and parameters used for the Mineral Resource and Mineral Reserve estimates are sufficiently reliable for those purposes.

12.3 Metallurgy data reviews

The QP undertakes regular reviews of the processing plant operational data such as metallurgical results, production, reagent consumption, treatment rates, plant availabilities and utilization, metallurgical lab procedures, and general business performance.

In the opinion of the QP, the data and assumptions used to estimate the metallurgical recovery model for the Mineral Resource and Mineral Reserve estimates are sufficiently reliable for those purposes.

13 MINERAL PROCESSING AND METALLURGICAL TESTING

No new metallurgical test work has been carried out since reporting in the 2014 PAS Technical Report. Metal recovery forecasts for Huaron are based on the historical performance of the plant operations. As part of normal plant operating procedures, routine metallurgical test work is undertaken on an annual basis to evaluate veins metallurgical performance and to manage the ore blend necessary to produce an optimal concentrate product. The majority of this test work comprises flotation tests and mineralogical analysis to assess metallurgical recovery, the presence and concentration of deleterious metals, and the proportion of each economic metal present in the silver-rich copper, lead, and zinc concentrates. Representative samples are selected for this work from the principal veins comprising the majority of the plant feed. The results of the test work form part of the parameters used for the annual Mineral Resource and Mineral Reserve estimates.

13.1 Production metallurgical recoveries

A summary of the metallurgical recoveries by metal achieved in the plant over the past 9 years is given in Table 13.1. The distribution of silver present in the concentrates is typically between 41% and 51% to the copper concentrates, between 21% and 32% to the lead concentrates, and between 9% and 11% to the zinc concentrates. The copper concentrates average 24% copper, the lead concentrates average 51% lead, and the zinc concentrates average 45% zinc. Silver grades in the concentrates are approximately 2,700 ppm Ag in the copper concentrate, 2,000 ppm Ag in the lead concentrate, and 350 ppm in the zinc concentrate.

Table 13.1 Metallurgical recovery by year

Year	% Recovery Ag	% Recovery Cu	% Recovery Pb	% Recovery Zn
2022	84	75	80	78
2021	83	77	72	77
2020	84	75	76	78
2019	84	76	76	77
2018	83	77	73	76
2017	85	78	78	78
2016	84	75	79	74
2015	83	78	73	64
2014	83	77	72	68

13.2 Pocock 2022 SLS test work

Solids Liquid Separation (SLS) test work was conducted by Pocock Industrial in 2022 from Huaron as part of evaluations for implementing dry-stacked tailings at the mine site. Samples include flotation tails as produced by the mineral processing plant and overflow of hydro-cyclone after underground backfill sands classification. The test work included flocculant screening tests, static and dynamic thickening tests, viscosity tests as well as vacuum and pressure filtration tests. Test results from the pressure filtration test work carried out range from 13% to 16% moisture content yielding a good discharge and stacking properties at reasonable dry times. Production rates achieved suggest that pressure filtration would likely be reasonable for dry stack tailings.

14 MINERAL RESOURCE ESTIMATES

14.1 Introduction

Pan American updates Mineral Resource estimates on an annual basis following reviews of metal price trends, operational performance and costs experienced in the previous year, and forecasts of production and costs over the LOM. Infill and near-mine drilling is conducted as required through the year. The drillhole data cut-off date for the commencement of the current geological interpretation was April 30, 2022 and the effective date of the Mineral Resource estimate is June 30, 2022

Mineral Resource estimates for the Property were prepared by Pan American staff under the supervision of, and reviewed by Christopher Emerson, FAusIMM, Vice President, Business Development and Geology of Pan American, who is a QP. They have been estimated in accordance with the CIM Estimation of Mineral Resources and Mineral Reserves, Best Practice Guidelines (2019), and reported according to the CIM Definition Standards (2014).

Mineralization domains representing vein structures were defined in Leapfrog Geo software, while sub-block model estimates were completed within Datamine software, using capped composites and a multi-pass OK or ID^2 interpolation approach. Blocks weren´t classified, the mined panels were classified considering local drillhole spacing and proximity to existing development.

Wireframe and block model validation procedures including wireframe to block volume confirmation, statistical comparisons with composite and swath plots, visual reviews in 3D, longitudinal, cross section, and plan views, as well as cross software reporting confirmation were completed for all structures.

A summary of the Mineral Resource estimates as of June 30, 2022 for the Huaron mine are presented in Table 14.1 and is prepared in accordance with NI 43-101 definitions. A detailed breakdown is shown in Table 14.11.

Table 14.1 Summary of Mineral Resources – June 30, 2022

Classification	Tonnes Mt	Ag g/t	Contained Ag Moz	Cu %	Pb %	Zn %
Measured	2.08	163	10.88	0.42	1.58	3.05
Indicated	2.37	166	12.69	0.40	1.71	2.92
Measured + Indicated	**4.46**	**165**	**23.57**	**0.41**	**1.65**	**2.98**
Inferred	**7.25**	**155**	**36.13**	**0.26**	**1.47**	**2.73**

Notes:
- CIM Definition Standards (2014) were used for reporting the Mineral Resources.
- Mineral Resources exclude those Mineral Resources converted to Mineral Reserves.
- Mineral Resources that are not Mineral Reserves do not have demonstrated economic viability.
- Mineral Resource estimates were prepared under the supervision of or were reviewed by Christopher Emerson, FAusIMM, Vice President, Business Development and Geology of Pan American.
- The Mineral Resource estimates are based on an incremental VPT of $80.59/t.
- Metal prices used are $19 per ounce of silver, $7,000/t for copper, $2,000/t for lead and $2,600/t for zinc.
- The VPT used to determine cut-off is based on a combination of metal price and individual metal recoveries which are variable throughout the deposit, and smelter considerations.
- Mineral Resources were constrained to conform with RPEEE.
- The drillhole database was closed at May 31, 2022.
- Totals may not add up due to rounding.

14.2 Resource database

The drilling database is maintained in Fusion Server, with drillhole location information in WGS84 projection, UTM Zone 18. All drillhole database and channel samples are maintained in metric units, all Mineral Resource estimates at Huaron have been completed in metric units.

The database for the Huaron mine Mineral Resources consists of diamond drilling of at 25 m to 30 m average spacing and channel sample data. This amounts to 112,377 assays made up of 66,215 assays from 34,693 channels (71,468 m) and 46,162 assays from 1,173 drillholes (37,726 m). Drilling was conducted from surface and from underground infrastructure. The data was imported into Leapfrog Geo for wireframe building and then block modelling and resource estimation in Datamine.

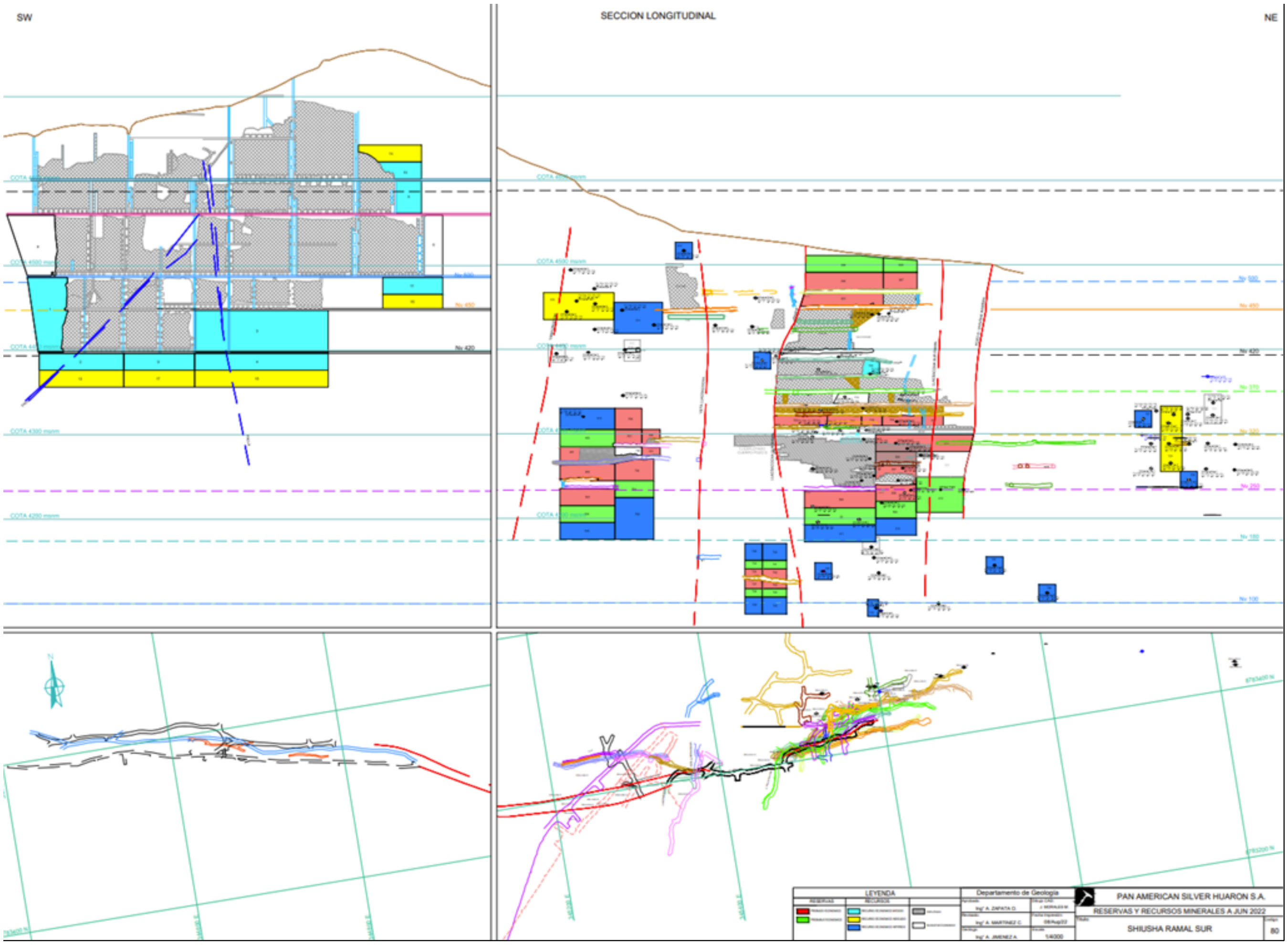
14.3 Discussion of the 2D method

The 2D estimates are prepared on an annual basis and updated with the additional diamond drilling and channel samples collected during the year, using a variation of the polygonal method in AutoCAD and Excel software. Each vein structure is projected onto a longitudinal section and divided into a series of geometrical blocks created to best fit an area of mineralization into a minable block, if the mineralization present is considered economic. The dimensions of the mining blocks are based on mining levels, stope layouts, and previously mined out areas, and range in length from between 20 m and 70 m. They are generally on the order of 50 m long and 15 m high. An example longitudinal section from the 69 structure is given in Figure 14.1.

The average true width of the vein intersection is projected for that block. The planned mining dilution (minimum mining width) based on, expected ground conditions is then added to the vein width of that block and the volume determined. Sample grades are reviewed and treated for extreme values if necessary, and then the average grade of the intersections (including the internal dilution) is assigned to the block. Bulk density values are applied to the volume of the block to estimate the tonnes of each block, based on the average bulk density measured from samples selected from each respective veins.

A value per tonne is applied to each block based on metal content, metal prices, concentrate sales terms, concentrate quality, processing recovery, transportation, refining, and other selling costs such as storage fees, port fees, etc. Metallurgical recoveries are determined separately for each group of veins or structures to account for variability in the recovery. Metal prices used to estimate mineral resources were $19 per ounce of silver, $2,000 per tonne of lead, $2,600 per tonne of zinc, and $7,000 per tonne of copper. Any blocks that do not meet the criteria of resources are removed. Each block is classified as Measured, Indicated, and Inferred Mineral Resources categories depending on confidence based on the location of the block relative to mine workings, the type of sample available in each block, and the number of samples available to estimate each block.

Figure 14.1 Example longitudinal section showing a 2D estimate



14.4 Geological interpretation and modelling

The Huaron Mineral Resource estimates are based on interpretation of vein structures in 34 domains (see Table 14.2).

Table 14.2 Modelled structures

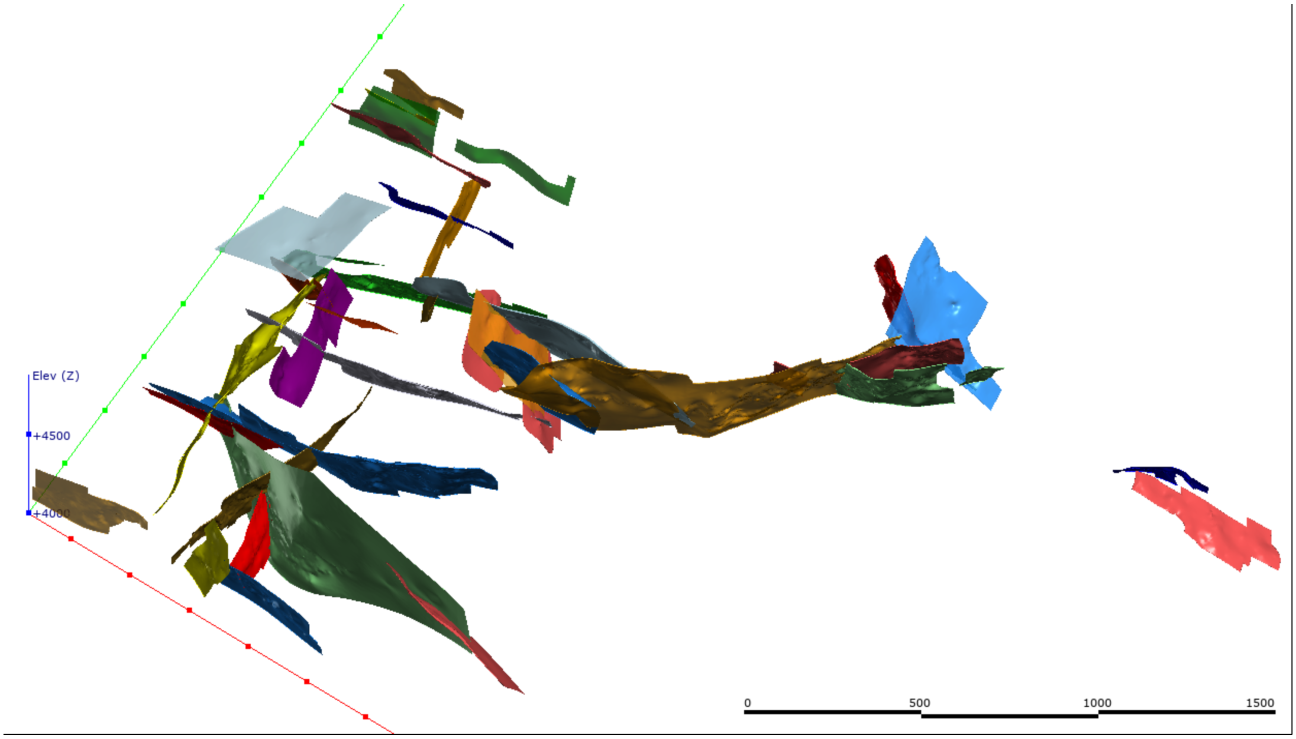
Domain code	Structure	Domain code	Structure
4	Bernabe Ramal	219	Sheyla Ramal
11	Cometa Ramal	221	Roxana Ramal 1
13	Danitza Ramal	222	Mariana Ramal 1
14	Dos Ramal	225	Shiusha Ramal
19	Fastidiosa Ramal 4	228	Consuelo Ramal
24	**Juanita Ramal**	229	Teresa Ramal
30	Labor Oeste	230	Cometa Ramal 1
34	Llacsacocha Sur	231	Cuerpo Labor
38	Margarita Ramal	233	Cuerpo Rey
40	Mariana Ramal	234	Cuerpo Santa Rita
44	Mily Ramal	235	La China Ramal
57	Productora Ramal	238	Rosita Ramal
58	Providencia Ramal	241	San Pedro Ramal
63	Roxana Ramal	250	Sevilla Ramal Este
88	Travieso Ramal	254	Shiusha Ramal Sur Piso
90	Uno Ramal	256	Lesly Ramal
91	Alianza	257	Pozo D Ramal Sur
94	Constancia	258	Pozo D Ramal Norte
98	Gavia	260	Pozo D - Chert
102	Pozo D	261	Constancia Ramal Techo
103	Rey Ramal	263	Cuerpo Shiusha Warren
104	San Narciso	265	Cuerpo Andres
106	Shiusha Warren	266	Tapada Ramal Piso
107	Tapada	267	Maritza Ramal Techo
108	Travieso	269	Halley Ramal
109	Yanacreston	271	Andres Ramal Piso
116	Yanacreston Ramal 1	401	Mariana Ramal
155	Farallon Ramal	941	Constancia
156	Llacsacocha	1551	Farallon Ramal
157	Llacsacocha Ramal Sur 1	1561	Llacsacocha
213	Cuatro Ramal	2151	Santo Tomas Ramal
215	Santa Tomas Ramal	2291	Teresa Ramal
217	Maritza Ramal		

Note: Domain 24 Juanita Ramal is used as an example throughout the report.

The domain wireframe was constructed by a geologist using a marginal VPT, and domain extensions were defined at a limit of closer to 50% of the local drillhole spacing, or 50% of the distance to an excluded drillhole. Also, domains were constructed for the HW and FW of each structure (adding 01 to the vein code for the HW and 02 to the vein code for the FW). Vein orientations at the structures have been confirmed through underground mapping and sampling, as well as vein orientations observed in drill core.

A total of 34 wireframes for the mineralized zone, 34 for the HW, and 34 for the FW were modeled altogether at Huaron mine. Final domains are presented in Figure 14.2. No minimum mining width was used to model shapes.

Figure 14.2 Wireframes of the structures



Source: PAS (2022).

14.5 Statistics and compositing

14.5.1 Compositing

Assay samples were composited to represent the full-length intercept of each domain. A histogram of assay lengths within mineralization domains is presented in Figure 14.3 as a histogram of the composite interval lengths within the mineralization domain at Juanita Ramal, as an example. The chosen composite length is 1.5 m or 2.0 m for different domains.

Figure 14.3 and silver composite statistics are summarized in Table 14.3.

Table 14.3 Composites statistics

Domain	Number of Composited	Mean (g/t Ag)	Mean (% Cu)	Mean (% Pb)	Mean (% Zn)
4	1145	236.14	0.15	5.56	10.09
401	160	20.94	0.02	0.49	1.28
402	138	23.67	0.04	0.41	1.15
11	125	342.45	0.12	6.75	7.26
1101	25	23.34	0.02	0.46	1.03
1102	25	94.88	0.11	0.58	0.25
13	347	517.23	0.27	5.97	5.99
1301	95	25.90	0.01	0.46	0.52
1302	94	50.59	0.03	0.30	0.27
14	10	250.41	0.07	1.56	5.58
1401	20	1.16	0.00	0.01	0.05
1402	19	2.49	0.01	0.01	0.16
19	384	215.02	0.17	2.54	3.70
1901	93	21.06	0.02	0.22	0.39
1902	98	28.86	0.02	0.61	0.68
24	2437	382.59	1.94	1.69	2.75
2401	332	37.89	0.12	0.34	0.46
2402	419	52.99	0.27	0.29	0.51
30	1191	369.51	0.47	4.55	8.26
3001	73	20.31	0.02	0.24	0.46
3002	71	30.93	0.05	0.32	0.57
34	2882	204.80	0.45	0.91	3.92
3401	296	47.23	0.08	0.62	1.47
3402	318	74.30	0.11	0.62	1.61
38	287	582.98	0.16	2.26	4.36
3801	86	63.83	0.03	0.37	0.99
3802	80	23.52	0.02	0.22	0.34
40	477	230.01	0.93	1.93	4.31
4001	100	9.72	0.03	0.14	0.33
4002	95	12.46	0.03	0.21	0.34
44	287	180.21	0.09	1.54	5.58
4401	273	21.24	0.02	0.26	0.75
4402	274	22.96	0.02	0.34	0.80
57	2126	206.53	0.95	1.08	3.18
5701	217	24.87	0.11	0.19	0.59
5702	202	29.28	0.12	0.16	0.70
58	2213	350.20	0.56	1.96	3.94
5801	328	25.87	0.04	0.16	0.35
5802	248	15.78	0.03	0.16	0.28
63	396	380.24	0.95	1.03	2.49
6301	153	17.03	0.08	0.12	0.21
6302	163	13.25	0.02	0.08	0.16
88	157	971.06	1.16	2.34	3.75

Domain	Number of Composited	Mean (g/t Ag)	Mean (% Cu)	Mean (% Pb)	Mean (% Zn)
8801	70	139.63	0.42	0.10	0.18
8802	101	28.96	0.09	0.18	0.26
90	15	289.69	0.09	2.06	4.61
9001	30	3.91	0.00	0.05	0.26
9002	16	1.26	0.00	0.01	0.08
91	2669	193.94	0.95	1.46	4.63
9101	258	33.50	0.12	0.24	1.14
9102	291	29.85	0.14	0.31	1.34
94	859	200.30	1.15	2.30	4.29
9401	176	30.18	0.08	0.43	0.81
9402	142	28.79	0.06	0.56	1.16
98	1253	257.86	1.11	5.07	10.02
9801	36	23.10	0.09	0.43	0.69
9802	43	38.98	0.14	0.68	1.23
102	1127	226.71	0.24	1.21	3.82
10201	107	92.04	0.07	0.74	1.46
10202	133	29.39	0.04	0.42	1.01
103	445	214.64	0.15	2.83	5.28
10301	76	33.88	0.04	0.37	0.83
10302	78	35.59	0.03	0.41	0.64
104	1436	240.70	1.03	1.21	3.27
10401	211	30.00	0.13	0.26	0.76
10402	187	61.84	0.21	0.34	0.83
106	1298	313.56	0.40	1.10	4.08
10601	323	55.51	0.05	0.60	1.53
10602	252	55.57	0.06	0.37	1.21
107	5082	336.32	1.95	1.22	2.93
10701	393	34.63	0.15	0.25	0.61
10702	404	37.46	0.14	0.22	0.54
108	3289	188.47	5.97	0.35	0.85
10801	333	42.04	2.28	0.15	0.35
10802	304	45.98	1.61	0.19	0.73
109	336	183.98	1.47	0.83	4.28
10901	100	46.18	0.11	0.07	0.94
10902	89	25.05	0.19	0.16	0.74
116	23	178.46	0.11	2.43	5.57
11601	21	20.33	0.02	0.29	1.38
11602	20	24.34	0.02	0.44	2.15
155	1044	288.66	0.14	4.24	5.07
15501	187	34.53	0.03	0.42	0.65
15502	205	29.87	0.02	0.36	0.58
156	6544	210.11	0.46	0.56	3.65
15601	525	37.31	0.10	0.16	1.00
15602	434	33.71	0.12	0.14	1.04
157	15	158.12	0.48	1.88	4.51

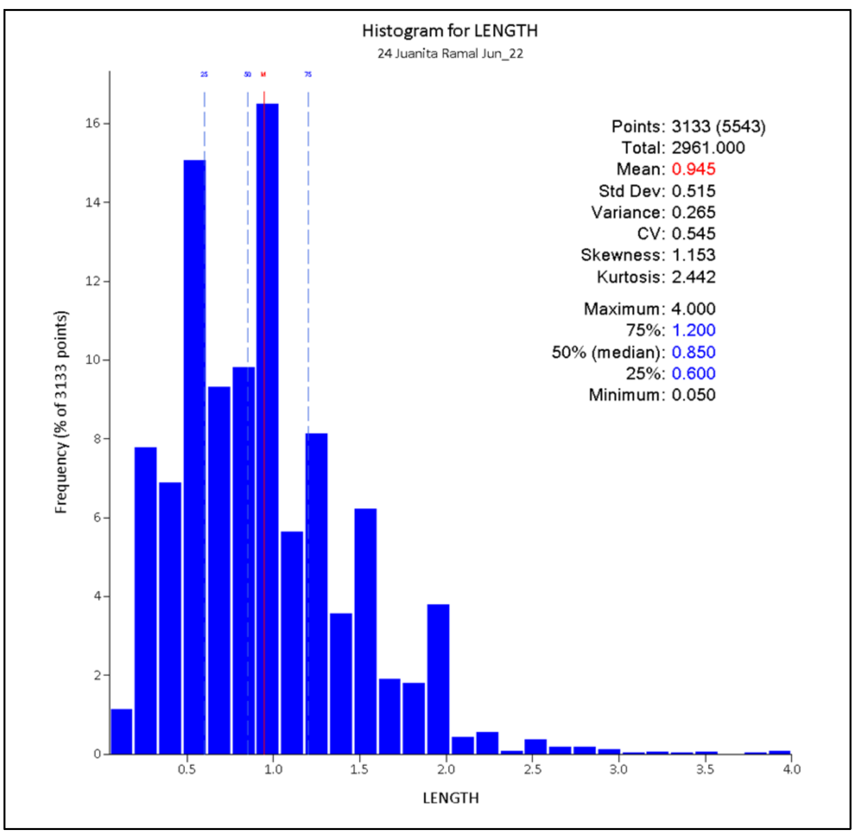
Domain	Number of Composited	Mean (g/t Ag)	Mean (% Cu)	Mean (% Pb)	Mean (% Zn)
15701	12	9.64	0.03	0.13	0.85
15702	12	25.42	0.03	0.42	2.28
213	3194	261.97	1.96	1.23	2.82
21301	341	31.13	0.18	0.20	0.65
21302	394	23.62	0.10	0.23	0.65
215	91	197.03	2.58	1.10	1.51
21501	65	7.35	0.07	0.05	0.15
21502	67	16.04	0.18	0.13	0.29
217	655	456.92	0.25	2.92	3.45
21701	29	25.25	0.02	0.25	0.25
21702	35	86.29	0.07	0.44	0.73
219	208	269.62	0.63	1.48	4.13
21901	17	11.31	0.02	0.17	0.39
21902	14	38.74	0.06	0.30	0.80
221	223	347.05	0.26	1.90	2.46
22101	106	17.21	0.02	0.13	0.29
22102	101	14.25	0.02	0.15	0.19
222	326	422.57	0.58	4.98	5.28
22201	16	38.40	0.30	0.31	0.90
22202	15	71.85	0.29	0.16	0.38
225	22	126.97	0.14	2.04	3.19
22501	41	12.17	0.01	0.24	0.43
22502	32	45.97	0.02	1.06	1.04
228	14	192.83	0.73	0.99	3.41
22801	39	4.29	0.01	0.02	0.03
22802	32	17.21	0.02	0.19	0.07
229	161	400.46	0.34	1.87	3.01
22901	82	43.03	0.03	0.54	0.73
22902	79	38.35	0.02	0.36	0.59
230	6	130.59	0.03	1.95	3.75
23001	14	16.96	0.00	0.44	0.54
23002	13	22.21	0.01	0.47	0.77
231	42	87.63	0.03	2.33	3.05
23101	8	15.56	0.01	0.40	0.68
23102	14	0.01	0.00	0.00	0.00
233	217	139.29	0.16	2.64	4.62
23301	25	83.50	0.09	1.64	2.92
23302	27	47.10	0.05	1.06	2.06
234	8	161.65	0.07	0.73	1.66
23401	7	5.71	0.00	0.02	0.09
23402	4	11.80	0.05	0.22	0.44
235	328	322.29	1.70	1.75	2.93
23501	49	39.60	0.23	0.20	0.54
23502	44	37.47	0.33	0.18	0.59
238	3	317.96	0.13	1.41	3.28

Domain	Number of Composited	Mean (g/t Ag)	Mean (% Cu)	Mean (% Pb)	Mean (% Zn)
23801	4	3.77	0.00	0.01	0.03
23802	3	1.63	0.00	0.01	0.01
241	304	246.33	0.06	4.55	3.75
24101	95	27.63	0.01	0.45	0.39
24102	87	42.69	0.02	0.66	0.53
250	394	159.31	0.03	0.42	3.24
25001	119	40.51	0.02	0.16	1.13
25002	130	32.46	0.01	0.14	1.08
254	12	115.79	0.08	1.70	2.57
25401	37	32.42	0.05	0.52	1.32
25402	25	41.80	0.05	0.68	1.68
256	191	178.09	0.89	1.92	5.87
25601	45	14.59	0.10	0.08	0.44
25602	28	29.24	0.06	0.22	1.09
257	197	186.99	0.04	0.98	3.23
25701	123	30.51	0.01	0.13	0.52
25702	102	46.19	0.01	0.18	0.79
258	841	435.58	0.10	0.59	3.38
25801	98	30.04	0.01	0.14	0.34
25802	108	28.16	0.01	0.38	0.76
260	141	209.93	0.04	0.64	2.06
26001	110	43.34	0.01	0.24	0.78
26002	131	36.56	0.01	0.40	0.87
261	431	249.33	0.60	4.64	6.62
26101	136	14.88	0.03	0.28	0.62
26102	148	19.22	0.03	0.39	0.69
263	107	148.26	0.12	1.78	3.74
26301	23	20.01	0.04	0.12	0.45
26302	33	32.45	0.04	0.19	1.06
265	421	206.64	0.06	5.47	4.15
26501	109	25.82	0.01	0.71	0.72
26502	95	23.27	0.01	0.61	0.49
266	856	542.04	1.52	2.64	4.51
26601	84	35.93	0.05	0.27	0.45
26602	71	59.77	0.07	0.27	0.45
267	277	552.98	0.21	4.89	3.12
26701	27	158.66	0.05	2.08	0.44
26702	20	23.34	0.01	0.44	0.55
269	383	660.38	0.35	3.70	2.91
26901	21	9.59	0.01	0.06	0.09
26902	22	5.77	0.03	0.02	0.03
271	228	266.84	0.04	6.84	3.52
27101	31	20.15	0.01	0.47	0.47
27102	38	27.18	0.01	0.59	0.56
401	46	256.26	1.06	1.88	4.53

Domain	Number of Composited	Mean (g/t Ag)	Mean (% Cu)	Mean (% Pb)	Mean (% Zn)
40101	22	26.97	0.06	0.28	0.55
40102	12	104.50	0.23	0.47	1.22
941	39	156.60	0.31	2.39	4.41
94101	2	61.70	0.07	1.08	2.53
94102	7	52.36	0.09	0.82	1.65
1551	568	179.08	0.67	1.19	5.93
15501	27	43.28	0.08	0.32	1.55
15502	11	107.17	0.59	0.33	1.67
1561	1813	271.61	0.58	0.82	3.89
15601	164	32.74	0.05	0.29	0.97
15602	183	32.93	0.07	0.38	1.03
2151	222	273.12	1.17	0.68	2.54
21501	33	38.77	0.33	0.43	1.11
21502	53	27.73	0.09	0.17	0.54
2291	147	483.23	1.31	1.75	3.68
22901	21	19.15	0.03	0.11	0.48
22902	21	31.61	0.03	0.28	0.76

Figure 14.3 is a histogram of the composite interval lengths within the mineralization domain at Juanita Ramal structure as an example. The chosen composite length varies between 1.5 m and 2.0 m.

Figure 14.3 Histogram of sample interval lengths within Juanita Ramal structure



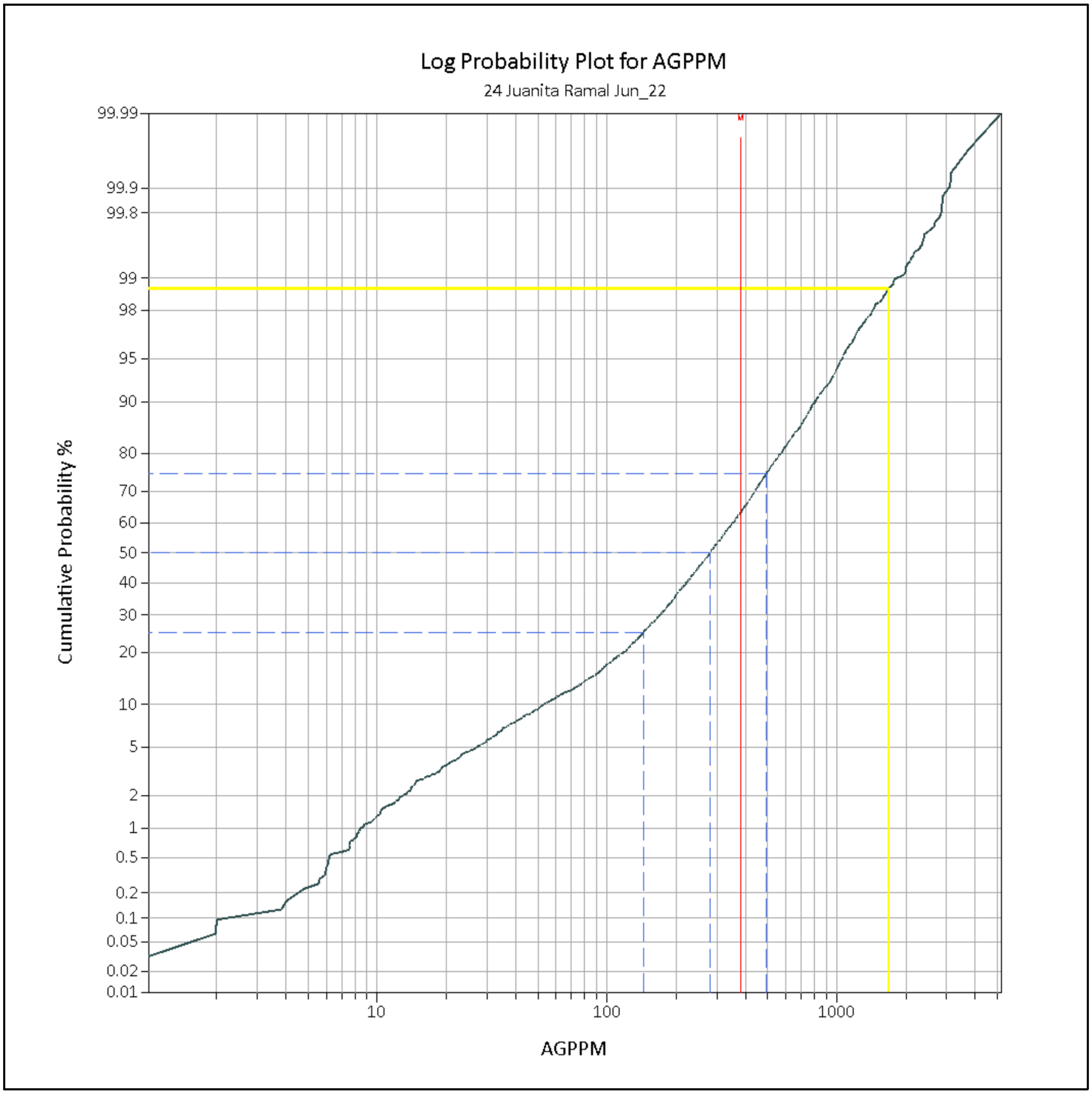
Source: PAS (2022).

14.5.2 Treatment of high-grade composites

Table 14.4 summarizes the uncapped and capped assays statistics at Huaron mine. Composites were reviewed using basic statistics, histograms, and log probability plots to determine variable global capped values for each domain independently.

Local capping was used too to reduce the impact of high grades in panels. The local capping algorithm identifies and manages, sample grades that will have an unacceptable large impact on the block grade estimates. The impact of a sample on the local estimates is evaluated by comparing two local averages: with and without the potential outlier sample. The impact of the potential outlier is measured by the ratio of the two average grades.

Figure 14.4 Probability plot Ag ppm at Juanita Ramal vein



Source: PAS (2022).

Table 14.4 Composites statistics and capping levels

	ORE									HW				FW			
Domain	Cap (g/t Ag)	Cap (% Cu)	Cap (% Pb)	Cap (% Zn)	Capped Mean (g/t Ag)	Capped Mean (% Cu)	Capped Mean (% Pb)	Capped Mean (% Zn)	Capped CV (g/t Ag)	Cap (g/t Ag)	Cap (% Cu)	Cap (% Pb)	Cap (% Zn)	Cap (g/t Ag)	Cap (% Cu	Cap (% Pb)	Cap (% Zn)
4	1142.00	0.47	32.47	33.61	212.04	0.14	4.92	9.69	0.91	65.52	0.07	1.45	4.57	78.00	0.15	1.48	4.08
11	890.56	0.44	23.09	17.75	314.30	0.08	6.45	6.98	0.61	42.49	0.05	1.25	3.87	75.51	0.09	0.60	0.58
13	1447.00	0.57	16.51	17.21	463.72	0.19	5.33	5.26	0.68	101.94	0.04	2.53	2.84	283.00	0.13	1.42	1.49
14	515.93	0.13	5.19	13.94	200.98	0.06	0.94	4.47	0.55	3.10	0.00	0.03	0.22	15.32	0.02	0.07	0.79
19	636.80	0.84	8.80	8.56	196.89	0.14	2.32	3.42	0.64	76.30	0.10	1.23	1.67	142.46	0.09	3.92	2.92
24	1245.06	9.71	7.56	10.39	351.50	1.76	1.56	2.54	0.68	170.70	0.46	1.41	1.83	208.25	1.22	1.33	1.89
30	1082.52	2.10	13.15	20.54	336.94	0.42	4.18	7.65	0.55	61.81	0.07	1.22	2.65	117.45	0.27	1.32	1.64
34	720.56	2.23	4.22	11.10	183.45	0.39	0.79	3.57	0.70	119.37	0.33	2.26	4.26	108.28	0.27	1.35	3.46
38	2807.89	0.48	6.90	10.86	502.30	0.15	2.12	4.18	0.81	256.75	0.13	1.38	4.16	70.09	0.11	0.74	1.42
40	788.75	4.04	7.78	13.80	208.81	0.85	1.77	3.99	0.61	43.78	0.11	0.84	1.74	55.23	0.11	0.76	1.52
44	566.93	0.21	5.40	14.76	163.06	0.07	1.27	5.01	0.62	74.17	0.08	1.17	3.06	94.15	0.06	1.38	3.81
57	608.51	5.16	5.83	11.26	187.34	0.83	0.96	2.91	0.60	85.50	0.56	0.86	2.48	85.76	0.56	0.54	2.47
58	1321.00	2.71	7.25	11.94	319.32	0.50	1.81	3.66	0.77	77.29	0.12	0.65	1.45	72.07	0.10	0.81	1.68
63	1703.56	3.91	4.19	8.26	345.97	0.82	0.92	2.31	0.79	66.85	0.44	0.63	1.36	37.22	0.06	0.31	0.72
88	3292.00	4.12	7.02	8.83	924.03	1.09	2.16	3.63	0.79	61.31	0.13	0.42	0.74	108.30	0.27	0.30	0.80
90	969.20	0.29	11.20	14.01	213.81	0.06	1.04	3.38	0.51	22.87	0.01	0.41	1.53	13.08	0.00	0.09	0.83
91	641.07	5.94	5.74	11.27	175.29	0.78	1.32	4.29	0.60	94.00	0.55	0.70	3.55	87.21	0.79	1.01	4.88
94	664.92	7.32	10.72	15.44	180.32	0.82	2.07	4.10	0.65	149.49	0.34	1.79	2.98	83.70	0.32	1.90	4.62
98	809.40	2.55	13.47	25.74	239.98	1.06	4.69	9.41	0.63	72.84	0.28	2.29	4.25	66.59	0.26	1.98	3.44
102	819.10	1.29	5.87	9.88	198.94	0.19	1.10	3.71	0.70	195.99	0.13	1.98	3.37	134.56	0.14	1.80	3.34
103	828.50	0.65	9.82	18.06	200.12	0.14	2.62	4.99	0.61	96.32	0.12	1.11	2.95	134.17	0.11	1.84	2.97
104	614.78	2.91	4.03	7.63	210.44	0.90	1.06	2.97	0.61	88.45	0.68	0.86	2.90	230.69	1.25	1.05	3.33
106	1239.22	2.54	4.49	12.11	263.43	0.32	0.99	3.86	0.70	111.42	0.10	1.23	3.19	86.27	0.13	0.86	2.77
107	1588.14	8.61	6.52	9.84	298.85	1.73	1.07	2.65	0.92	111.24	0.75	0.93	2.54	122.39	0.63	0.88	2.25
108	1295.92	15.23	2.98	6.74	133.79	3.78	0.23	0.56	1.16	127.77	9.65	0.72	1.58	146.35	7.59	1.06	3.96
109	561.71	12.79	4.88	11.66	174.33	1.31	0.75	4.16	0.62	78.00	0.13	0.25	2.75	85.48	0.31	0.92	3.79
116	423.01	0.31	8.64	15.92	165.04	0.11	2.05	5.09	0.38	63.97	0.09	1.07	4.31	59.29	0.06	2.28	5.94
155	515.21	4.46	4.64	12.71	256.12	0.10	3.86	4.67	0.69	71.73	0.20	0.69	3.05	295.68	1.93	0.94	3.00
156	762.73	3.09	2.28	10.56	188.27	0.39	0.50	3.34	0.63	101.48	0.34	0.54	3.27	94.67	0.51	0.48	3.25
157	239.16	2.45	7.37	10.16	156.22	0.30	0.98	3.41	0.36	38.42	0.12	0.51	3.43	60.28	0.08	1.01	4.42
213	1814.00	13.88	14.57	12.38	239.42	1.80	1.10	2.61	0.80	80.63	0.90	0.76	2.67	73.95	0.45	0.99	2.52
215	872.37	9.47	12.12	5.45	168.53	2.35	0.65	1.26	0.74	48.92	0.18	0.38	0.95	101.00	1.17	0.65	1.42

	ORE									HW				FW			
Domain	Cap (g/t Ag)	Cap (% Cu)	Cap (% Pb)	Cap (% Zn)	Capped Mean (g/t Ag)	Capped Mean (% Cu)	Capped Mean (% Pb)	Capped Mean (% Zn)	Capped CV (g/t Ag)	Cap (g/t Ag)	Cap (% Cu)	Cap (% Pb)	Cap (% Zn)	Cap (g/t Ag)	Cap (% Cu	Cap (% Pb)	Cap (% Zn)
217	1674.78	0.91	10.38	11.79	399.51	0.25	2.71	2.99	0.72	75.66	0.04	0.57	0.59	96.72	0.10	0.51	1.30
219	737.42	2.17	7.05	9.93	258.36	0.58	1.32	3.89	0.62	74.19	0.11	0.68	1.71	129.69	0.20	1.53	2.38
221	1936.32	1.28	9.70	11.40	276.71	0.21	1.62	2.15	1.01	136.40	0.11	0.52	1.63	90.00	0.07	0.55	0.89
222	1190.00	1.70	12.61	13.68	403.64	0.53	4.74	4.88	0.57	122.82	1.45	1.00	2.75	197.73	0.76	0.61	1.18
225	337.09	0.47	6.53	8.06	113.78	0.12	1.47	2.45	0.57	62.61	0.02	1.43	2.04	149.69	0.07	3.86	3.18
228	411.59	2.56	3.91	10.84	174.35	0.56	0.64	2.50	0.49	15.11	0.03	0.06	0.11	119.47	0.10	1.03	0.32
229	1229.00	1.16	4.35	7.17	348.05	0.29	1.31	2.77	0.76	150.72	0.18	1.97	3.17	140.40	0.10	1.73	2.27
230	190.52	0.06	3.75	10.81	115.71	0.02	1.40	1.90	0.26	42.21	0.01	1.22	1.86	37.98	0.03	0.89	1.47
231	226.22	0.07	7.00	6.78	72.79	0.03	2.00	2.72	0.49	66.73	0.03	1.77	3.11	10.00	0.00	0.00	0.00
233	411.65	0.51	8.13	16.31	128.40	0.13	2.45	4.25	0.61	227.54	0.27	7.23	12.48	176.40	0.24	6.28	8.10
234	338.55	0.18	2.39	3.86	135.66	0.05	0.30	1.33	0.38	23.65	0.01	0.08	0.32	16.10	0.11	0.36	0.65
235	1167.49	7.75	9.05	12.24	281.75	1.56	1.49	2.42	0.68	92.57	0.88	0.91	1.80	90.58	1.20	0.71	1.88
238	433.69	0.15	1.79	3.74	254.61	0.12	1.05	3.07	0.21	10.76	0.00	0.02	0.08	6.12	0.00	0.03	0.06
241	968.69	0.28	17.40	11.97	222.93	0.06	4.13	3.68	0.89	161.23	0.04	2.20	2.33	205.63	0.08	3.47	2.48
250	640.55	0.19	1.74	10.47	144.60	0.03	0.35	2.87	0.95	214.65	0.04	0.57	4.61	128.50	0.04	0.48	3.59
254	194.29	0.15	3.11	4.65	101.28	0.08	1.54	2.29	0.27	56.86	0.11	1.22	2.98	74.53	0.06	1.26	3.10
256	534.45	6.09	6.66	13.94	162.35	0.75	1.82	5.68	0.61	71.68	0.38	0.30	2.09	139.27	0.21	1.00	5.71
257	641.16	0.17	6.64	13.41	163.25	0.04	0.64	2.54	0.67	105.43	0.02	0.48	1.77	170.41	0.03	0.50	2.44
258	2314.11	0.51	3.69	16.32	376.38	0.09	0.49	2.97	1.24	87.53	0.01	0.51	1.86	129.98	0.04	1.46	5.06
260	918.14	0.23	2.36	8.39	159.86	0.03	0.36	1.61	0.73	136.07	0.03	0.90	3.17	156.77	0.04	0.95	2.22
261	866.30	5.44	17.28	20.75	224.95	0.47	4.17	6.06	0.69	55.22	0.07	1.14	2.82	80.57	0.20	2.34	3.16
263	2649.00	6.66	12.71	12.85	138.01	0.12	1.59	3.33	0.51	223.70	0.21	0.66	1.86	209.80	0.19	0.92	0.83
265	650.68	0.17	17.01	11.40	190.92	0.05	5.19	3.71	0.58	99.69	0.04	2.46	2.15	89.77	0.02	2.12	1.56
266	1789.35	5.53	8.54	12.40	501.80	1.39	2.37	4.06	0.65	146.43	0.22	1.20	1.84	171.96	0.25	1.00	2.31
267	2278.89	1.40	17.15	15.49	465.77	0.19	4.33	2.40	0.91	292.72	0.06	3.09	1.43	10.68	0.01	0.33	0.53
269	2914.10	1.79	14.57	15.90	514.99	0.34	3.21	2.11	0.85	38.89	0.02	0.19	0.71	29.37	0.30	0.04	0.11
271	712.81	0.12	18.59	11.45	250.02	0.03	6.53	3.05	0.61	52.64	0.02	1.53	1.72	73.90	0.01	1.68	1.65
401	782.23	3.61	8.17	22.75	233.56	0.90	1.54	3.72	0.49	50.84	0.14	1.14	2.41	44.87	0.05	0.39	0.79
941	519.67	2.09	9.59	12.62	143.33	0.26	2.33	4.30	0.58	66.09	0.10	1.09	2.70	77.18	0.15	1.24	2.37
1551	515.21	4.46	4.64	12.71	166.08	0.54	1.07	5.55	0.51	71.73	0.20	0.69	3.05	295.68	1.93	0.94	3.00
1561	1282.68	4.50	3.02	12.08	245.70	0.48	0.76	3.61	0.84	89.45	0.16	1.11	2.93	78.62	0.16	0.98	3.12
2151	1310.77	5.60	3.24	7.18	246.33	1.13	0.58	2.23	0.71	136.56	1.47	1.60	3.99	87.13	0.49	0.57	2.05
2291	1564.51	9.65	8.84	9.65	445.33	1.15	1.63	3.52	0.68	79.10	0.13	0.43	1.89	127.32	0.11	1.63	3.12

14.6 Trend analysis

14.6.1 Variography

Experimental variograms were calculated and modelled in Snowden Supervisor software using capped full-length composites for each domain (ore, HW, and FW). Variograms directions were validated against vein outlines. While the mineralization domain lacked sufficient samples to obtain robust variograms, the results were useful in supporting the range of expected grade continuity. The variograms were exported to Datamine format to use in the estimation process.

Table 14.5 summarize the variogram parameters for each metal for all domains.

Table 14.5 Variogram parameters

Domain	Metals	NUGGET C_o	SILL C_1/C_2	ROTATION			RANGES		
				Z	X	Z	X	Y	Z
4	AGPPM	0.00	1.00	80	45	180	50	23	6
	CUPERC	0.01	0.99	80	45	150	36	32	6
	PBPERC	0.31	0.69	80	45	180	44	25	6
	ZNPERC	0.36	0.64	80	45	180	26	46	6
13	AGPPM	0.44	0.56	170	70	180	28	26	30
	CUPERC	0.29	0.71	170	70	180	34	29	30
	PBPERC	0.22	0.78	170	70	180	26	28	30
	ZNPERC	0.00	1.00	170	70	180	30	89	29
19	AGPPM	0.44	0.56	80	90	180	44	33	18
	CUPERC	0.32	0.68	80	90	180	50	35	18
	PBPERC	0.00	1.00	80	90	180	42	20	18
	ZNPERC	0.26	0.74	80	90	180	28	14	18
24	AGPPM	0.25	0.76	90	110	-170	30	25	12
	CUPERC	0.16	0.84	80	110	-170	40	69	12
	PBPERC	0.16	0.84	90	110	160	26	47	18
	ZNPERC	0.47	0.53	90	110	180	59	73	24
30	AGPPM	0.04	0.97	180	90	180	23	45	6
	CUPERC	0.07	0.93	180	90	180	26	45	3
	PBPERC	0.23	0.77	180	90	180	30	43	3
	ZNPERC	0.28	0.72	180	90	180	22	60	6
34	AGPPM	0.17	0.83	140	100	100	56	50	10
	CUPERC	0.02	0.99	140	100	100	47	50	10
	PBPERC	0.00	1.00	140	100	100	41	35	10
	ZNPERC	0.11	0.89	140	100	100	56	57	10
38	AGPPM	0.06	0.94	170	105	180	13	26	9
	CUPERC	0.12	0.89	170	105	180	40	55	9
	PBPERC	0.24	0.76	170	105	180	16	34	9
	ZNPERC	0.00	1.00	170	105	180	27	40	9
40	AGPPM	0.00	1.00	70	65	40	52	33	3
	CUPERC	0.00	1.00	70	70	40	35	22	3
	PBPERC	0.00	1.00	70	70	20	51	20	3
	ZNPERC	0.00	1.00	70	70	40	44	20	3

Domain	Metals	NUGGET C_o	SILL C_1/C_2	ROTATION			RANGES		
				Z	X	Z	X	Y	Z
44	AGPPM	0.42	0.58	180	110	180	69	30	40
	CUPERC	0.43	0.57	175	110	180	111	20	10
	PBPERC	0.36	0.64	175	110	-175	65	38	15
	ZNPERC	0.33	0.67	175	110	180	60	20	15
57	AGPPM	0.25	0.75	170	105	-170	30	62	8
	CUPERC	0.00	1.00	180	105	145	75	65	8
	PBPERC	0.17	0.59	-180	105	-140	19	50	5
	ZNPERC	0.15	0.85	170	105	-140	25	42	8
58	AGPPM	0.14	0.86	180	70	-100	43	50	6
	CUPERC	0.15	0.85	-180	70	170	42	32	6
	PBPERC	0.12	0.88	-180	70	170	22	24	6
	ZNPERC	0.25	0.75	-180	70	170	17	28	6
63	AGPPM	0.15	0.85	70	70	170	30	41	5
	CUPERC	0.09	0.91	70	70	-170	51	31	6
	PBPERC	0.07	0.93	70	70	170	30	25	6
	ZNPERC	0.00	1.00	80	70	170	25	40	5
91	AGPPM	0.25	0.75	165	105	90	73	50	9
	CUPERC	0.30	0.70	165	105	90	61	50	9
	PBPERC	0.00	1.00	165	105	90	87	33	9
	ZNPERC	0.00	1.00	165	105	90	70	31	9
94	AGPPM	0.46	0.54	55	60	180	51	40	8
	CUPERC	0.27	0.73	55	60	180	21	40	8
	PBPERC	0.32	0.69	55	60	180	25	40	8
	ZNPERC	0.54	0.46	55	60	180	22	35	8
98	AGPPM	0.00	1.00	170	90	170	34	32	8
	CUPERC	0.00	1.00	170	90	170	30	32	5
	PBPERC	0.06	1.00	170	90	170	13	65	8
	ZNPERC	0.06	0.94	170	90	170	20	50	6
102	AGPPM	0.34	0.67	180	85	170	46	40	7
	CUPERC	0.27	0.74	180	85	170	81	40	7
	PBPERC	0.22	0.78	180	85	170	39	42	6
	ZNPERC	0.30	0.70	180	85	170	84	40	4
103	AGPPM	0.00	0.99	-155	85	-150	42	26	5
	CUPERC	0.00	1.00	-155	85	-170	38	50	7
	PBPERC	0.00	1.00	-155	85	-170	50	19	7
	ZNPERC	0.00	0.99	-155	85	-170	70	21	6
104	AGPPM	0.40	0.60	110	85	170	40	45	16
	CUPERC	0.16	0.84	110	85	170	42	15	9
	PBPERC	0.45	0.56	110	95	140	48	27	5
	ZNPERC	0.00	1.00	110	90	140	42	27	5
106	AGPPM	0.21	0.79	175	95	175	32	40	5
	CUPERC	0.22	0.78	175	95	175	30	27	5
	PBPERC	0.19	0.81	175	95	175	45	39	6
	ZNPERC	0.17	0.83	175	95	175	46	34	5

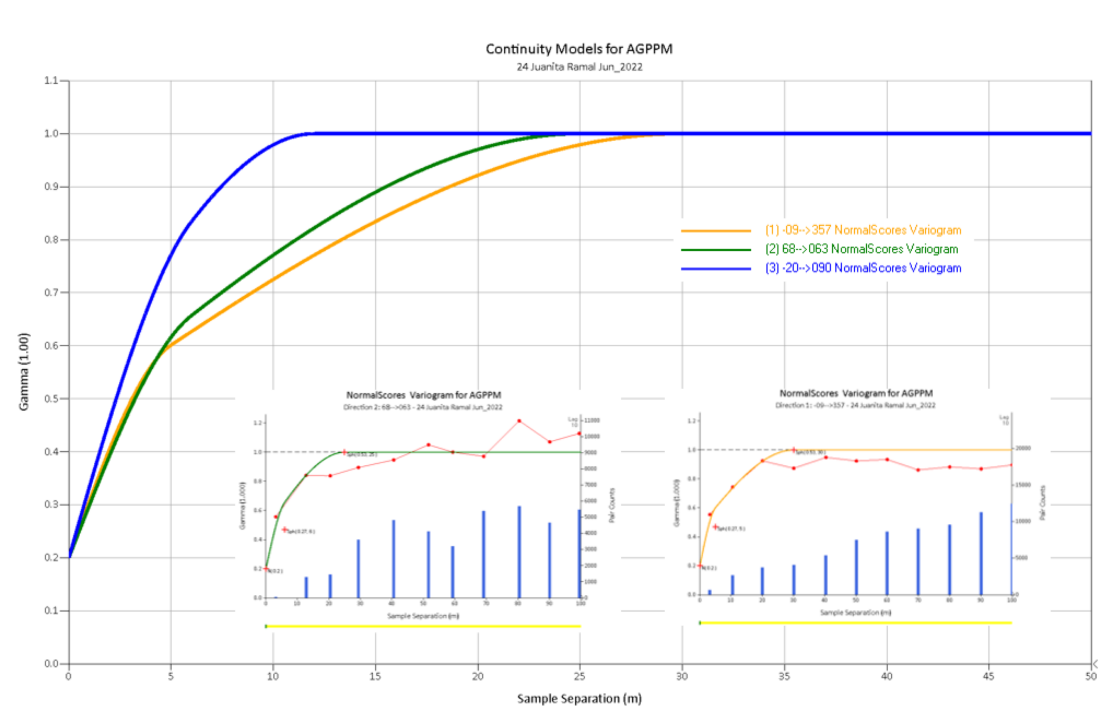
Domain	Metals	NUGGET C_o	SILL C_1/C_2	ROTATION			RANGES		
				Z	X	Z	X	Y	Z
107	AGPPM	0.14	0.86	170	100	140	40	62	12
	CUPERC	0.13	0.87	170	100	140	48	62	5
	PBPERC	0.48	0.52	170	100	170	48	80	7
	ZNPERC	0.34	0.66	170	100	170	62	96	7
108	AGPPM	0.00	1.00	165	110	180	40	65	13
	CUPERC	0.00	1.00	165	110	165	62	22	13
	PBPERC	0.00	1.00	165	110	155	50	18	8
	ZNPERC	0.00	1.00	165	100	180	30	36	13
109	AGPPM	0.13	0.88	160	120	180	23	55	8
	CUPERC	0.19	0.81	150	120	180	54	50	8
	PBPERC	0.19	0.81	150	120	180	60	40	8
	ZNPERC	0.00	1.00	150	120	180	45	128	8
1551	AGPPM	0.00	1.00	170	100	180	24	24	10
	CUPERC	0.00	1.00	170	100	180	15	24	7
	PBPERC	0.00	1.00	170	100	180	35	24	6
	ZNPERC	0.00	1.00	170	100	180	24	24	8
155	AGPPM	0.00	1.00	0	70	-30	44	31	12
	CUPERC	0.19	0.82	0	70	10	60	28	6
	PBPERC	0.00	1.00	180	110	135	30	33	6
	ZNPERC	0.00	1.00	0	70	-45	31	36	10
156	AGPPM	0.29	0.71	-50	70	-40	100	109	20
	CUPERC	0.32	0.68	-50	70	-40	85	81	20
	PBPERC	0.27	0.73	-50	70	-40	111	93	20
	ZNPERC	0.22	0.78	-50	70	-40	100	105	20
1561	AGPPM	0.00	0.99	130	100	80	42	38	2
	CUPERC	0.00	0.99	130	100	80	35	20	2
	PBPERC	0.00	0.99	145	105	80	35	33	2
	ZNPERC	0.00	0.99	145	105	80	35	33	2
213	AGPPM	0.49	0.51	160	105	-90	82	39	4
	CUPERC	0.48	0.52	160	105	-90	40	63	4
	PBPERC	0.31	0.69	160	105	-90	20	28	4
	ZNPERC	0.00	1.00	160	105	-90	22	18	4
215	AGPPM	0.18	0.82	75	70	-120	43	82	10
	CUPERC	0.00	1.00	75	70	-120	40	65	20
	PBPERC	0.27	0.73	75	70	-120	40	46	10
	ZNPERC	0.00	1.00	75	70	-120	43	36	10
217	AGPPM	0.05	0.95	170	80	-170	38	45	4
	CUPERC	0.05	0.95	170	80	-170	38	45	4
	PBPERC	0.05	0.95	170	80	170	34	12	4
	ZNPERC	0.05	0.95	170	80	-170	55	47	4
219	AGPPM	0.29	0.71	135	100	90	74	20	0
	CUPERC	0.01	0.99	135	100	90	42	10	0
	PBPERC	0.15	0.85	135	100	90	77	10	0
	ZNPERC	0.00	1.00	135	100	90	74	10	0

Domain	Metals	NUGGET C_o	SILL C_1/C_2	ROTATION			RANGES		
				Z	X	Z	X	Y	Z
222	AGPPM	0.23	0.77	-140	70	180	30	22	4
	CUPERC	0.00	1.00	-150	70	-170	13	28	4
	PBPERC	0.00	1.00	-150	70	-170	30	24	4
	ZNPERC	0.22	0.78	-145	70	-170	10	15	4
229	AGPPM	0.04	0.96	10	80	70	22	23	20
	CUPERC	0.05	0.95	10	80	70	22	23	20
	PBPERC	0.03	0.97	10	80	70	22	23	20
	ZNPERC	0.03	0.97	10	80	70	22	25	20
2291	AGPPM	0.06	0.94	180	110	130	26	26	10
	CUPERC	0.02	0.98	0	60	-60	44	41	10
	PBPERC	0.06	0.94	180	120	180	12	30	10
	ZNPERC	0.05	0.95	0	60	0	23	31	10
233	AGPPM	0.00	1.00	0	0	-170	16	11	15
	CUPERC	0.00	1.00	0	0	180	19	11	15
	PBPERC	0.00	1.00	0	0	180	19	14	15
	ZNPERC	0.00	1.00	0	0	180	35	22	15
235	AGPPM	0.27	0.73	130	90	50	40	40	10
	CUPERC	0.06	0.94	130	90	50	40	38	10
	PBPERC	0.18	0.82	130	90	50	48	45	10
	ZNPERC	0.04	0.96	130	90	50	25	40	10
241	AGPPM	0.00	1.00	-80	20	-30	55	40	6
	CUPERC	0.00	1.00	-80	20	-30	55	40	6
	PBPERC	0.23	0.77	-80	20	-10	37	40	6
	ZNPERC	0.00	1.00	-80	20	-10	23	40	6
250	AGPPM	0.12	0.88	60	20	180	23	45	6
	CUPERC	0.00	1.00	60	20	180	30	45	6
	PBPERC	0.02	0.73	60	20	180	4	60	3
	ZNPERC	0.01	0.99	60	20	180	38	28	6
256	AGPPM	0.18	0.83	-170	90	180	16	42	15
	CUPERC	0.24	0.76	-170	90	180	48	50	15
	PBPERC	0.29	0.71	-170	90	180	34	60	15
	ZNPERC	0.06	0.94	-170	90	180	50	120	15
257	AGPPM	0.08	0.92	170	110	130	65	40	10
	CUPERC	0.09	0.91	170	110	130	65	40	10
	PBPERC	0.11	0.90	170	110	130	34	31	10
	ZNPERC	0.08	0.92	170	110	130	41	52	10
258	AGPPM	0.28	0.72	160	110	180	31	35	8
	CUPERC	0.00	1.00	160	110	160	20	25	8
	PBPERC	0.64	0.36	160	110	180	16	55	6
	ZNPERC	0.27	0.73	160	110	180	41	45	8
261	AGPPM	0.00	1.00	65	65	95	30	26	5
	CUPERC	0.00	1.00	65	65	95	40	32	5
	PBPERC	0.00	1.00	60	65	95	42	28	5
	ZNPERC	0.00	1.00	65	65	95	32	30	5

Domain	Metals	NUGGET C_o	SILL C_1/C_2	ROTATION			RANGES		
				Z	X	Z	X	Y	Z
263	AGPPM	0.48	0.52	-10	80	-90	36	32	6
	CUPERC	0.43	0.57	-10	80	-90	42	28	6
	PBPERC	0.53	0.47	-10	80	-90	30	32	6
	ZNPERC	0.42	0.58	-10	80	-90	30	17	6
265	AGPPM	0.01	0.99	5	70	90	67	32	6
	CUPERC	0.02	0.98	5	70	90	75	44	6
	PBPERC	0.11	0.89	5	70	90	89	30	6
	ZNPERC	0.21	0.79	5	70	90	92	42	6
267	AGPPM	0.00	1.00	180	110	180	37	28	10
	CUPERC	0.09	0.91	0	70	0	38	42	10
	PBPERC	0.00	1.00	0	60	0	19	31	10
	ZNPERC	0.17	0.83	0	60	0	23	31	10
269	AGPPM	0.23	0.77	-175	80	180	24	40	40
	CUPERC	0.23	0.77	-175	80	180	23	35	40
	PBPERC	0.23	0.77	-175	80	180	35	40	40
	ZNPERC	0.25	0.75	-175	80	180	90	40	40
271	AGPPM	0.09	0.91	180	85	180	37	20	10
	CUPERC	0.24	0.77	180	85	180	52	20	10
	PBPERC	0.09	0.91	180	85	180	39	20	10
	ZNPERC	0.09	0.91	180	85	180	40	50	10

Figure 14.5 is an example of the silver variogram for the Juanita Ramal vein.

Figure 14.5 Variogram of Ag at Juanita Ramal



Source: PAS (2022).

14.7 Search strategy and grade interpolation parameters

Grade interpolation was performed on sub cell block using Ordinary Kriging or Inverse Distance and three progressively larger interpolation passes. Search ellipse dimensions and orientations are detailed in Table 14.6. The number of composites are shown for passes 1, 2, or 3 in Table 14.7.

Table 14.6 Search strategy and grade interpolation parameters

Domain	Method	1° Pass			2° Pass			3° Pass			Orientation		
		X-axis (m)	Y-axis (m)	Z-axis (m)	X-axis (m)	Y-axis (m)	Z-axis (m)	X-axis (m)	Y-axis (m)	Z-axis (m)	VANGLE1	VANGLE2	VANGLE3
4	KO	15	25	6	30	50	12	90	150	36	80	45	180
11	KO	28	26	30	56	52	60	168	156	180	90	-80	0
13	KO	28	26	30	56	52	60	168	156	180	170	70	180
14	KO	25	15	8	50	30	16	150	90	48	90	-80	-
19	KO	44	33	18	88	66	36	264	198	108	80	90	180
30	KO	23	35	8	46	70	16	138	210	48	180	90	180
40	KO	42	33	6	84	66	12	252	198	36	70	65	40
44	KO	15	10	4	30	20	8	90	60	24	90	60	0
57	KO	30	42	8	60	84	16	180	252	48	170	105	-170
63	KO	30	41	10	60	82	20	180	246	60	70	70	170
88	KO	15	10	4	30	20	8	90	60	24	80	80	0
90	KO	36	25	9	72	50	18	360	250	90	165	105	90
94	KO	51	40	8	102	80	16	357	280	56	55	60	180
98	KO	34	32	8	68	64	16	204	192	48	170	90	170
102	KO	30	25	20	60	50	40	180	150	120	180	85	170
103	KO	42	26	5	84	52	9	126	78	14	-155	85	-150
104	KO	40	45	16	80	90	32	280	315	112	110	85	170
106	KO	15	10	4	30	20	8	90	60	24	90	90	0
107	KO	40	32	12	80	64	24	280	224	84	170	100	140
108	KO	35	45	13	70	90	26	280	360	104	165	110	180
109	KO	15	10	4	30	20	8	90	60	24	80	80	0
116	KO	42	26	5	84	52	9	126	78	14	-90	-110	-
155	KO	44	31	12	88	62	24	264	186	72	0	70	-30
156	KO	40	48	20	80	96	40	240	288	120	-50	70	-40
215	KO	15	10	4	30	20	8	90	60	24	-15	-60	0
217	KO	38	45	6	76	90	12	228	270	36	170	80	-170
219	KO	21	12	10	42	24	20	126	72	60	135	100	90
221	KO	15	10	4	30	20	8	90	60	24	-15	-85	0
222	KO	30	25	10	60	50	20	180	150	60	-140	70	180
225	KO	15	10	4	30	20	8	90	60	24	-95	-100	0
228	KO	15	10	4	30	20	8	90	60	24	95	-100	0
230	KO	15	10	4	30	20	8	90	60	24	40	-130	0
234	KO	15	10	4	30	20	8	90	60	24	35	-87	0
235	KO	15	10	4	30	20	8	90	60	24	35	-80	0
238	KO	15	10	4	30	20	8	90	60	24	70	-85	0
241	KO	55	40	6	110	80	12	330	240	36	-80	20	-30

Domain	Method	1° Pass			2° Pass			3° Pass			Orientation		
		X-axis (m)	Y-axis (m)	Z-axis (m)	X-axis (m)	Y-axis (m)	Z-axis (m)	X-axis (m)	Y-axis (m)	Z-axis (m)	VANGLE1	VANGLE2	VANGLE3
250	KO	23	35	10	46	70	20	92	140	40	60	20	180
254	KO	15	10	4	30	20	8	90	60	24	85	-80	0
256	KO	15	10	4	30	20	8	90	60	24	-85	-70	0
257	KO	10	15	4	20	30	8	60	90	24	75	65	0
260	KO	10	15	4	20	30	8	60	90	24	-85	-60	0
261	KO	30	26	5	60	52	10	180	156	30	65	65	95
263	KO	36	32	6	72	64	12	252	224	42	-10	80	-90
265	KO	47	32	6	94	64	12	470	320	60	5	70	90
266	KO	30	33	10	60	66	20	210	231	70	170	100	180
267	KO	20	15	10	40	30	20	120	90	60	180	110	180
269	KO	24	40	40	48	80	80	144	240	240	-175	80	180
271	KO	10	15	4	20	30	8	60	90	24	90	0	0
401	KO	42	33	6	84	66	12	252	198	36	70	65	40
941	KO	51	40	8	102	80	16	357	280	56	55	60	180
1551	KO	24	24	10	48	48	20	144	144	60	170	100	180
1561	KO	42	38	2	84	76	4	210	190	10	130	100	80
2151	KO	15	10	4	30	20	8	90	60	24	-15	-60	0
233	ID	16	11	15	32	22	30	112	77	105	STRIKE	TRDIP	0
229	ID	20	30	4	40	60	8	140	210	28	STRIKE	TRDIP	0
91	ID	36	25	9	72	50	18	360	250	90	STRIKE	TRDIP	0
58	ID	25	20	10	50	40	20	300	240	120	STRIKE	TRDIP	0
258	ID	31	35	8	62	70	16	186	210	48	STRIKE	TRDIP	0
2291	ID	20	30	4	40	60	8	140	210	28	STRIKE	TRDIP	0
24	ID	10	35	25	20	70	50	50	175	125	STRIKE	TRDIP	0
34	ID	35	50	10	70	100	20	350	500	100	STRIKE	TRDIP	0
38	ID	18	26	9	36	52	18	90	130	45	STRIKE	TRDIP	0

Notes:
- KO: Kriging Ordinary (40 Domains)
- ID: Inverse Distance (15 Domains)
- KO-ANI: Kriging Ordinary + Dynamic Anisotropy (10 Domains)

Table 14.7 Composite selection plan

Domain	1° Pass		2° Pass		3° Pass	
	Min N°	Max N°	Min N°	Max N°	Min N°	Max N°
4	5	15	5	15	1	5
11	6	15	5	12	1	3
13	6	15	5	12	1	3
14	4	16	3	9	1	5
19	8	18	6	14	1	5
30	5	18	2	14	1	3
40	6	18	4	12	1	4
44	4	16	3	9	1	5
57	3	9	3	9	2	5
63	6	18	1	16	1	5
88	4	16	1	9	1	5
90	4	12	3	15	1	4
94	6	15	5	12	1	3
98	6	15	5	12	1	3
102	5	20	4	16	1	5
103	6	12	6	10	1	4
104	8	18	6	14	1	4
106	4	16	3	9	1	5
107	8	22	8	18	1	5
108	6	25	5	20	1	3
109	4	16	3	9	1	5
116	6	12	6	10	1	4
155	8	18	6	14	1	4
156	8	16	6	12	2	5
215	4	16	3	9	1	5
217	6	18	4	16	1	5
219	8	20	6	16	1	5
221	4	16	3	9	1	5
222	4	12	4	12	1	5
225	4	16	3	9	1	5
228	4	16	3	9	1	5
230	4	16	3	9	1	5
234	4	16	3	9	1	5
235	4	16	3	9	1	5
238	4	16	3	9	1	5
241	8	18	6	14	1	5
250	3	12	3	10	1	3
254	4	16	3	9	1	5
256	4	16	3	9	1	5
257	4	16	3	9	1	5
260	4	16	3	9	1	5
261	8	18	6	12	1	3

Domain	1° Pass		2° Pass		3° Pass	
	Min N°	Max N°	Min N°	Max N°	Min N°	Max N°
263	8	18	6	14	1	4
265	6	20	5	15	1	4
266	8	16	6	14	1	4
267	8	18	6	14	1	4
269	6	15	5	12	1	3
271	4	16	3	9	1	5
401	6	18	4	12	1	4
941	6	15	5	12	1	3
1551	8	16	4	12	2	5
1561	8	20	6	16	2	4
2151	4	16	3	9	1	5
258	8	20	6	16	1	5
260	8	18	6	14	1	5
261	8	18	6	12	1	3
263	8	18	6	14	1	5
265	6	20	5	15	1	4
266	8	18	6	14	1	4
267	8	18	6	14	1	4
269	6	15	5	12	1	3
271	8	20	6	16	1	5
233	6	14	5	10	1	3
229	6	18	5	16	1	5
91	4	12	3	15	1	4
58	8	18	6	14	1	5
258	8	20	6	16	1	5
2291	6	18	5	16	1	5
24	5	20	4	12	1	3
34	8	20	6	12	2	5
38	4	16	4	12	1	4

14.8 Bulk density

Through May 2022 a total of 1,954 density measurements were collected at the Huaron mine by structure (ore, HW, and FW) and analyzed by Actlabs using the wax coating method for whole samples and Pycnometer for crushed samples. Densities ranged from 2.49 grams per cubic centimetre (g/cm^3) to 4.19 g/cm^3 within mineralization domains and from 2.58 g/cm^3 to 3.61 g/cm^3 in adjacent material.

Basic density statistics for Huaron mine are presented in Table 14.8.

Table 14.8 Density statistics by domain

Domain	Average density (g/cm^3)			N° samples			Total
	ORE	HW	FW	ORE	HW	FW	samples
213	3.42	2.81	2.88	120	32	30	182
24	3.07	2.75	2.73	113	22	20	155
156	3.00	2.70	2.68	94	25	26	145
107	3.23	2.77	2.70	93	24	26	143
94	3.20	2.69	2.78	80	36	33	149
57	3.11	2.69	2.72	64	18	19	101
108	3.82	3.05	2.93	56	17	21	94
34	2.87	2.69	2.69	42	20	18	80
58	3.27	2.75	2.68	42	12	14	68
91	3.13	2.76	2.79	42	13	12	67
155	3.39	2.82	2.93	35	10	9	54
261	3.30	2.77	2.76	33	22	17	72
98	3.32	2.75	2.76	32	10	10	52
4	3.71	2.89	2.98	27	8	6	41
233	3.34	2.84	2.84	27	3	2	32
258	2.85	2.62	2.62	23	13	13	49
63	3.18	2.73	2.81	21	9	8	38
241	3.12	2.70	2.68	21	5	6	32
13	3.96	2.88	2.71	19	17	19	55
103	3.48	2.93	2.99	19	6	8	33
30	3.31		3.10	18		1	19
267	3.54	2.66	2.69	16	14	12	42
215	3.16	2.72	2.75	46	12	10	68
257	2.95	2.74	2.76	27	4	6	37
38	3.10	2.78	2.76	14	10	7	31
265	4.15	2.81	2.92	12	12	12	36
229	3.30	2.75	2.70	11	3	4	18
19	3.10	2.66	2.59	9	5	6	20
269	3.09	2.69	2.73	9	9	8	26
104	2.96	2.84	2.75	11	2	2	15
222	4.19	2.87	2.67	Data Histórica			
40	3.04			Data Histórica			
250	2.60			Data Histórica			
217	3.56	2.67	2.65	Data Histórica			
271	4.10	2.94	2.79	Data Histórica			
106	3.71	2.75	3.61	Data Histórica			
256	3.55	2.58	2.90	Data Histórica			
228	2.49	2.65	2.63	Data Histórica			
235	3.28	2.78	2.70	Data Histórica			
Total				**1176**	**393**	**385**	**1954**

14.9 Block models

Block models were constructed for individual domains with block model dimensions presented in Table 14.9. The block model was constructed, and estimation was completed in Datamine software. The QP considers the block model size for the individual domains to be appropriate for the deposit geometry and proposed mining methods.

Table 14.9 Block model details

Domain	Type	X	Y	Z
4	Base Point (m)	344977.00	8783043.00	4026
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	90.00	70.00	82
11	Base Point (m)	344058.00	8781367.00	4125
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	87.00	28.00	48
13	Base Point (m)	343347.00	8782858.00	4016
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	141.00	39.00	50
14	Base Point (m)	344338.00	8782428.00	4631
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	39.00	9.00	22
19	Base Point (m)	343730.00	8782506.00	3996
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	25.00	96.00	55
24	Base Point (m)	343434.00	8781495.00	3972
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	49.00	186.00	90
30	Base Point (m)	343763.00	8781443.00	3932
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	95.00	15.00	70
34	Base Point (m)	344953.00	8782860.00	4042
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	98.00	58.00	101
38	Base Point (m)	343252.00	8782709.00	4027
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	154.00	21.00	53

Domain	Type	X	Y	Z
40	Base Point (m)	343813.00	8781467.00	4060
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	31.00	58.00	50
401	Base Point (m)	343774.00	8781606.00	4064
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	44.00	40.00	5
44	Base Point (m)	343307.00	8782715.00	3
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	242.00	47.00	72
57	Base Point (m)	344086.00	8782298.00	4113
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	96.00	34.00	119
58	Base Point (m)	343486.00	8781577.00	3969
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	235.00	84.00	135
63	Base Point (m)	343568.00	8781977.00	4070
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	43.00	111.00	56
88	Base Point (m)	343430.00	8782197.00	4071
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	81.00	16.00	43
90	Base Point (m)	344335.00	8782400.00	4568
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	42.00	9.00	31
91	Base Point (m)	343844.00	8782386.00	3997
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	202.00	55.00	152
94	Base Point (m)	344072.00	8782269.00	4005
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	69.00	72.00	108
941	Base Point (m)	344312.00	8782313.00	4079
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	24.00	18.00	36

Domain	Type	X	Y	Z
98	Base Point (m)	343259.00	8781402.00	3988
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	118.00	20.00	68
102	Base Point (m)	345135.00	8783088.00	4014
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	143.00	15.00	68
103	Base Point (m)	344885.00	8783119.00	4153
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	55.00	29.00	61
104	Base Point (m)	343714.00	8781348.00	4068
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	56.00	225.00	88
106	Base Point (m)	345239.00	8783102.00	4209
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	74.00	10.00	65
107	Base Point (m)	343382.00	8781758.00	3983
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	211.00	65.00	138
108	Base Point (m)	343341.00	8782155.00	3938
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	212.00	58.00	77
109	Base Point (m)	344612.00	8782673.00	4198
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	102.00	93.00	87
116	Base Point (m)	344236.00	8782663.00	4552
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	53.00	14.00	41
1551	Base Point (m)	343304.00	8782841.00	3991
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	153.00	28.00	68
155	Base Point (m)	344760.61	8782806.00	4064
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	44.00	20.00	82

Domain	Type	X	Y	Z
156	Base Point (m)	344266.00	8782237.00	3983
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	203.00	192.00	153
1561	Base Point (m)	344775.00	8782706.00	3983
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	105.00	100.00	136
157	Base Point (m)	344545.00	8782319.00	4516
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	28.00	26.00	25
158	Base Point (m)	344100.00	8781500.00	4100
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.25	0.25	0
	Number of cells	140.00	65.00	80
213	Base Point (m)	343100.00	8782140.00	3900
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	300.00	132.00	120
215	Base Point (m)	343400.00	878200.00	4000
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	120.00	160.00	92
217	Base Point (m)	343200.00	8782900.00	3900
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	200.00	60.00	92
219	Base Point (m)	343260.00	8781120.00	3900
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	148.00	104.00	92
221	Base Point (m)	343460.00	8781860.00	4000
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	88.00	140.00	60
222	Base Point (m)	343728.00	8781416.00	4052
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	37.00	32.00	56
225	Base Point (m)	345260.00	8783100.00	4100
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	60.00	20.00	60

Domain	Type	X	Y	Z
228	Base Point (m)	343360.00	8782040.00	4000
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	124.00	28.00	80
229	Base Point (m)	343400.00	8782200.00	4000
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	100.00	60.00	60
2291	Base Point (m)	343400.00	8782200.00	4000
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	100.00	60.00	60
230	Base Point (m)	344500.00	8781200.00	4500
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	60.00	56.00	60
231	Base Point (m)	344560.00	8781320.00	4400
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	36.00	44.00	60
233	Base Point (m)	344860.00	8783100.00	4000
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	108.00	36.00	100
234	Base Point (m)	343660.00	8781680.00	4500
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	32.00	40.00	40
235	Base Point (m)	343620.00	8781660.00	3900
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	76.00	100.00	80
238	Base Point (m)	344140.00	8780960.00	4200
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	72.00	40.00	32
241	Base Point (m)	343180.00	8782100.00	4300
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	144.00	140.00	60
250	Base Point (m)	345680.00	8782600.00	4100
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	156.00	160.00	84

Domain	Type	X	Y	Z
254	Base Point (m)	345340.00	8783000.00	4200
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	24.00	20.00	40
256	Base Point (m)	344600.00	8782640.00	4100
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	100.00	32.00	80
257	Base Point (m)	345800.00	8783100.00	4100
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	68.00	28.00	60
258	Base Point (m)	345700.00	8783100.00	4100
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	80.00	40.00	60
260	Base Point (m)	345820.00	8783080.00	4100
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	32.00	32.00	60
261	Base Point (m)	344000.00	8782280.00	4000
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	80.00	84.00	120
263	Base Point (m)	344920.00	8783140.00	4200
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	40.00	20.00	60
265	Base Point (m)	344300.00	8781400.00	4200
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	110.00	70.00	100
266	Base Point (m)	344300.00	8781400.00	4200
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	110.00	70.00	100
267	Base Point (m)	343300.00	8782820.00	4000
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	128.00	60.00	100

Domain	Type	X	Y	Z
269	Base Point (m)	343320.00	8782975.00	4000
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	72.00	25.00	60
271	Base Point (m)	344380.00	8781520.00	4300
	Parent Block Size (m)	5.00	5.00	5
	Min. Sub-block Size (m)	0.50	0.50	1
	Number of cells	48.00	16.00	60

14.10 Estimation

Estimation was carried out within the individual mineralization domains representing vein structures within Datamine software using capped composites and a multi-pass OK or ID^2 interpolation approach. While individual blocks were not classified, mining panels were classified considering local drillhole spacing and proximity to existing development.

14.11 Block model validation

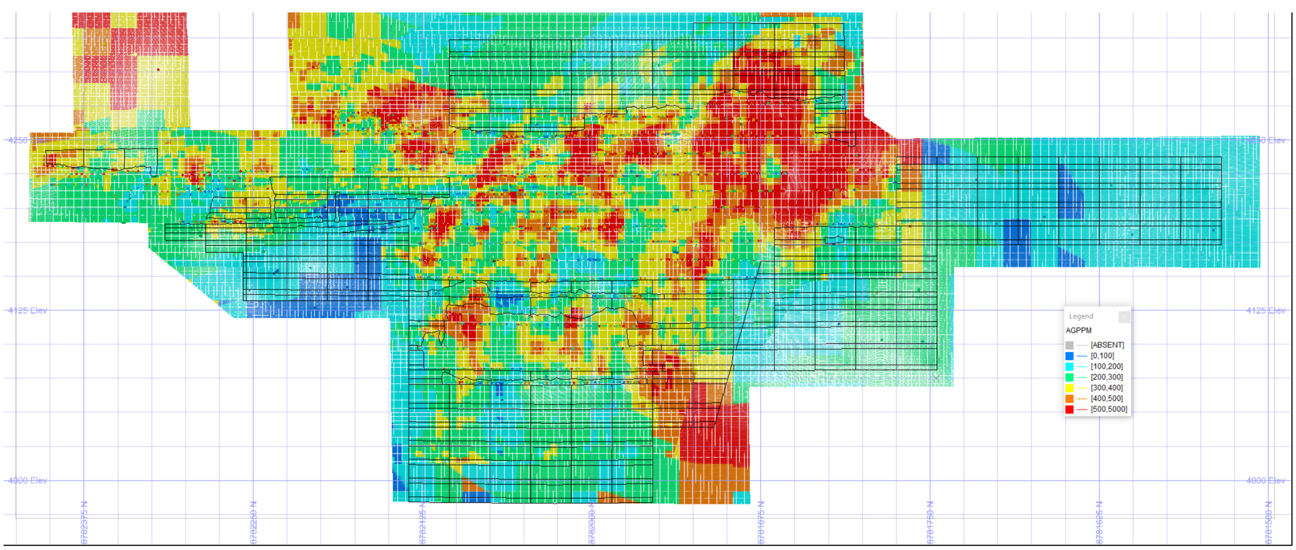
Wireframe and block model validation procedures including wireframe to block volume confirmation, statistical comparisons with composite and swath plots, visual reviews in 3D, longitudinal, cross section, and plan views, as well as cross software reporting confirmation were completed for all structures.

Examples are shown below as follows:

- Visual inspection of composites versus block grades (Figure 14.6).
- Swath plots (Figure 14.7 and Figure 14.8).

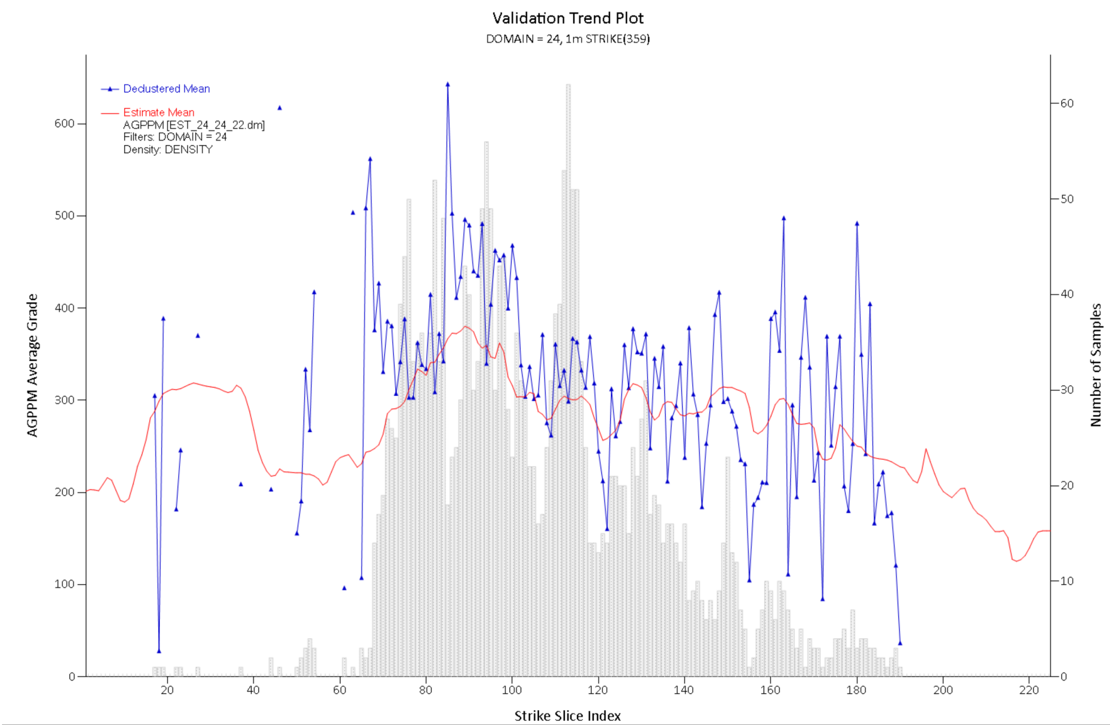
Swath plots generally demonstrated good correlation, with block grades somewhat smoothed relative to composite grades, as expected.

Figure 14.6 Longitudinal section Juanita Ramal



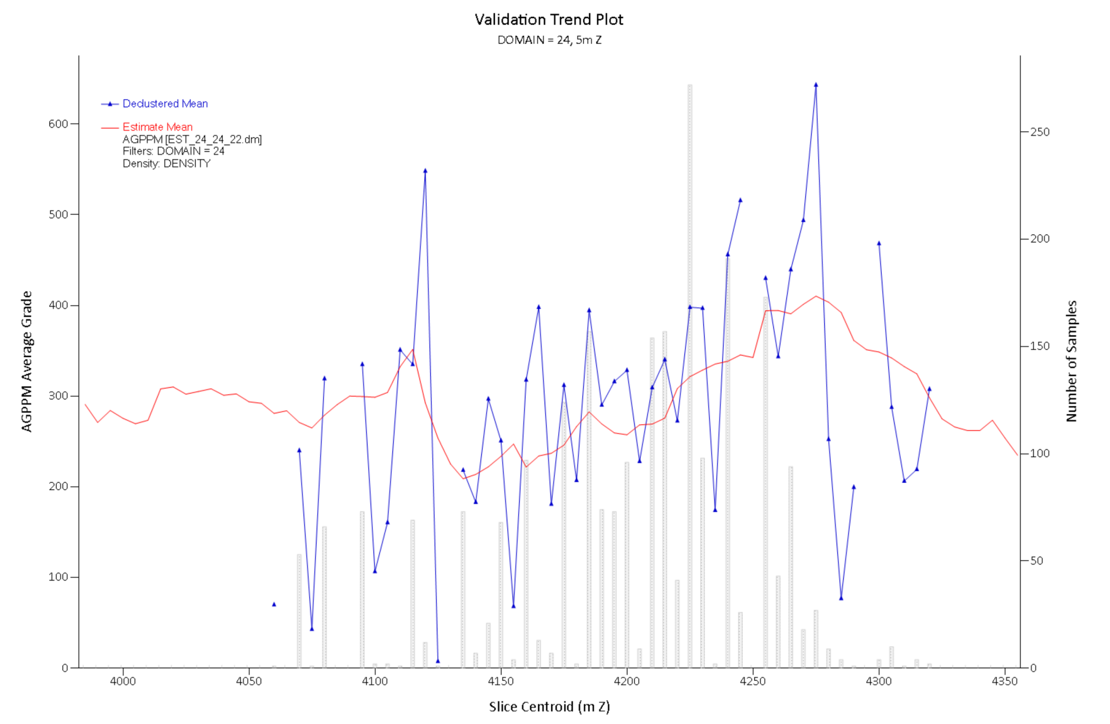
Source: PAS (2022).

Figure 14.7 Strike swath plot at Juanita Ramal



Source: PAS (2022).

Figure 14.8 Cross strike swath plot at Juanita Ramal



Source: PAS (2022).

14.12 Mineral Resource classification

Measured Mineral Resources have been defined where they are proximal to mine development. Indicated and Inferred Mineral Resources have been defined where drillhole spacing of up to approximately 25 m to 30 m and 50 m to 60 m were achieved, respectively, and modified to consider geological understanding, grade continuity, and the creation of cohesive class boundaries.

14.13 Reasonable prospects for eventual economic extraction

RPEEE was addressed by reporting the Mineral Resources within the domains only at a VPT cut-off. Individual COGs were calculated for each of the principal vein structures. A summary of the average of the input parameters is shown in Table 14.10.

Table 14.10 Economic input parameters for Mineral Resource COGs

Item	Units	Cost
Silver price	$/oz	19
Gold price	$/oz	1,300
Copper Price	$/tonne	7,000
Lead price	$/tonne	2,000
Zinc price	$/tonne	2,600
Mining cost	$/tonne	49.50
Processing Costs	$/tonne	11.77
G&A Costs	$/tonne	22.79
Silver recovery	%	84.62
Copper recovery	%	78.63
Lead recovery	%	76.11
Zinc recovery	%	79.26
Cut-off value (Average)	$/tonne	73.59

Detail breakdown on the costs is shown in Table 15.1.

14.14 Mineral Resource tabulation

Mineral Resources for Huaron as of June 30, 2022, are shown in Table 14.11. This tabulation is for underground Mineral Resources and have been assessed for mineability and constrained within the mineralized domains.

Table 14.11 Huaron Mineral Resources as of June 30, 2022

Classification	Tonnage Mt	Ag g/t	Ag contained metal Moz	Cu%	Pb%	Zn%
3D Modeling						
Measured	1.19	168	6.40	0.61	1.68	3.27
Indicated	1.50	164	7.90	0.56	1.5	3.00
Measured+ Indicated	2.69	165	14.29	0.58	1.58	3.12
Inferred	4.43	151	21.53	0.34	1.32	2.68
2D Modeling						
Measured	0.90	156	4.48	0.17	1.44	2.75
Indicated	0.87	171	4.79	0.12	2.07	2.78
Measured+ Indicated	1.77	163	9.28	0.15	1.75	2.77
Inferred	2.82	161	14.60	0.14	1.71	2.80
Combined 3D and 2D Modeling						
Measured	2.08	163	10.88	0.42	1.58	3.05
Indicated	2.37	166	12.69	0.4	1.71	2.92
Measured+ Indicated	4.46	165	23.57	0.41	1.65	2.98
Inferred	7.25	155	36.13	0.26	1.47	2.73

Notes: Footnotes beneath Table 14.1 apply.

15 MINERAL RESERVE ESTIMATES

15.1 Introduction

Pan American updates Mineral Reserve estimates on an annual basis following reviews of metal price trends, operational performance and costs experienced in the previous year, and forecasts of production and costs over the LOM. Other than normal course changes in metal prices, which fluctuate from time to time, no new material information has become available between June 30, 2022 and the signature date given on the certificates of the QPs.

Mineral Reserve estimates were prepared by Pan American technical staff under the supervision of and reviewed by Martin Wafforn, P.Eng., Vice President, Technical Services of Pan American, who is a QP.

Mineral Reserve estimates are based on assumptions that included mining, metallurgical, infrastructure, permitting, taxation, and economic parameters. Increasing costs and taxation and lower metal prices will have a negative impact on the quantity of Mineral Reserve estimates. There are no other known factors that may have a material impact on the Mineral Reserve estimates at Huaron.

15.2 Method

Mineral Resource blocks classified as Measured and Indicated Mineral Resources that can be mined economically are converted to Mineral Reserves. Some small isolated blocks may be removed if the cost and the logistics make them uneconomic to mine. A VPT is applied to each block based on metal content, metal prices, concentrate sales terms, concentrate quality, metallurgical recovery, transportation, refining, and other selling costs such as storage fees, port fees, etc. A minimum required VPT cut-off is calculated for the blocks depending on the block location and the mining method used to mine the block. Processing costs are assumed to be the same for all ore types, and metallurgical recoveries are determined separately for each group of veins or structures to account for variability in the metal recovery. Metal prices used in the Mineral Reserve estimates were $19 per ounce of silver, $2,000 per tonne of lead, $2,600 per tonne of zinc, and $7,000 per tonne of copper.

Any blocks which are considered uneconomic after these parameters are applied either remain as Mineral Resources or may be removed from the inventory completely if they do not meet the criteria of Resources. The Mineral Reserves are classified as Proven or Probable depending on the Mineral Resource classification.

15.3 Cut-off value

The cut-off value supporting the underground Mineral Reserve is based on the operating costs for the LOM plan. The cut-off value varies by location within the mine and by the planned mining method for that block. Table 15.1 shows the build-up of costs for a typical block.

Table 15.1 Huaron unit costs considered for reserves cut-off value estimation

Description	Total ($/t)
Mine	32.46
Processing	5.78
Water treatment	0.59
Planning & engineering	1.55
Geology	1.65
Safety and environmental	3.25
General maintenance	12.20
Electrical system	7.93
Camp administration	11.48
Lima administration	7.16
Breakeven cut-off value Huaron	84.05
Subtract management fee Canada	-0.33
Add tailings dam LOM capital	5.82
Full cost value Huaron	89.54
Incremental cut-off value	80.59

An incremental cut-off value is utilized as on balance there is excess mill capacity available, which in this typical example is $80.59/t or 90% of the full cost value for Huaron (Table 15.1). The tailings dam LOM capital of $5.82/t includes the cost of tailings pressure filtration and stacking from 2025 to the end of the mine life.

The VPT calculation that is applied to each of the mineral resource blocks accounts for metallurgical recovery and the costs associated with royalties and concentrate transportation and treatment for each of the major structures.

15.4 Dilution and recovery factors

In the evaluation of underground Mineral Reserves, modifying factors were applied to the tonnages and grades of all in situ mining shapes to account for dilution and ore losses that are common to all mining operations.

The unplanned dilution for SLOS will consist mainly of floor mucking dilution and has been estimated as 7%, which was applied to the SLOS in the Mineral Reserve estimates. In addition, planned internal dilution has been applied to the SLOS that ranges from 9% to 36%. Each vein (or domain) in the orebody has varying amounts of planned internal dilution based on empirical reconciliation of the actual vein width versus the surveyed width of mining. These empirical reconciliations, provide the approximation methodology for each vein’s (or domain’s) planned internal dilution, which has been added to the SLOS stopes in the Mineral Reserve estimates.

Similarly, the unplanned dilution for mechanical C&F is 5% that consists primarily of floor mucking dilution. In addition, the planned internal mining dilution is from 18% to 31% for C&F. Both the planned and unplanned dilution for C&F have been applied to the Mineral Reserve estimates.

A mining recovery for SLOS is 93% and C&F is 95%, which has been applied to the Mineral Reserve estimates.

15.5 Mineral Reserve tabulation

Mineral Reserve estimates for Huaron as of June 30, 2022, are provided in Table 15.2.

Table 15.2 Summary of Huaron Mineral Reserves as of June 30, 2022

Classification	Tonnes Mt	Ag ppm	Ag contained metal Moz	Cu %	Pb %	Zn %
Proven	7.0	169	38.1	0.54	1.51	2.97
Probable	3.9	167	21.1	0.30	1.63	2.97
Proven + Probable	**11.0**	**168**	**59.2**	**0.45**	**1.55**	**2.97**

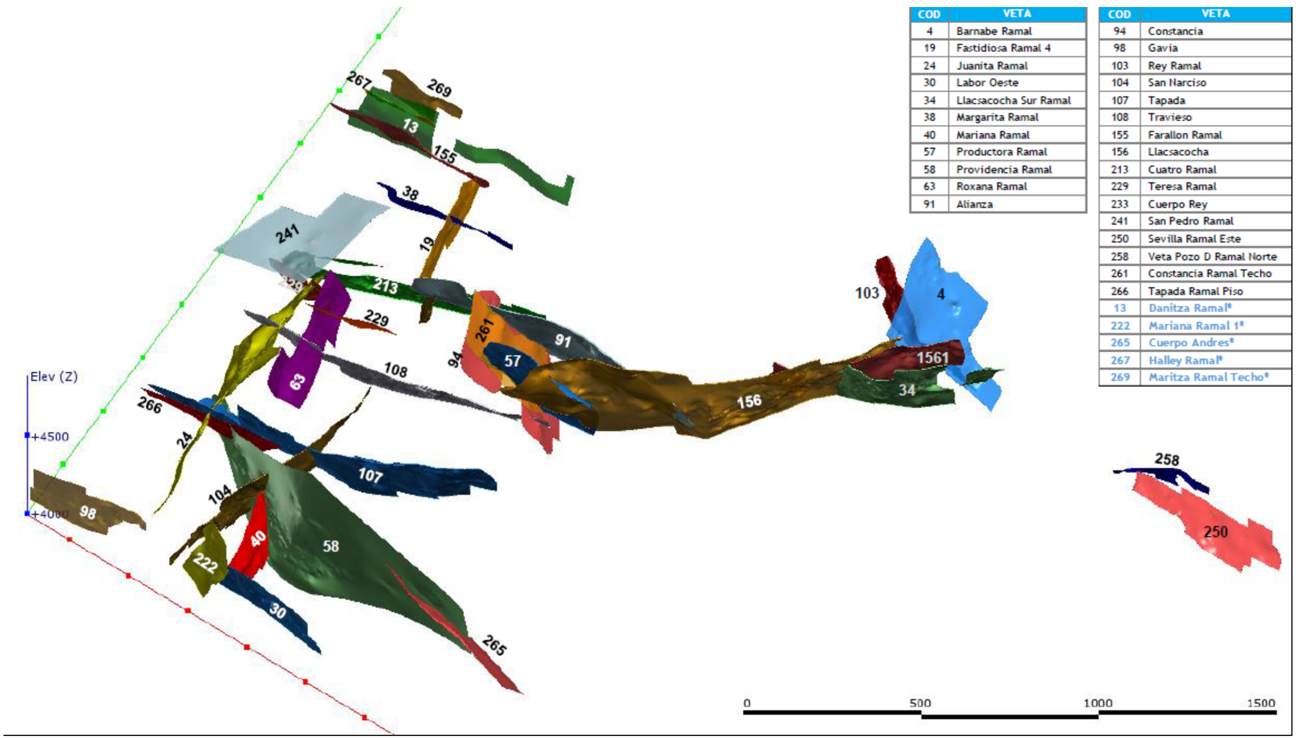
Notes:
- CIM Definition Standards (2014) were used for reporting the Mineral Reserves.
- Mineral Reserves are classified as Proven or Probable depending on the resource classification.
- Figures in the table may not compute exactly due to rounding.
- The Mineral Reserves are based on cut-off value that vary by location in the mine and by planned mining method.
- Cut-off values are based on a silver metal price of $19/oz, lead metal price of $2,000/t, zinc metal price of $2,600/t, and $7,000/t of copper.
- Metallurgical recoveries are based on feed grades, routine metallurgical testing results and historical recoveries.
- Mining recoveries for SLOS and C&F are 93% and 95%, respectively.
- Unplanned mining dilution for SLOS is 7%, and the planned internal mining dilution is from 9% to 36% for SLOS. C&F has unplanned mining dilution of 5%, and the planned internal dilution varies from 18% to 31%.
- Mineral Reserve estimates were prepared under the supervision of or were reviewed by Martin Wafforn, P.Eng., Vice President, Technical Services of Pan American.
- Mr. Wafforn, P.Eng. is the QP for the Mineral Reserve.
- Mineral Reserves are in addition to Mineral Resources.

16 MINING METHODS

16.1 Mining methods

Mining is undertaken using a combination of mechanized cut and fill (C&F) and mechanized sub-level open stoping (SLOS) methods. The overall geometry of the Huaron orebody is shown in Figure 16.1 as a plan view of the 33 domains in the underground.

Figure 16.1 Plan view of Huaron underground



Source: PAS (2022).

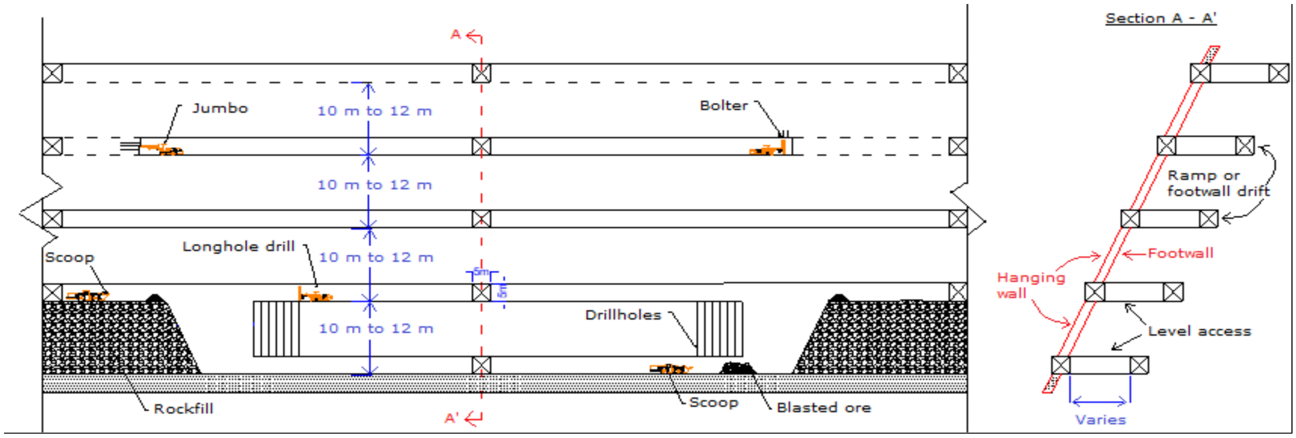
The selection of the mining method depends on the location, width, and orientation of the vein to be mined, as well as the ground conditions of the FW and HW. The following sections will further describe the mining methods and their application.

16.1.1 Sub level open stoping

Longitudinal SLOS uses electric hydraulic long hole drills, scoop trams and development waste for backfill (see Figure 16.2). Cement is occasionally added to the waste rock backfill to create a pillar which is stable upon exposure. The dimensions of the mining blocks are based on mining levels, stope layouts, previously experience and geotechnical constraints. Stopes are typically 40 m long but can range between 20 m to 100 m in length. Sub levels spacing varies between 10 m to 12 m apart vertically.

Sub levels, cross cuts, drifts, and ramps are excavated at 3.5 m wide by 3.8 m high in sub level stoping areas. More than 80% of the mine's production is extracted using the long hole stoping method. SLOS is done at Huaron using this methodology as shown in Figure 16.2 (also known as Avoca mining method) and at times by leaving rib pillars and stopping to fill a mined block when access from the mined side of the stope is not available for backfilling.

Figure 16.2 Sub level stoping long section



Source: AMC (2022).

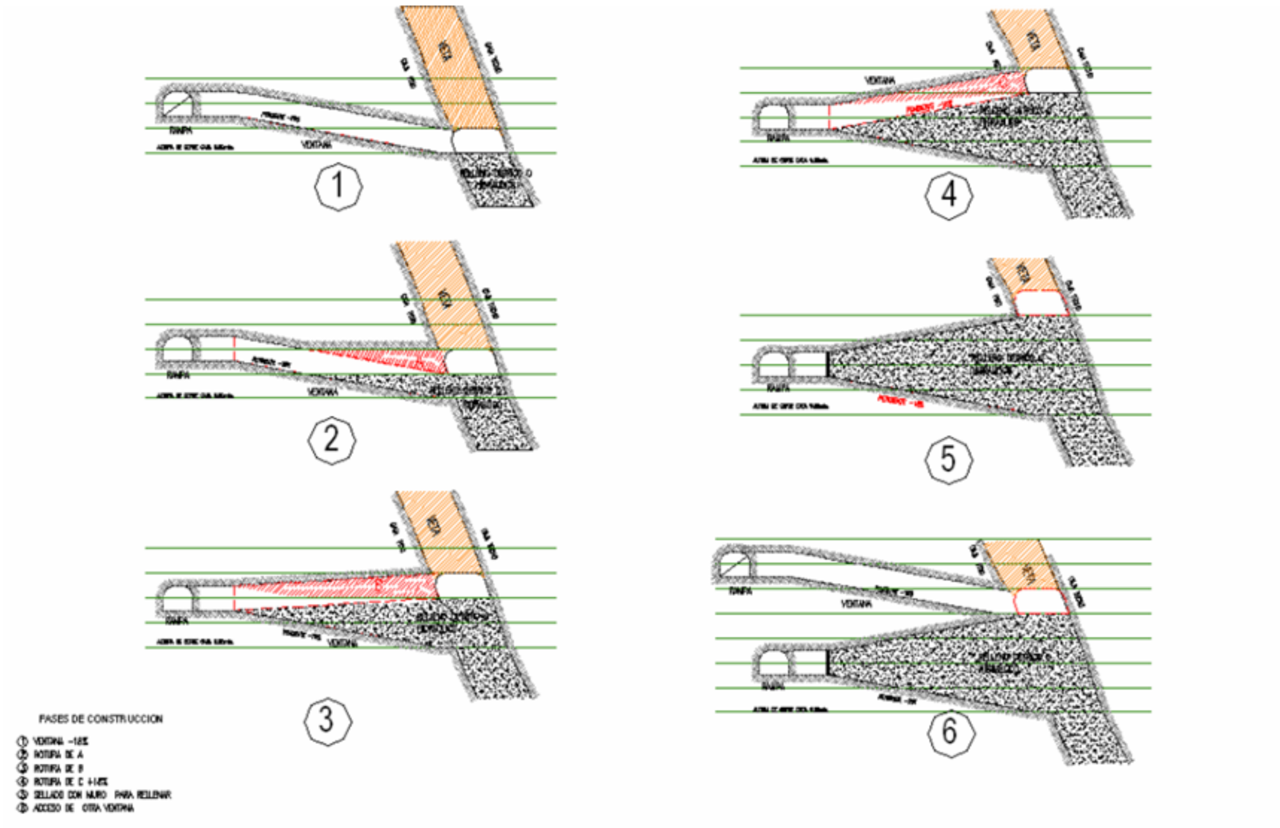
The minimum mining width for SLOS is 1.0 m and planned dilution is included in the mine design. Dilution estimates vary according to the ground conditions, mining method, vein width and the dip of the vein. The dilution factors range from 9% to 36% for planned dilution (LOM average is approximately 24%) and unplanned floor dilution is 7%. In the SLOS areas, dilution is reconciled using a cavity monitoring survey and comparing actual to design. This methodology is used to determine the planned dilution of SLOS for each vein in the orebody.

16.1.2 Mechanized longitudinal cut and fill

Mechanized longitudinal C&F is used in areas where the development of an access ramp can be economically justified. This is typically the case where the orebody is moderately dipping (<55°), sufficiently wide (up to 10 m) and economic veins are present, or where the north-south striking and east-west striking vein sets cross and provide additional mining faces. Drilling is undertaken with electric hydraulic jumbo drills and the broken ore is removed using scoop trams.

C&F mining at Huaron commences once the decline (Spiral Ramp) reaches the FW drive or level access elevation of the orebody, usually midway along its strike length (see representative C&F sequence sketch in Figure 16.3). C&F is an overhand mining method, and the stope sequence begins with the lowest 3.5 m high lift. Then each subsequent lift requires the back of the level access to be slashed down to reach the next lift. There are typically four or five lifts between levels for a total rise of 15.0 m to 17.5 m from each access.

Figure 16.3 Cross section of C&F mining



Source: PAS (2022).

Generally, for across orebody width (FW to HW thickness) of 10 m or less, the stope will be developed as longitudinal C&F. The mining begins by driving the level access to the FW contact of Lift 1 and then the drive is extended flat (zero gradient) to the HW contact of the ore. Next, the ore is mined longitudinally in a single pass along strike in both directions to the limits of the orebody. Any remaining ore on the HW side will be slashed out on retreat and then the drift will be backfilled.

The initial backfill material placed in the stope is waste rock from development in the mine, which is evenly distributed with a scoop along the length of the stope to fill approximately 80% of the void. The remainder of the stope is backfilled with cyclones mill tailings on top of the rockfill, which is piped into the SLOS. It is further noted that uneconomic materials in the stope is typically blasted down and left as backfill.

Once the stope has been backfilled the level access will be TDB to provide access for the next lift, and the process will be repeated for subsequent lifts.

The minimum mining width for C&F is 1.5 m and planned dilution is included in the mine design. Dilution estimates vary according to the ground conditions, mining method, vein width, and the dip of the vein. The dilution factors range from 18% to 31% for planned dilution (LOM average is approximately 26%), and unplanned floor dilution is 5%. In C&F mining the width of the stope is surveyed on a regular basis as mining advances and compared to the actual vein width. This reconciliation is the methodology for determining the planned dilution of C&F stopes for each vein in the orebody.

16.2 Materials handling

A combination of haul trucks and electric locomotives are used for haulage from the upper parts of the mine. A rehabilitated shaft with a tower mounted friction hoist is used for hoisting ore and occasionally waste from the 250 Level to the surface. The capacity of the shaft is limited to approximately 50,000 tonnes per month, material in excess of this amount is trucked out of the mine. There is a rail haulage system on the 500 Level that feeds directly into the surface crusher however this system is not currently being used. Ore sourced from below the 250 Level is hauled to the surface crusher using a combination of diesel haul trucks, rail haulage system on the 250 Level and hoisting in the mine shaft. The rail haulage system completed on the 250 Level is used in conjunction with mine shaft and reduces mine haul trucks requirement, as well as contractors, who provide the truck haul services.

16.3 Underground access

Employee and material movement in and out of the mine is via three mine portals driven into the side of the mountain. Access and secondary egress are also possible via ladders in escape ways and ventilation raises to the surface as well as via a drainage tunnel.

16.4 Personnel

The mine currently operates 24 hours per day, seven days per week on two shifts per day for a total of 14 worked shifts per week. Support staff at the mine works only a single shift.

The operation currently has a full complement of 1,554 workers with a production rate of one Mtpa.

The mine has been reducing the use of third-party contractors but still relies on contractors for several important aspects of the underground mine. These include drilling; mine development; stope preparation and mining in the south zone of the mine; raise boring; the preparation, transport, and application of wet mix shotcrete; and truck haulage of plant feed for processing up the mine ramp to surface stockpiles.

16.5 Geotechnical

Pan American's minimum ground support policy is to support each round after blasting with rock bolts. Inflatable Swellex style rock bolts are installed around the excavation profile with sacrificial Splits Sets and mesh used to support the face.

The sites team of geotechnical engineers routinely inspect the mines workings identifying any areas that do not satisfy the site geotechnical standards. Remediation plans are issued using a ground support design matrix that considers ground conditions, the degree of rock fracturing, joint conditions and the excavation size. The matrix also specifies a bolting pattern and any surface support requirements that may be required (which typically include weld mesh and / or fibre-reinforced shotcrete). To control any atypical conditions, ground support elements such as heavy gauge straps, rapid set and / or high strength fibre-reinforced shotcrete, steel arches and wooden lagging are also available for use. QA/QC programs are in place to ensure rock bolts and shotcrete are installed and perform to design specifications.

Excavation dimensions typically range between 2.5 m to 4.5 m wide and 3.0 m to 4.5 m high. Historically rock bolt installation was completed manually using jacklegs, however, mechanized techniques are now used with Resemin Muki and Raptor jumbos. Fibre-reinforced shotcrete is batched on surface, then transported underground and sprayed robotically.

SLOS stope stability designs are evaluated using industry standard empirical technics such as the Mathews Stability Method and Equivalent Linear Overbreak Slough (ELOS) methods.

The ground support standards were last updated in the third quarter of 2022 and when required the engineers will seek technical assistance from third-party geotechnical consultants.

16.6 Mining fleet and machinery

The current underground mobile mining equipment fleet owned by Pan American and the mine contractors is shown in Table 16.1.

Table 16.1 Current underground mobile mining equipment

Item	Specification	Quantity
Scooptram	6.0 cubic yard	2
Scooptram	4.2 cubic yard	9
Scooptram	2.2 cubic yard	4
Drill jumbo	1 boom	10
Long hole drill	1 boom	4
Bolting jumbo	1 boom	4
Mine haul truck	15 tonne	1
Scissor lift	2.7 tonne	170
Volvo trucks	25 tonne	14

16.7 Backfill

The backfill for C&F is rockfill from waste development. If additional rockfill is required, the Huaron mine has a waste rock stockpile on surface that can be trucked underground.

The backfill for SLOS is a mixture of rockfill (approximately 80% by volume) and cycloned tailing (20% by volume) from the mill. The initial backfill material placed in the SLOS is development waste rock, which is distributed with a scoop along the length of the stope to fill approximately 70% of the void. The remainder of the stope is backfilled with a cap on top of the waste rock using cycloned mill tailings that is transported hydraulically by pipe into the stope. Cement is added occasionally to the waste rock to make a cemented rockfill product that results in a pillar which is stable upon exposure.

16.8 Ventilation

16.8.1 Ventilation strategy

The function of the ventilation system is to dilute/remove airborne dust, diesel emissions, explosive gases and to maintain temperatures at levels necessary to ensure safe production throughout the LOM. The ventilation system has been designed to meet the requirement of the Peruvian Occupational Health and Safety Laws.

The primary ventilation circuit is designed with exhaust fan stations located at Raisebore 39 (RB-39) and Raisebore 52 (RB-52) pulling the air through the mine. Each fan station consists of two Airtec S.A. fans installed in parallel. Fresh air ingress is via the Union, Cosmos and Yanamina Ramps, D Shaft, old workings and the Paul Nevejans tunnel. Between levels the air is distributed using internal raises and collectively this arrangement enables a maximum of 439 cubic metres per second (m^3/s) of air to be available for total mine ventilation.

Contaminated return air is exhausted from the mine using internal raises adjacent to each ore block before feeding the 500 Level for exhausting into the primary exhaust raise.

Ventilation for each production level is designed such that fresh air will be sourced from level accesses and FW drives and delivered to work areas will be via auxiliary fan and duct.

Two means of egress are provided for each production area of the mine. The primary means of egress is via the haulage ramps and secondary egress is via a series of internal ladderways located within raises with ladderways and crossover drifts.

16.8.2 Emergency preparedness

In development of the ventilation strategy for Huaron, consideration has been given to the potential for mine emergencies. As such, the following criteria have been established:

- Ramps are located in fresh air and once developed may be used for either up- or down ramp egress.
- Egress from almost all levels is either using the haulage ramp or by the escape ladderway in the internal raises.
- Portable refuge chambers are installed in close proximity to active working areas of the mine.
- Huaron's primary means of communication is radio, however, a secondary stench gas system is installed to release ethyl mercaptan into the ventilation and compressed air systems in the event of fire.

16.9 Underground infrastructure

16.9.1 Service water

The service water for the entire Huaron mine, process plant, and camps is supplied from Lake Llacsacocha. The average monthly consumption is around 100 cubic metres per hour (m^3/hr).

16.9.2 Underground workshop

There are no underground workshops, only satellite repair bays. The equipment is taken to surface for major repairs.

16.9.3 Explosives magazine

The underground explosives magazine for caps and explosives are located on mining level 500. There are three separate bays to accommodate ammonium nitrate fuel oil (ANFO), emulsion, and caps.

16.9.4 Fuel storage

There is no underground fuel storage. Fuel is transported underground by a tanker to the mobile equipment fleet eliminating the need for the equipment to come to surface for refueling.

16.9.5 Compressed air

The compressed air is reticulated underground in a 30.5 cm diameter pipe fed from four compressors located on surface.

16.9.6 Electrical power

See Section 18.3.5 for more detail.

16.9.7 Mine dewatering

There are approximately two km^2 of abandoned mine workings in the areas of Huaron and the adjacent Animon mines. The Paul Nevejans tunnel receives approximately 150 litres per second of water from water draining from Lake Llacsacocha and lagoons overlying the Animon mine. Drainage at Huaron is by gravity via the 8 km long Paul Nevejans tunnel located at the 250 Level. This tunnel was constructed between 1948 and 1954 to drain the faults and Sevilla chert in the areas north of Lake Llacsacocha. Only minimal discharge (less than 20 litres per second) occurs from the mine workings above the 250 Level. Most of the flow (at a rate of approximately 290 litres per second) enters the Paul Nevejans tunnel at a 1 km stretch located to the north of Lake Llacsacocha.

The deepest mining level at Huaron is the 100 Level which is located 150 m vertically below the Paul Nevejans drainage tunnel. The 100 Level was developed with a pumping station that included a backup diesel generated power supply to pump any water inflows to the Paul Nevejans drainage tunnel.

16.10 Mine schedule

16.10.1 Production rate and expected mine life

The LOM plan is based on the Mineral Reserves presented in Section 15.5 of 10.95 Mt with an annual processing rate of one Mtpa (2,800 tpd) and with the current reserves the projected mine life is 10.5 years. The projected mine life may increase if the current Mineral Resources can be converted to Mineral Reserves or if additional Mineral Resources are defined and can be converted to Mineral Reserves.

The bottom level of the current Mineral Reserve and LOM is assumed to be the 100 Level. Mineralization characteristics that have already been extracted from the 100 Level do not appear to differ significantly (in terms of grade and geometry) to the same structures encountered higher up on the 180 Level. This supports the theory that these veins and structures potentially continue at depth below the 100 Level.

An economic evaluation of the resource and mineral extraction below the 100 Level has not yet been completed. The processing plant is approaching its maximum designed capacity and any increases in plant throughput further without increasing the crushing, grinding, and flotation capacity of the plant would result in reduced metal recovery. Some studies have been conducted into incrementally increasing the capacity of the processing plant; however, the economics of a mine expansion have not been quantified at this time.

16.10.2 Development schedule

The total annual waste produced from mine development is approximately 300,000 tonnes, The majority of the waste is retained within the mine and placed as backfill (in the SLOS and C&F stopes). Any waste rock that is required to be mined while mining C&F stopes is blasted and where possible and left in the stope as backfill. Waste that is hauled to surface is either used as construction material (for the tailings facility construction or other projects), or deposited on an engineered waste rock dump located on top of historical tailings facility.

17 RECOVERY METHODS

17.1 Introduction

Huaron mine operates a 3,200 tpd mill with froth induced flotation to produce silver in copper, lead, and zinc concentrates. The mill flowsheet consists of a three-stage crushing circuit, ball mill grinding and selective flotation of the ore to concentrates, followed by thickening and filtering of the concentrates. A portion of the tailings from the process are cycloned to produce sands for backfill material for the underground mining operation, and the fines and rest of tailings are deposited into a tailing impoundment facility.

The processing plant at Huaron has been modified multiple times since 2015 to improve operations. These modifications include:

- Additional cyclones to improve size classification.
- Addition of rougher flotation cells, a conditioner cell, and cleaner cells to the zinc circuit to increase residence time, depress iron minerals, and improve zinc concentrate quality.
- Addition of lead flotation cells to improve quality of the lead and copper concentrates.
- Addition of a high frequency screen ahead of the bulk flotation to remove trash from the pulp.

17.2 Crushing

Ore is delivered from the mine to a 15,000-tonne capacity stockpile where the ore is classified by metallurgical characteristics to obtain an optimal ore blend for processing through the plant. The blended material is fed into a 100-tonne capacity coarse ore bin where it is reclaimed by an apron feeder to a vibrating grizzly. The oversize from the grizzly is reduced in size by a jaw crusher to 3.5 inches and rejoined with the grizzly undersize onto a conveyor which feeds a vibrating screen. The oversize material reports to the secondary cone crushers where it is reduced to a 2.5-inch product size then joins the undersize via conveyor to another vibrating screen. The oversize material reports to a tertiary short head cone crusher where it is reduced in size to 100% passing one quarter inch. The undersize product travels by conveyor belt equipped with an electromagnetic separator and metal detector for storage in three 300 tonne capacity fine ore bins prior to entering the grinding circuit.

17.3 Grinding and classification

The grinding circuit consists of a primary ball mill 12-foot diameter by 16 foot long, operating in an open circuit with two parallel secondary ball mills (one 8 foot diameter by 8 foot long and one 6.5 foot diameter by 14 foot long) operating in a closed circuit. The milled product from the primary and secondary ball mills reports to the classification hydrocyclone nest. Underflow from the hydrocyclones is fed to the secondary ball mills and the overflow is treated in a third stage 8-foot diameter by 3-foot-long conical mill. The third stage grinding operates in a closed circuit with a hydrocyclone nest. The final milled product is approximately 60% passing 200 mesh.

17.4 Flotation

The pulp from the grinding circuit is fed to the flotation circuit. The flotation circuit includes an initial stage of depression of zinc and flotation of a bulk concentrate. The bulk concentrate consists of lead and copper and is treated with sodium dichromate to separate and produce a silver rich lead and copper concentrate. The tailings from the bulk flotation are activated and conditioned with copper sulphate and lime to modify the pH and to produce a zinc concentrate. The bulk flotation occurs in three stages of roughing, three stages of cleaning, and three stages of scavenging. The cleaning concentrate is sent to the copper-lead separation circuit while the scavenger tails are pumped to a zinc flotation circuit. The copper-lead separation circuit consists of the flotation of copper through one conditioning tank, one stage of roughing, three stages of cleaning, and one scavenging stage, while the lead concentrates are produced from the scavenger tails. The zinc flotation circuit includes three conditioning tanks, three stages of roughing, three stages of cleaning, and two stages of scavenging to produce the zinc concentrate. The final flotation plant residues are produced in the zinc flotation circuit from the second scavenger tails.

17.5 Thickening and filtering

The copper, lead, and zinc concentrates are thickened in separate thickeners with dimensions of 18 foot by 8 foot, 26 foot by 6 foot (for high copper), 20 foot by 8 foot, and 28 foot by 10 foot, respectively, to obtain a pulp of approximately 50% to 60% solids, and are stored in separate holding tanks. From the holding tanks, the concentrates are dewatered in a filter press to obtain a moisture content of approximately 7% to 8%. The concentrates are then transported to their respective destinations in 30 tonne trucks.

17.6 Tailings storage

Tailings from the processing plant are sent directly to the tailings facility or classified in a hydrocyclone to obtain two products. The coarser fraction is returned underground hydraulically to act as backfill material in the mining areas and the fine material is delivered to a tailing impoundment area via a pipeline. The tailings storage facility is constructed primarily of waste rock from the mine. The tailings facilities are continually reviewed and expanded as required, and engineered and constructed to ensure geotechnical stability by Pan American’s independent designer and Engineer of Record, Anddes Associates, based in Lima, Peru. Inspections and monitoring instrumentation are in place to confirm that the performance of the facilities is stable and within design limits. The tailings protocol of the Towards Sustainable Mining program from the Mining Association of Canada has been implemented in the tailings management and Huaron has achieved level A of the program in tailings protocol.

Recent test work performed by Pocock Industrial indicates that the tailings are amenable to pressure filtration to produce a stackable product and engineering design for a filtered-stacked tailings facility is currently in progress. The filtered-stacked facility considers thickening the mill tailings before pressure filtration to produce a filter cake with a moisture content of approximately 15% by weight. The tailings filter cake will discharge to a concrete collection bunker where it will be reclaimed into trucks to be delivered to the filtered-tailings storage facility. Filtrate for the filter presses will be returned to the process or delivered to the existing tailings facility. The filtered-stacked tailings storage facility will provide additional tailings storage capacity to the conventional tailings facility. Pending permit approval, the filtered tailings facility is planned to be constructed in 2023.

17.7 Power, water, and process consumable requirements

The primary source of power for the mine is the Peruvian national power grid and is sufficient for the mine’s current requirements. The annual power consumption at the processing plant is approximately 29 million kilowatt hours per year. For water consumption, the mine is authorized to use up to 320 litres per second of water obtained from a system of nearby lakes for mining and processing activities through payment of a water use permit. This volume of water is more than sufficient for the mine’s requirements. A summary of the major process consumable requirements is given in Table 17.1.

Table 17.1 Summary of major process consumables

Item	Annual usage (tonnes)
Grinding media	550
Collectors	44
Frother	41
Copper sulphate	169
Lime	2,200

17.8 Summary of metal production

In the first two quarters of 2022, the mill processed approximately 468,800 tonnes of ore with metallurgical recoveries averaging 84% for silver, 75% for zinc, 80% for lead, and 78% for copper. Metal production during 2021 was approximately 1.8 Moz of silver, 7,800 tonnes of zinc, 5,500 tonnes of lead, and 2,300 tonnes of copper. Metal recoveries have been very consistent since 2015 with overall good production results. Metal production during 2020 was significantly reduced compared to previous years and is largely due to mine shutdowns associated with the COVID-19 global pandemic; metal recoveries for 2020 were consistent with previous years and expectations. Metal production for the past 9 years is given in Table 17.2.

Table 17.2 Metal production for the past 9 years

Year	Processed tonnes	Produced silver ounces (Moz)	Produced zinc tonnes	Produced lead tonnes	Produced copper tonnes
2022*	468,800	1.8	7,800	5,500	2,300
2021	940,300	3.5	15,400	7,500	5,900
2020	555,600	2.1	11,200	5,600	3,600
2019	994,000	3.8	18,000	9,200	6,000
2018	935,000	3.6	17,400	8,000	5,400
2017	928,100	3.7	19,400	8,800	6,100
2016	904,400	3.8	20,200	10,800	6,200
2015	894,500	3.7	13,800	7,100	6,800
2014	892,800	3.7	14,600	6,200	6,000

Note: *First half of year.

18 PROJECT INFRASTRUCTURE

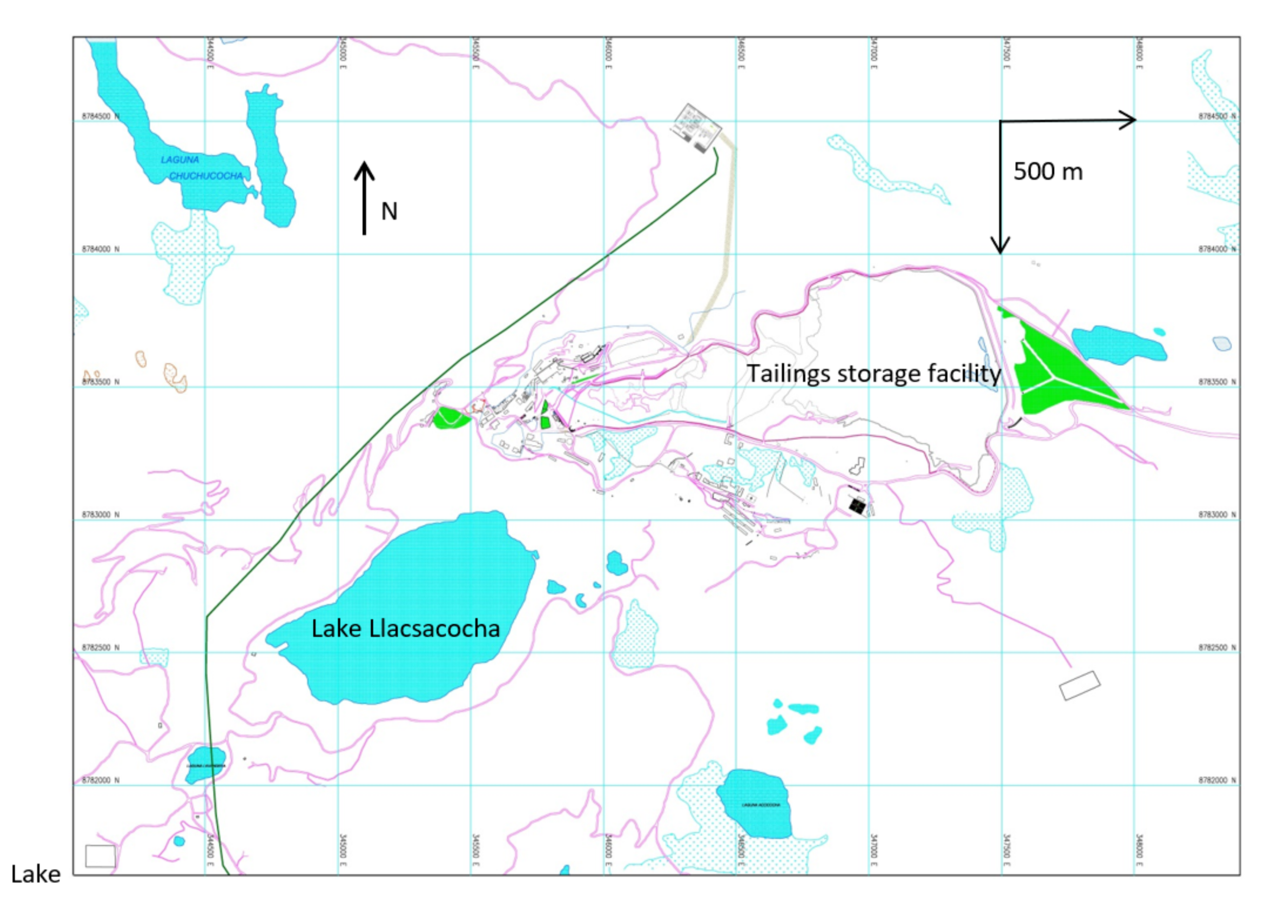
The Huaron mine is an underground silver-copper-lead-zinc mine located in the province of Pasco in the Central Highlands of Peru. Pan American is the 100% owner of Huaron and the mining concessions, through its wholly-owned subsidiary, Pan American Silver Huaron S.A.

The mine infrastructure comprises the underground mine workings, processing facilities, existing tailing impoundments, effluent management and treatment systems, waste rock storage facilities and maintenance shops and warehouses laboratories, storage facilities, offices, drill core and logging sheds, water and power lines, access roads, and the worker's camp and recreational facilities. The primary source of power for the mine is the Peruvian national power grid and is sufficient for the mine's current requirements. The power consumption is approximately 66 million kilowatt hours per year.

The operating mine is mature and site infrastructure including site roads are fully developed to support the existing mine production of one Mtpa.

A plan of the mine infrastructure is given in Figure 18.1.

Figure 18.1 Mine infrastructure plan



Source: PAS.

18.1 Transportation and logistics

Access to Huaron is by a continuously maintained 285 km paved highway between Lima and Unish and a mostly paved 35 km road between Unish and Huaron. Access is also possible by two other longer and more difficult gravel roads. There is also a light aircraft strip at the town of Vicco, which is located approximately 30 minutes flying time from Lima, at which point an additional 30 minutes of driving is required to reach Huaron.

The nearest city is Cerro de Pasco, a major historical mining center with a population of approximately 70,000 people, which is connected to Lima 320 km to the southwest by road and rail. The nearby town of Huayllay also provides workers, lodging, and supplies. Experienced mining personnel from the region commute to the Property via company sponsored buses, company vehicles, or privately owned vehicles. Materials, fuel, and produced metal concentrates are transported to their destinations by road. Concentrates may also be transported by rail.

18.2 Processing facilities

The process plant, known as François, has a capacity of 3,200 tpd of ore and produces three different silver bearing copper, lead, and zinc concentrates. The process plant consists of crushing, grinding, flotation, thickening, filtration, and concentrate storage areas. The building also includes some process plant offices and a reagent preparation area.

Other major processing facilities include a stockpile area near the processing plant and a tailings facility for the storage of flotation tails. Minor processing facilities include a small building with an analytical lab and metallurgical lab, another building for general administrative offices, a milk of lime preparation plant, a water reservoir for domestic use, a water reservoir for industrial use, and two sewage water treatment plants.

18.3 Water supply

The service water for the entire Huaron mine including the process plant, underground mine and camps is obtained from Lake Llacsacocha through payment of a water use permit. The average monthly consumption is around 100 m^3/hr. The mine is authorized to use up to 320 litres per second of water. This volume of water is more than sufficient for the mine’s requirements.

8.3.1 Mine workshop

The central maintenance workshop is located on surface. There are two wash bays, two equipment maintenance bays, tire shop, centralized lubrication area, bridge crane, spare parts area, warehouse, and electrical workshop. There are four smaller satellite maintenance bays in the underground mine.

8.3.2 Explosives magazine

The explosives magazine and blasting accessories are located on mining level 500 in an area specially designed to comply with the Peruvian national regulations. This magazine storage is separated into three areas for storage of ANFO, emulsion, dynamite and blasting accessories. The storage capacity is sufficient for 30 days.

8.3.3 Fuel storage

The site fuel storage facility with a capacity of 14 days demand is located on surface. A fuel truck / tanker is used for distribution to the underground mobile fleet.

8.3.4 Compressed air

The compressed air for underground activities is supplied by four compressors GA 315 (Atlas Copco) with nominal capacity of 1200 CFM. Air supply is distributed with a 30.5 cm (12 inches) pipeline and supported by compressed air tanks to maintain the pressure at 7.2 bar (105 PSI).

8.3.5 Electrical power

The primary source of power for the mine is the Peruvian national power grid, National Interconnected Electrical System (SEIN) and is sufficient for the mine's current requirements. The power consumption is approximately 66 million kilowatt hours per year. The electrical power has an installed capacity of 20 megawatts (MW). The powerline comes from the Chungar mine, a mine next to Huaron. The incoming line is at 50 kilovolts (kV) and transforms to 22.9 kV in Huaron's main Substation. From here power is distributed to two substations, Francois substation and RB 29 substation. The voltage is further dropped to 5.5 kV for reticulation into the mine.

18.4 Mine communication system

The primary means of communication in the mine is by radio.

18.5 Tailings management facilities (TMF)

This is covered in Section 17.6.

19 MARKET STUDIES AND CONTRACTS

Pan American has been producing silver rich zinc, lead, and copper concentrates at Huaron since 2001, which are sold under contracts with arm's length smelters and concentrate traders located in Peru, Asia, and Europe. Huaron receives payment for an agreed upon percentage of the silver, zinc, lead, or copper contained in the concentrates it sells after deduction of smelting and refining costs, based on quotational periods negotiated on each contract that may differ from the month in which the concentrate was produced. Under these circumstances, Pan American may, from time to time, fix the price for a portion of the payable metal content during the month that the concentrates are produced. To date, Pan American has been able to secure contracts for the sale of all concentrates produced, however, there can be no certainty that Pan American will always be able to do so or what terms will be available at the time.

Huaron has a contract in place with Robocon Shotcrete Services of Lima, Peru, for the preparation, transport, and application of wet mix shotcrete. The haulage of plant feed for processing up the mine ramp to surface stockpiles is under a contract with Dinet Logistica Inteligente of Lima, Peru. A contract is also in place with TUMI Contratistas Mineros S.A.C. of Lima, Peru, for raise boring.

In the opinion of the QP, the contracts in place conform to industry norms.

Martin Wafforn, P.Eng., Senior Vice President, Technical Service and Process Optimization of Pan American and the QP responsible for this section of the technical report, has reviewed the contract terms, rates, and charges for the production and sale of the silver, zinc, lead, and copper produced at Huaron, and considers them sufficient to support the assumptions made in this Technical Report.

20 ENVIRONMENTAL STUDIES, PERMITTING, AND SOCIAL OR COMMUNITY IMPACT

20.1 Environmental factors

The most significant environmental issue currently associated with the mine is treatment of the waters discharged from the mine and localized areas of acid rock drainage from historic tailings below the mine's tailings deposit. All waters are captured and treated in a treatment plant near the exit of the Paul Nevejans drainage tunnel to achieve compliance with discharge limits. There are no known environmental or social issues that could materially impact the mine's ability to extract the Mineral Resources and Mineral Reserves.

20.2 Environmental studies

A full suite of environmental baseline and impact assessment studies were completed by Pan American for an update and tailings facility expansion EIA. The studies performed include surface water, groundwater, biodiversity, seismic hazards, soils, geomorphology, air quality, and climate. No material issues were identified in any environmental studies and the EIA was approved by the Peruvian Ministry for Energy of Mines in 2010. Pan American is planning to commence new baseline studies, which will supplement the regular environmental monitoring, for a modification to the Huaron EIA in mid-2022.

Huaron participates in the Mining Association of Canada's "Towards Sustainable Mining" program and has achieved Level A on environmental protocols.

20.3 Permitting factors

Huaron holds all necessary environmental permits for the continued operation of the mine, including environmental licenses, water use and discharge permits, an approved closure plan, approved management plans, and approved operating permits for the tailings facility. Huaron has commenced the process of an EIA modification which will include a number of mine operations and tailings management projects to ensure continued operations over the LOM.

20.4 Waste disposal

Waste rock is used principally as backfill in the underground mine. Any excess material is deposited in an engineered waste rock dump at surface or used for tailings dam buttress construction.

The fine fraction of the process tailings is delivered to a tailing impoundment area via a pipeline. The tailing impoundment area is constructed of quarried rock fill and waste rock from the mine. The facility is continually reviewed and expanded as required and engineered and constructed to ensure geotechnical stability by Pan American's Engineer of Record, Anddes Associates. Monitoring instrumentation is in place to confirm that the performance of the facility is within design limits. In 2020 and 2021 the tailings facility was expanded to accommodate production until 2025. Further tailings facility raises will be required throughout the LOM.

20.5 Site monitoring

Pan American conducts environmental monitoring in and around the mine as part of its approved environmental management plans which continues to confirm legal compliance and add to the extensive environmental database. This monitoring includes water flow and quality monitoring, air quality, noise, soil, and flora and fauna. The mine also records waste generation, recycling, energy consumption, greenhouse gas emissions, water use, and effluent quality and flow. There are no material issues arising from the results of this monitoring.

20.6 Water management

Contact waters, including mine dewatering, tailings facility discharge, and acid drainage from waste rock and tailings are captured and treated in a treatment plant near the exit of the Paul Nevejans drainage tunnel to achieve compliance with discharge limits.

20.7 Social and community factors

There are no social or community pressures that materially affect our ability to extract the Mineral Reserves and Mineral Resources. Pan American's Peruvian community relations team implements an extensive program of community engagement activities including information sessions, health services, infrastructure works, and educational and training programs for the local people, which have resulted in the establishment of several small businesses.

20.8 Project reclamation and closure

In October 2003, the Peruvian government passed legislation requiring active mining operations to file closure plans within six months of the date of passage of the legislation. Administrative rules associated with this legislation which laid out detailed closure requirements, including bonding and tax deductibility of reclamation and rehabilitation expenses, were promulgated in October 2005. These rules require that detailed closure plans and cost estimates be compiled by a certified third-party consultant by October 2006. The original closure plan for Huaron was filed by mid-year 2004.

In August of 2006, Pan American submitted a comprehensive closure plan for Huaron to the MEM in accordance with that ministry's regulations. The closure plan was prepared by third-party consultants registered with the Peruvian authorities as qualified to present closure plans to the MEM. The closure plan includes a summary of the proposed closure scheme for each of the major areas of impact such as mine water, tailings areas, waste rock dumps, plant site infrastructure, and the underground mine. A detailed cost estimate was prepared based on Pan American's and the consultant's shared experience with closure works and experience with other projects in Peru. As required by the MEM, the costs were summarized in three phases: concurrent closure, final closure, and post closure. Updated closure plans are filed as required, with the most recent closure plan modification approved in 2019.

A closure cost estimate for Huaron was prepared according to State of Nevada approved Standard Reclamation Cost Estimator methodology in 2011 and is updated every year. The current undiscounted value of closure expenditures at Huaron is estimated at $17.6 million.

20.9 Expected material environmental issues

The most significant environmental issue currently associated with the mine is treatment of the waters discharged from the mine and localized areas of acid rock drainage from historic tailings below the mine's tailings deposit. All waters are captured and treated in a treatment plant near the exit of the Paul Nevejans drainage tunnel to achieve compliance with discharge limits. There are no known environmental or social issues that could materially impact the mine's ability to extract the Mineral Resources and Mineral Reserves.

21 CAPITAL AND OPERATING COSTS

Since the mine is in operation, any sustaining capital expenditures are justified on an on-going basis based on actual experience at the mine. Sustaining capital expenditures during 2022 primarily for mine development, diamond drilling, tailings facility expansions and mine infrastructure are estimated to total $17.5 million. The main mobile mining equipment is leased, and new leases will be undertaken throughout the LOM to ensure that the mining fleet maintains a high availability. Operating lease expenditures in 2022 are expected to total $2.7 million. The amount of diamond drilling conducted to extend the mine life beyond the existing Mineral Reserves forming the basis of the current LOM plan will be at the discretion of Pan American and may depend on the success of exploration and diamond drilling programs, if any, and prevailing market conditions.

The long-term assumptions for operating costs are shown in Table 21.1. The assumptions are justified on the basis of the current actual operating costs at the mine, and on the basis of an annual throughput of one Mtpa. As there are a number of fixed costs associated with operating a large underground mine such as Huaron, an increase in the annual throughput could reasonably be expected to increase the total costs but to reduce unit operating costs, and similarly a reduction in throughput could reasonably be expected to decrease the total costs and to increase the unit operating costs.

Table 21.1 Annual operating costs

Area	Estimated unit costs (US$ per tonne)
Mining	32.46
Processing	5.78
Maintenance	12.20
Electrical power and distribution	7.93
Safety, environment, and water treatment	3.84
Engineering and geology	3.20
Camp administration	11.48
Sub total production costs	76.89
Administration, insurance, legal, concessions	3.25
Management costs allocated	7.16
Shipping, selling, ocean freight	3.89
Total operating costs	**91.19**

22 ECONOMIC ANALYSIS

An economic analysis has been excluded from this Technical Report as Huaron mine is currently in production and this Technical Report does not include a material expansion of current production.

23 ADJACENT PROPERTIES

There is no relevant information on adjacent properties to report.

24 OTHER RELEVANT DATA AND INFORMATION

There is no additional information to report.

25 INTERPRETATION AND CONCLUSIONS

Pan American has been operating Huaron since 2001 and expects to process approximately one Mtpa over the course of the remaining LOM.

Pan American conducts infill and near-mine drilling through much of the year and updates Mineral Resource and Mineral Reserve estimates on an annual basis following reviews of metal price trends, operational performance and costs experienced in the previous year, and forecasts of production and costs over the LOM.

There are no known environmental, permitting, legal, title, taxation, socio-economic, marketing, political, or other factors or risks that could materially affect the development of the Mineral Resources other than noting that delays in the permitting process for the tailings dam filtration plant expansion could impact the availability of tailings storage. Mineral Reserve estimates are based on assumptions that included mining, metallurgical, infrastructure, permitting, taxation, and economic parameters. Increasing costs and taxation and lower metal prices will have a negative impact on the quantity of Mineral Reserve estimates. Other than normal course changes in metal prices, which fluctuate from time to time, there are no other known factors that may have a material impact on the Mineral Reserve estimates at Huaron.

Since 2014, the Huaron mine has been processing between 900,000 to 1,000,000 tonnes of ore annually, producing copper, lead, and zinc concentrates containing approximately 3.7 Moz of silver, 6,000 tonnes of copper, 8,500 tonnes of lead, and 18,000 tonnes of zinc. Pan American expects to process approximately one Mtpa in 2022. Engineering design for filtered-stacked tailings is currently underway to complement the existing conventional tailings facility.

Huaron is a producing mine. No expansions or specific economic analyses are currently underway.

26 RECOMMENDATIONS

The authors of this report have no further recommendations to make at this time.

27 REFERENCES

Author	Title
Long, S.D., Parker, H.M., and Françis-Bongarçon, D. 1997.	Assay quality assurance-quality control programme for drilling projects at the pre-feasibility to feasibility report level, prepared by Mineral Resources Development Inc. (MRDI), August 1997.

28 QP CERTIFICATES

CERTIFICATE of QUALIFIED PERSON

I, Martin Wafforn, Senior Vice President, Technical Services and Process Optimization of Pan American Silver Corp., 1500-625 Howe St, Vancouver, BC, V6C 2T6, Canada do hereby certify that:

1. I am the co-author of the technical report titled "Technical Report for the Huaron Property, Pasco, Peru", with an effective date of October 30, 2022 (the "Technical Report").
2. I graduated with a Bachelor of Science in Mining degree from the Camborne School of Mines in Cornwall, England in 1980. I am a Professional Engineer in good standing with The Association of Professional Engineers and Geoscientists of the Province of British Columbia. I am also a Chartered Engineer in good standing in the United Kingdom. My experience is primarily in the areas of mining engineering and I have worked as an engineer in the mining industry for a total of 40 years since my graduation from the Camborne School of Mines.
3. I have read the definition of 'qualified person' set out in National Instrument 43-101 (the "Instrument") and certify that by reason of my education, affiliation with a professional association and past relevant work experience, I fulfil the requirements of a 'qualified person' for the purposes of the Instrument.
4. I have visited the Property on October 27, 2021.
5. I am responsible for Sections 2 - 5, 15, 16, 19 - 22, 24 - 26 and 1.1, 1.7, 1.8, 1.11, 1.12, 12.2 of the Technical Report.
6. I am currently employed as the Senior Vice President, Technical Services and Process Optimization for Pan American Silver Corp., the owner of the Property, and by reason of my employment, I am not considered independent of the issuer as described in Section 1.5 of the Instrument.
7. I have had prior involvement with the Property that is the subject of the Technical Report; I am an employee of Pan American Silver Corp. and have conducted site visits to the Property, including as described in Section 2 – Introduction of the Technical Report, and most recently from October 27, 2021.
8. I have read the Instrument and Form 43-101F1, and the Technical Report has been prepared in compliance with the Instrument and that form.
9. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the Technical Report contains all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated at Vancouver, British Columbia, this 25th day of November 2022.

"signed and sealed"

Martin Wafforn, P.Eng.

CERTIFICATE of QUALIFIED PERSON

I, Christopher Emerson, Vice President, Business Development and Geology of Pan American Silver Corp., 1500-625 Howe St, Vancouver, BC, V6C 2T6, Canada do hereby certify that:

1. I am the co-author of the technical report titled "Technical Report for the Huaron Property, Pasco, Peru", with an effective date of October 30, 2022 (the "Technical Report").
2. I graduated with a Bachelor of Engineering in Industrial Geology from Camborne School of Mines, Exeter University, England, in 1998 and earned my Master of Science in Mineral Exploration from Leicester University in 2000. I am a Fellow of the Australasian Institute of Mining and Metallurgy (FAusIMM) and a Fellow of the Geological Society of London (FGS). I have worked as a geologist in both mining and exploration for the past 17 years since my graduation from Leicester University.
3. I have read the definition of 'Qualified Person' set out in National Instrument 43-101 (the "Instrument") and certify that by reason of my education, affiliation with a professional association, and past relevant work experience, I fulfil the requirements of a 'Qualified Person' for the purposes of the Instrument.
4. I have visited the Property on October 27, 2021.
5. I am responsible for Sections 6 - 11, 14, 23, 27 and 1.2, 1.3, 1.4, 1.6, 12.1 of the Technical Report.
6. I am currently employed as the Vice President, Business Development and Geology for Pan American Silver Corp., the owner of the Property, and by reason of my employment, I am not considered independent of the issuer as described in Section 1.5 of the Instrument.
7. I have had prior involvement with the Property that is the subject of the Technical Report; I am an employee of Pan American Silver Corp. and have conducted site visits to the Property, including as described in Section 2 – Introduction of the Technical Report, and most recently on October 27, 2021.
8. I have read the Instrument and Form 43-101F1, and the Technical Report has been prepared in compliance with the Instrument and that form.
9. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the Technical Report contains all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated at Vancouver, British Columbia, this 25th day of November 2022.

"signed and sealed"

Christopher Emerson, FAusIMM

CERTIFICATE of QUALIFIED PERSON

I, Americo Delgado, Vice President, Mineral Processing, Tailings and Dams of Pan American Silver Corp., 1500-625 Howe St, Vancouver, BC, V6C 2T6, Canada, do hereby certify that:

1. I am the co-author of the technical report titled "Technical Report for the Huaron Property, Pasco, Peru", with an effective date of October 30, 2022 (the "Technical Report").
2. I graduated with a Master of Science in Metallurgical and Material Engineering from the Colorado School of Mines in Golden, Colorado, in 2007, and with a Bachelor of Science in Metallurgical Engineering degree from the Universidad Nacional de Ingenieria, Lima, Peru, in 2000. I am a Professional Engineer in good standing with the Association of Professional Engineers and Geoscientists of the Province of British Columbia. My experience is primarily in the areas of metallurgy and mineral processing engineering and I have worked as a metallurgist in the mining industry for a total of 21 years since my graduation from the Universidad Nacional de Ingenieria.
3. I have read the definition of 'qualified person' set out in National Instrument 43-101 (the "Instrument") and certify that by reason of my education, affiliation with a professional association and past relevant work experience, I fulfil the requirements of a 'qualified person' for the purposes of the Instrument.
4. I have visited the Property on September 21 - 23, 2021.
5. I am responsible for Sections 13, 17, 18, and 1.5, 1.9, 1.10, 12.3 of the Technical Report.
6. I am currently employed as the Vice President, Mineral Processing, Tailings and Dams for Pan American Silver Corp., the owner of the Property, and by reason of my employment, I am not considered independent of the issuer as describe in Section 1.5 of the Instrument.
7. I have had prior involvement with the Property that is the subject of the Technical Report; I am an employee of Pan American Silver Corp. and have conducted site visits to the Property, including as described in Section 2 – Introduction of the Technical Report, and most recently from September 21 - 23, 2021.
8. I have read the Instrument and Form 43-101F1, and the Technical Report has been prepared in compliance with the Instrument and that form.
9. As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the Technical Report contains all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated at Vancouver, British Columbia, this 25th day of November 2022.

"signed and sealed"

Americo Delgado, P.Eng.