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A&B GLOBAL MINING

Exhibit 96.4

Hindustan Zinc Limited – SEC - SK 1300

Technical Summary Report

Sindesar Khurd Mines

Document Version:	**Rev1**
Customer Name:	**HZL Mine**
Date:	**20 July 2022**
Prepared by:	**ABGM**
Document Number:	**2022-07-25-SKM-SEC**

PREPARED AND REVIEWED BY:

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TITLE	NAME	SIGNATURE	DATE
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Qualified Person - Reserves	Bill Gillespie		28/07/2022
Managing Director - ABGM	Devendra Vyas		28/07/2022

Disclaimer:

This document will serve only for the Purposes of Hindustan Zinc Limited (HZL) based on information received from the mine and its respective mining operations in India namely: Rampura Agucha Mine; Rajpura Dariba; Sindesar Khurd; Kayad and the four Zawar operations – Balaria, Baroi, Mochia and Zawarmala, The data requested was complete / incomplete with assumption made for delivery. The information within this technical report is aligned to the Securities Exchange Commission (SEC), SK-1300 guidelines and the information within is to be use for this purpose only.

LIST OF ABBREVIATIONS:

%	Percentage
^{0}C	degree Celsius
ABGM	A & B Global Mining Consultants
Ag	Silver
BOQ	Bill of Quantities
CAPEX	Capital expenditure
Coeff. Of Variation	coefficient of variation
COG	Cut-off Grade
Con	Concentrate
CSD	calc-silicate dolomites
g/t	grams per ton
GMS	graphite-mica schist
GSSA	Geological Society of South Africa
HDPE	High Density Polyethylene
Hr.	Hour
HZL	Hindustan Zinc Limited
IDW^2	Inverse Distance Weighting to the power of two
INR	Indian Rupee
kA	KiloAmpere
kL	KiloLitre
km	Kilometre
kN/m^2	KiloNewton per square metre
Koz	Kilo Ounces
Kt	Kilo tonne
kV	KiloVolt
lb	Pound
LHD	Load Haul Dumper
LOM	Life-of-Mine
LOM	Life of Mine
m	metre

m^2	Squared Metre
m^3	Cubic Metre
m^3/hr	Cubic metres per hour
mRL	Mean Relative Elevation
Mt	Million tonnes
mtpa	Million tonnes per annum
OGL	Original ground level (original surface elevation)
OK	Ordinary Kriging
OPEX	Operating expenditure
oz	Ounces
Pb	Lead
PbEQ	Lead Equivalent
PFS	Preliminary Feasibility Study
QA	Quality Assurance
QC	Quality Control
RAM	Rampura Agucha Mine
RAUG	Rampura-Agucha underground
RDM	Rajpura Dariba Mines
ROM	Run-of-Mine (ore/rock of economic value containing the target mineral(s)
ROM	Run of Mine
RPEEE	reasonable prospects of eventual economic extraction
SACNASP	South African Council for Natural Scientific professions
SEC	Securities Exchange Commission
SKM	Sindesar Khurd
Std Dev	standard deviation
t	tonnes
TRS	Technical Review
USD	Us Dollar
USD/g	US Dollar per gram
USD/pb	US Dollar per pound
USD/t	US Dollar per tonne

VDS/PDS	Vehicle Detection System / Personnel Detection System
ZAW	Zawar Complex
Zn	Zinc
ZnEQ	Zinc Equivalent

Glossary of Terms

Block model: This is the cubical representation in 3 dimensions of the mineral resource. The block model data is usually constructed using industry accepted geological software packages.

Concentrating: The process of separating milled ore into a waste stream (tailings) and a valuable mineral stream (concentrate) by flotation.

Orebody: A well-defined mineralised rock mass that can be defined or modelled based upon its distinct mineral content or associated rock type/lithology.

Run of Mine (ROM): A loose term used to describe ore produced from the mine available for processing.

Tailings: That portion of the ore from which most of the valuable material has been removed by concentrating and that is therefore low in value and rejected.

Tonne: Metric ton, equal to 1 000kg, unless otherwise defined.

Finance

Capital expenditure (CAPEX): Total capital expenditure on mining and non-mining property, plant, equipment, and capital work-in-progress.

Effective tax rate: Current taxation, deferred taxation, and tax normalization as a percentage of profit before taxation.

IRR: Internal Rate of Return (the discount rate at which the project “NPV” becomes zero).

NPV: Nett Present Value (cash flow of the project discounted to current day value – includes project OPEX and CAPEX).

Operating expenditure (OPEX): Total operating expenditure for mining and non-mining functions pertaining to the project.

Definitions:

The following Definition apply to this report and are aligned to meanings ascribed in terms of internationally recognized institutions and standards namely the Canadian CIM Definition Standards for Mineral Resources and Mineral Reserves (CIM) . The Australian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC). The South African Code for Reporting of Exploration Results, Mineral Resources and Mineral Reserves (SAMREC)

Mineral Resources:

A **'Mineral Resource'** is a concentration or occurrence of material of intrinsic economic interest in or on the earth's crust in such form, quality and quantity that there are reasonable prospects for eventual economic extraction. Mineral Resources are further sub-divided, in order of increasing geological confidence, into inferred, indicated and measured as categories.

Inferred Mineral Resource is the part of a mineral resource for which quantity, grade (or quality) and mineral content can be estimated with a low level of confidence. It is inferred from geological evidence and assumed but not verified geological or grade continuity. It is based on information gathered through appropriate techniques from locations such as outcrops, trenches, pits, workings and drill holes which may be of limited or uncertain quality and it is also reliability.

Indicated resources are simply economic mineral occurrences that have been sampled (from locations such as outcrops, trenches, pits and drill holes) to a point where an estimate has been made, at a reasonable level of confidence, of their contained metal, grade, tonnage, shape, densities, physical characteristics.

Measured resources are indicated resources that have undergone enough further sampling that a 'competent person' (defined by the norms of the relevant mining code; usually a geologist) has declared them to be an acceptable estimate, at a high degree of confidence, of the grade (or quality), quantity, shape, densities, physical characteristics of the mineral occurrence.

<u>Mineral Reserves</u>

Mineral Reserve is the economically mineable part of a Measured Mineral Resource and/or Indicated Mineral Resource. Mineral Reserves are subdivided in order of increasing confidence into **Probable Mineral Reserves** or **Proved Mineral Reserves**.

Probable Mineral Reserve is the economically mineable part of an Indicated Mineral Resource, and in some circumstances, a **Measured Mineral Resources**. It includes diluting material and allowances for losses which may occur when the material is mined. A Probable Mineral Reserve has a lower level of confidence than a Proved Mineral Reserve but is of sufficient quality to serve as the basis for decision on the development of deposit.

Proved Mineral Reserve is the economically mineable part of a **Measured Mineral Resource**. It includes diluting materials and allowances for losses which occur when the material is mined.

Proved Mineral Reserve represents the highest confidence category of Mineral Reserve estimate. It implies a high degree of confidence in the geological factors and a high degree of confidence in the Modifying Factors. The style of mineralization or other factors could mean that Proved Mineral Reserves are not achievable in some deposits.

Generally the **conversion** of Mineral Resources into Mineral Reserves requires the application of various Modifying Factors, including, but not restricted to:

- mining factors;
- mineral processing / ore dressing related factors;
- metallurgical factors;
- infrastructure factors;
- economic factors;
- marketing factors;

- legal factors;
- ESG factors: Environmental, Social (including Health and Safety) and Governance

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF GRAPHS

No table of figures entries found.

1 EXECUTIVE SUMMARY

1.1 Property summary and ownership

The Sindesar Khurd Lead Zinc Mine is located 6 km NNE of Rajpura Dariba Mines (RDM) in Railmagra Tehsil of Dist. Rajsamand (Rajasthan). The deposit forms a part of Rajpura-Dariba Bethumni metallogenic belt. The nearest railway station is Fatehnagar, about 25 km, on Chittorgarh-Udaipur broad gauge line. The deposit is approachable from Rajpura Dariba Mine by a metalled road. It lies between Latitudes 24°59’N - 25°01’N and Longitudes 74°09’E - 74°10’E on Survey of India topo sheet No. 45L/1 and 45K/4.

Mining lease was granted on 11.06.1998 and registered on 20.03.1999 for a period of 30 years which got extended for additional 20 years by Government of Rajasthan under the amendment of section 8A of MMDR 1957 on letter vide no. M.E.-II/Raj/CC-Major/ML-7/1995/5308 dated 26.11.2015 i.e. up to 19.03.2049. The total granted lease hold are 199.8425 ha. and no forest area falls within the lease hold.

1.2 Mineral Resource Statement

The Mineral Resources described in this Item are based on appropriate geoscientific information, economic and technical parameters, and grade and tonnage estimation processes. The Mineral Resource estimates were determined using ordinary kriging (OK) geostatistical methodology and considered sample lengths, grade capping / cutting, the spatial distribution of drill holes and the quality assurance and quality control results for the analytical sample grades determined. Geological modelling and grade estimation used Datamine software.

The Mineral Resources exclusive of the Mineral Reserves as at the end of the last fiscal year are summarised in Table 1, whilst Table 2 summarises the same period where the Mineral Resources are inclusive of the Mineral Reserves.

The Mineral Resources are reported at a ZnEQ COG of:

- SKM: 2.58%
- SKA1: 2.65%
- SKA2: 3.09%
- SKA6: 2.78%
- SKA4, SKA5, SKA7, SKA17, and SKA21: 2.65%
- SKA8: 2.68%
- SKA11: 2.83%.

Table 1: Mineral Resource Statement (exclusive of Mineral Reserves) – 31 March 2022

Classification	Tonnage	Grade			Metal Content		
	(Mt)	Zn (%)	Pb (%)	Ag (g/t)	Zn (Kt)	Pb (Kt)	Ag (Koz)
Measured	29.9	4.30	2.60	134	1,295	769	129,205
Indicated	13.9	3.30	1.50	62	462	201	27,508
Measured + Indicated	**43.8**	**4.00**	**2.20**	**111**	**1,757**	**970**	**156,713**
Inferred	15.5	3.40	1.90	96	530	292	47,759
Total	**59.3**	**3.90**	**2.10**	**107**	**2,287**	**1,261**	**204,472**

The Measured Mineral Resources as a proportion of the total Inclusive Mineral Resource as of 31 March 2022 accounts for ~51% of the tonnes, the Indicated Mineral Resources is ~33%, and the Inferred at ~16%.

Table 2: Mineral Resource Statement (inclusive of Mineral Reserves) – 31 March 2022

Classification	Tonnage	Grade			Metal Content		
	(Mt)	Zn (%)	Pb (%)	Ag (g/t)	Zn (Kt)	Pb (Kt)	Ag (Koz)
Measured	49.9	4.20	2.70	139	2,101	1,336	223,662
Indicated	32.6	3.40	1.80	85	1,121	587	89,106
Measured + Indicated	**82.6**	**3.90**	**2.30**	**118**	**3,222**	**1,923**	**312,768**
Inferred	15.5	3.40	1.90	96	530	292	47,759
Total	**98.1**	**3.80**	**2.30**	**114**	**3,752**	**2,214**	**360,527**

1.3 Mineral Reserve Statement

The HZL mine operations and technical teams engage on annual industry statutory evaluation and conduct standard works that is applied across all the mine operation from the geology resource estimations to applying the mine designs and evaluating the potential Mineral Reserves. The HZL Resources and Reserves technical team has kept extensive data that is used annually to do the statutory mineral reserves statements and calculations that is audited and supervised by reputable consultant houses. Each mine undergoes individual assessments and apply the modifying factors, grade cut-off calculation and assumptions.

The Ore Reserve estimate for SKM is based on a fully engineered stope and development design. There is an opportunity to increase the Ore Reserve estimate for next year by extending the same level of engineering design to the limit of the Measured and Indicated Mineral Resource. A suitable LoM schedule needs to be linked to the mine design and used to support the projections for production and ensure that the mine can continue to meet the high production rates that it has realised and notably the current plant capacity of 6.3 Mtpa.

ABGM collated the data and reviewed the mine designs, input parameters and mine design criteria for the mine operation. A comprehensive analysis and relevant input parameters is applied to the Mineral Resource to develop the Mineral Reserves.

The Mineral Reserve statement (March 2022) suggests SKM has 45.4 Mt at 3.0 g/t Zinc, 2.0% Lead and 100 g/t Silver within the minable Ore Reserve.

Table 3: Mineral Reserves Estimates (2022)

Ore Reserve summary							
Ore Reserve	Tonnage (Mt)	Grade (Zn %)	(Pb %)	(Ag g/t)	Metal (Zn kt)	(Pb kt)	(Ag koz)
Proved	21.4	3.3	2.4	125	701	511	86,001
Probable	24.0	2.8	1.6	78	674	378	59,994
Ore Reserves (Total)	45.4	3.0	2.0	100	1,376	889	145,995

1.4 Geology and Mineralization

The Sindesar Khurd Mine is in the central part of the eastern limb of the major Dariba-Bethumni synformal fold. The deposit consists of multiple horizons, up to 50 m thick, with a complex folded geometry and internal grade distribution due to intercalation of higher-grade dolomite-hosted ore and low-grade mineralisation in mica schists, in addition to discrete narrow 'minor' lenses. The mineralisation has been traced over almost 2 km along strike and 1 km vertical extension. In the mine area of the main deposit, the dip is steep towards the west, which rotates into an easterly direction in the lower-southern part of the deposit. The current "mine block" extends over 1200 m along strike and up to 500 m depth extension.

The main orebody exhibits a higher lead/zinc ratio in comparison with the other HZL deposits, higher silver (approximately 150g/t Ag on average, although the extension areas exhibit higher grades in the region of 250g/t Ag) and higher pyrrhotite content than the Rajpura Dariba deposit. The grade continuity is more variable than that exhibited at Rajpura Dariba and exhibits a locally highly complex folded structure with highly variable grades.

Mineralisation exhibits lithological, stratigraphic and structural controls and occurs in the form of fracture-filling veins, stringers and disseminations forming tabular to lenticular ore bodies. The mineralisation is a highly folded and faulted strata-bound (in metamorphosed dolomite) sulphide assemblage. The main economic base metal minerals at SK Mine are sphalerite and galena with a relatively high level of pyrrhotite indicated (12% Fe as pyrrhotite). Two ore types are identified: dolomite hosted (CSD), which constitutes the majority of the ore feed (90%); and graphite mica schist (GMS).

1.5 Metallurgical Testing

The HZL has a network of operations across India and SKM is currently an operating mine with a working CPP with many years of operations behind them. The mineral processing is well understood and there is no need to conduct any additional metallurgical test work at the current operations.

1.6 Mine Design, Optimizations and Scheduling

The mine has 13 openings with two ramps, 9 ventilation-raises, one shaft & an incline. North Ramp & South Ramp (5.5m x 5.0m, 1 in 7 gradient) are suitable for deploying 30t/50t/60t/63t/65t mine trucks & 7t/10t/17t/21t LHDs, North Ventilation Raise & South Ventilation Raises (SVR-2 & SVR-3) are equipped with 200 cum/sec and 233 cum/sec respectively as main exhaust fans and Central Ventilation Raise is equipped with exhaust fan of 100 cum/sec. SKA2 area is being ventilated through a 630kW fan with capacity of 150 m3/ sec.

The mine is scheduled to produce 5.6mtpa in 2022 and will increase to 7.0mtpa in the next two years and remain there till 2029 as per the reserves available at this stage. No documents suggest that there is any optimisations being conducted at this stage. The mine seems to be operating successfully and financial evaluations suggest the mine is in very good state.

Table 4: : SKM – Schedule Summary – 2.5mtpa

Lens	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
Main Lens	3,398,000	3,724,000	4,000,000	4,000,000	4,000,000	4,400,000	3,991,790	-
SKA1	1,202,000	1,200,000	1,500,000	1,500,000	412,400	-	-	-
SKA2	279,000	-	200,000	200,000	258,800	-	-	-
SKA6	751,000	376,000	600,000	600,000	1,000,000	554,200	-	-
SKA8	-	-	-	-	328,800	545,800	255,900	-
SKA11	-	700,000	700,000	700,000	1,000,000	1,500,000	1,502,310	1,161,390
Total Tons	**5,630,000**	**6,000,000**	**7,000,000**	**7,000,000**	**7,000,000**	**7,000,000**	**5,750,000**	**1,161,390**
Zn%	3.11	3.05	3.05	3.05	3.02	3.05	3.05	2.23
Pb%	2.00	2.04	1.94	1.94	1.93	2.05	2.16	0.73
TMC%	5.11	5.09	4.99	4.99	4.95	5.10	5.22	2.96
Ag(ppm)	102	105	99	99	98	104	112	40
Developemnt & PasteFil	**2022-23**	**2023-24**	**2024-25**	**2025-26**	**2026-27**	**2027-28**	**2028-29**	**2029-30**
Development (m)	34,500	33,333	38,889	38,889	38,889	38,889	31,944	6,452
Development Ore (t)	540,480	576,000	672,000	672,000	672,000	672,000	552,000	111,493
Development Waste (t)	1,960,770	1,840,667	2,147,444	2,147,444	2,147,444	2,147,444	1,763,972	356,289
Production Drilling (m)	663,000	666,667	777,778	777,778	777,778	777,778	638,889	129,043
Pastefilling (cu.m)	1,980,000	1,980,000	1,980,000	1,980,000	1,980,000	1,980,000	1,952,563	1,611,622

1.7 Mineral Processing

Existing beneficiation capacity at Sindesar Khurd Lead Zinc Mine is 6.5mtpa with Plant-1 having capacity of 3.0 mtpa, Plant-2 and capacity of 2.0 mtpa. A new beneficiation plant with a 1.5mtpa capacity with similar specifications the existing 2mtpa plant was commissioned in FY 2018-19 which brings the capacity to 6.5mtpa. Surplus ROM is sent to the RDM plant for processing that cannot be put through the SKM plants.

The ROM ore from the mine is being dumped into primary crusher. After primary crushing, the ore is being stacked at coarse ore stockpile.

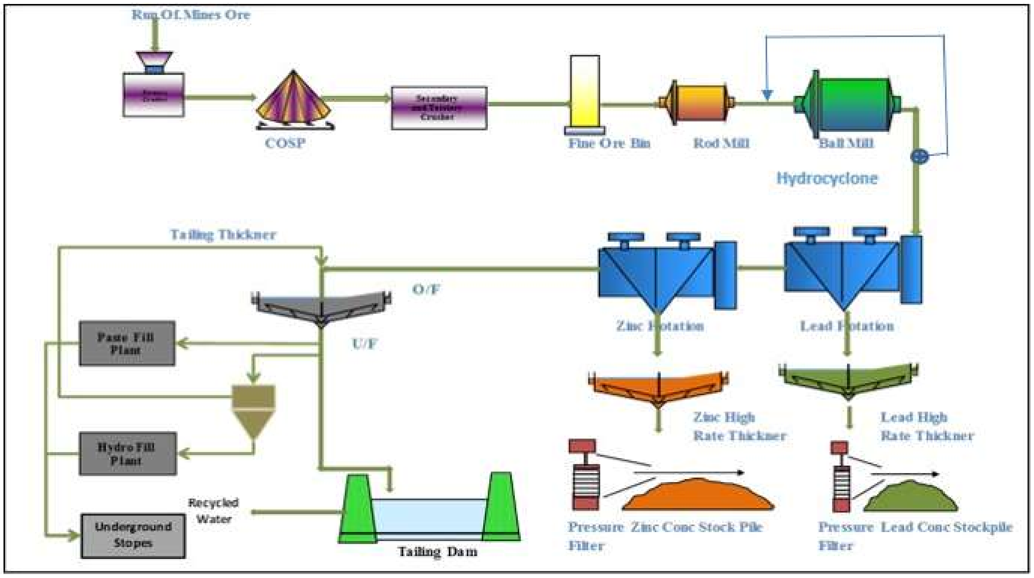

Figure 1: Mill Flow Sheet

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1.8 Environmental, Permitting and Community Impact

Environment clearance was granted for 6.0million tpa ore production and 6.5million tpa beneficiation (including treatment of 0.5million tpa ore from other mines) by MoEF&CC vide letter no. J-11015/7/2017-IA.II (M) dated 31-05-2018. CTO for 6 million tpa ore production was granted by RSPCB vide letter no. F(Mines)/Rajsamand(Railmagra)/1715/2017-2018/6402-6406 dated 30-01-2019. Water withdrawal permission from Matrikundia Dam. Certificate of non-involvement of national park, sanctuary, Biosphere reserve, wild life corridor, tiger/elephant reserve in core and buffer zone was granted by vide letter no. dated 22-09-2017.

SKM is doing sufficient work around the environmental assessments and are continuously monitoring all vital statutory aspects required. There is various sites and locations where site monitoring is conducted in regard to the following main elements:

- Land Use
- Water Quality and Management
- Air Quality
- Noise Pollution
- Soil Monitoring
- Tailing disposal

The mine is also engaging with the local communities to ensure alignment with EIA requirements overall. The mine is also planning, reviewing, and executing the annual mine closure plan as required by IBM.

1.9 Capital Costs, Operating Costs and Financial Analysis

As this is an operating mine, HZL provided their operational estimates for the mine operations to develop financial sensitivities.

The operating costs for SKM is indicated in this document and financial sensitives indicate that SKM is not very sensitive to economic parameters at plus and minus 20%

	20%	10%	100%	-10%	-20%
Cashflow	4,203	3,853	3,503	3,152	2,802
Cost	438	479	521	562	603
Revenue	4,828	4,426	4,023	3,621	3,219

Figure 2: SKM Financial Sensitivity Analysis (unit: Million US $)

2 Introduction

2.1 Terms of Reference and Purpose of the Report

A&B Global Mining (ABGM) was commissioned by Hindustan Zinc Limited (HZL) to prepare a review on the Mineral Resources and Ore Reserves – 31 March 2022 Statement, for the following mine operations that are operated by HZL namely:

- Rampura Agucha (RAM)
- Kayad (KDM)
- Sindesar Khurd (SKM)
- Rajpura Dariba (RDM)
- Zawar Mines (ZAW)

This report is a Technical Report Summary (TRS) which summarizes the findings of the review in accordance with Securities Exchange Commission Part 229 Standard Instructions for Filing Forms Regulation S-K subpart 1300 (S-K 1300).

The purpose of this TRS is to report the review of Resource and Reserve Estimates as stated in their Draft document dated 31 March 2022, and to review the data & information received from HZL that will potentially be included in the 2022 Resource and reserve Statement Technical report. The effective date of this report is 29 July 2022.

The quality of information, conclusions, and estimates contained herein is based on the data and information received from HZL and is consistent with the level of effort involved in ABGM's services, based on:

i. information available at the time of preparation,
ii. data supplied by the client, and
iii. the assumptions, conditions, and qualifications set forth in this report.
iv. The time available to complete this review

Any opinions, analysis, evaluations, or recommendations issued by ABGM under this report are for the sole use and benefit of HZL. Because there are no intended third-party beneficiaries, ABGM (and its affiliates) shall have no liability whatsoever to any third parties for any defect, deficiency, error, omission in any statement contained in or in any way related to its deliverables provided under this Report.

2.2 Sources of Information

The information, opinions, conclusions, and estimates presented in this report are based on the following:

- Information and technical data provided by HZL
- Review and assessment of previous investigations
- Assumptions, conditions, and qualifications as set forth in the report
- Review and assessment of data, reports, and conclusions from other consulting organizations and previous property owners.

These sources of information are presented throughout this report and in the References section. The qualified persons are unaware of any material technical data other than that presented by HZL.

ABGM and their associates received a database of information of the HZL operations between 30 June 2022 and 25 July 2022 and reviewed the documents, datasets and information to consolidated into the document presented as of date 29 July 2022.

2.3 List of source materials

HZL provided AGBM with access to a data room housed in EthosData. Here HZL delivered the required documentation and design data from the modelling to the string. Point and wireframes used in the development of the resources model estimates and the reserve estimates.

Figure 3: File Structure and extraction source of data

2.4 Qualified Persons and Details of Inspection

A comprehensive site visit was conducted in the week of 17 July to 25 July 2022. The objectives of the site visits was to conduct the following:

- Physical verification of the mining operations and onsite infrastructure.
- Obtain outstanding information required to complete the technical report.
- Interact with the mine technical team to obtain further clarifications.

Three consultants from ABGM attended the site visits at the various mines.

- **Devendra Vyas:** Managing Director and Principal Mining Engineer
- **Andre van der Merwe:** General Manager and Principal Consultant (Geophysics, Hydrogeology, Geology, Mineral Processing and Environmental Engineering)
- **Pieter Groenewald:** Head – Technical Services and Principal Consultant (Rock Engineering and Hydrogeology)

2.5 Previous Reports on the Project

This is the only SEC -S-K 1300 TRS, A&B Global Mining (ABGM) has submitted for the Hindustan Zinc Limited (HZL) and authors are not aware of any other TRS submitted by prior owners of the project. This is the first TRS A&B Global Mining) ABGM has submitted for the Hindustan Zinc Limited (HZL) and authors are not aware of any other TRS submitted by prior owners of the project. State any other reports that may have been submitted

3 Property Description and Locations

3.1 Property Location

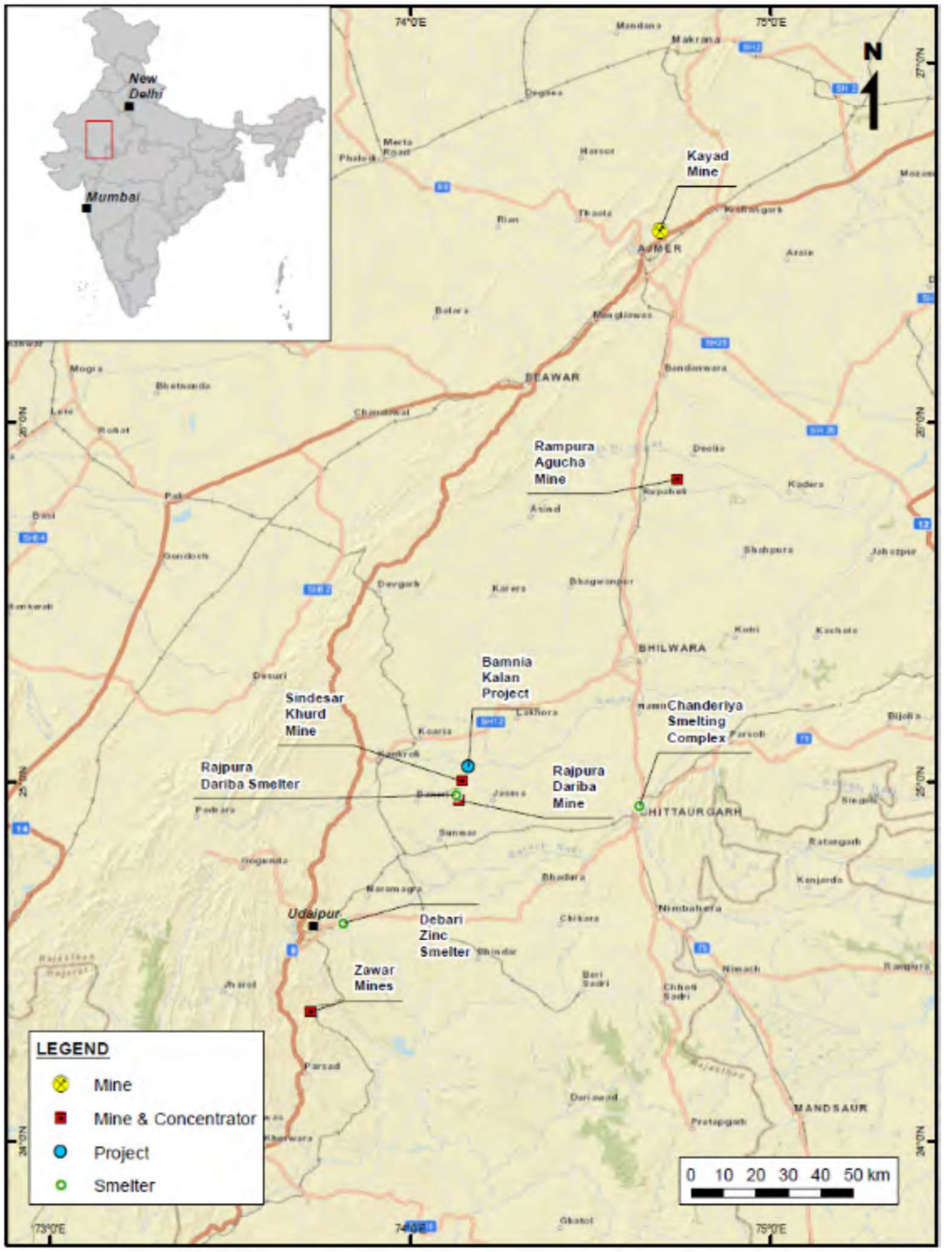

Figure 4: HZL Mine Locations

The Sindesar Khurd mine ("SKM") is located in the Dariba-Bethumni Mineral Belt, together with the Rajpura Dariba mine.

The SKM is situated approximately 65 km NE of Udaipur in the Rajasthan Province of India in the district of Rajsamand. The Sindesar Khurd deposit extends over a lease area of 199.8425 ha. The Mining Lease is demarcated on part plan of Survey of India Topo sheets No. 45/L1 and 45K/4. It lies between Latitudes 24°59’N-25°01’N and Longitudes: 74°09” E-74°10’E on Survey of India topo sheet No. 45/L1 and 45K/4.

3.2 Mineral Titles, Claim Rights, Leases and Options

3.2.1 Lease agreements – Details

Lease Details	(Existing Mine)
Name of Mine	Sindesar Khurd Lead-Zinc Mine
Lat / Long of any boundary point :	Boundary point A: Lat 24˚59’32.47” and Long 74˚08’23.22”
Date of grant of lease :	11.06.1998
Period / Expiry Date :	19.03.2049 as per section 8A (5) of MMDR (Amendment) Act, 2015

3.2.2 Lease agreements – Area

Forest		Non-Forest	
Forest (Specify)	**Area (ha)**	**Non-Forest**	**Area (ha)**
Nil		Waste Land	148.85
		Grazing Land	6.5
		Agriculture Land	39
		Others (Settlement)	5.5

3.2.3 Lease agreements – District

District & State	Rajsamand, Rajasthan
Taluka / Tehsil (Administration Area)	Relmagra
Village	Dariba
Whether the area falls under Coastal Regulation Zone (CRZ)	Not Applicable

3.3 Environmental Impacts, Permitting, Other Significant Factors and Risks

3.3.1 Commitments

No major commitments other than continuous Ambient Air Monitoring. Ambient Air Quality Monitoring (AAQM) stations were set up at Fourteen locations with due considerations to above mentioned points.

3.3.2 Security bonds

Bank Guarantee for degraded land has been submitted and reclamation plan submitted to IBM. The total breakup of land calculated for financial assurance of around 359.23 hectares. Bank guarantee for the same shall be INR 10,80,00,000.

Table 5: Summary of the Security Bonds

Area put in use	Rate/Ha (Rs.)	Bank Guarantee Amount (Rs.)
359.23	3,00,000	10,80,00,000

Bank Guarantee covering amount of Rs.10,87,98,000 (Ten crore, eighty-seven lakhs, nighty eight thousand only) has already been submitted.

Table 6: Details of bank guarantees for financial assurance

Date	Bank	Amount in Rs.
18-04-2020	ICICI, Udaipur	9,066,500
09-06-2020	IDBI, Udaipur	99,731,500
Total		**108,798,000**

3.4 Royalties and Agreements

3.4.1 Joint ventures

SKM is in no current joint venture with third parties or other companies.

3.4.2 Royalty agreements

Lead & Zinc Concentrates are being produced and dispatched from the lease area to the smelters which are located outside the leased area, then royalty shall be chargeable on the processed product i.e. concentrate.

The Lead and Zinc Mineral royalty is to be paid based on London Metal Exchange or London Bullion Market Association price, the royalty shall be calculated at the specified percentage of the average sale price of the metal for the month as published by the Indian Bureau of Mines, for the metal contained in the concentrate of such mineral for the month.

The Rates of royalty declared as per Mine and Mineral (Development and Regulation) Act 1957 and royalty rates are:

- The Royalty for Lead is 14.5% of London Metal Exchange lead metal price chargeable on the contained lead metal in the concentrate produced.
- The Royalty for Zinc is 10% of London Metal Exchange Zinc metal price on ad valorem basis chargeable on contained zinc metal in the concentrate produced.

4 Accessibility, Climate, Local Resources, Infrastructure and Physiography

4.1 Topography, Elevation and Vegetation

4.1.1 Topography

The topography of the area is marked by an NNE-SSW trending quartzite ridge with highest elevation of 567 m, flanked on either side by gently undulating surface with an average elevation of 500 m. The lowest level of the lease area is 494 m in the North-West region of the lease area

4.1.2 Drainage Pattern

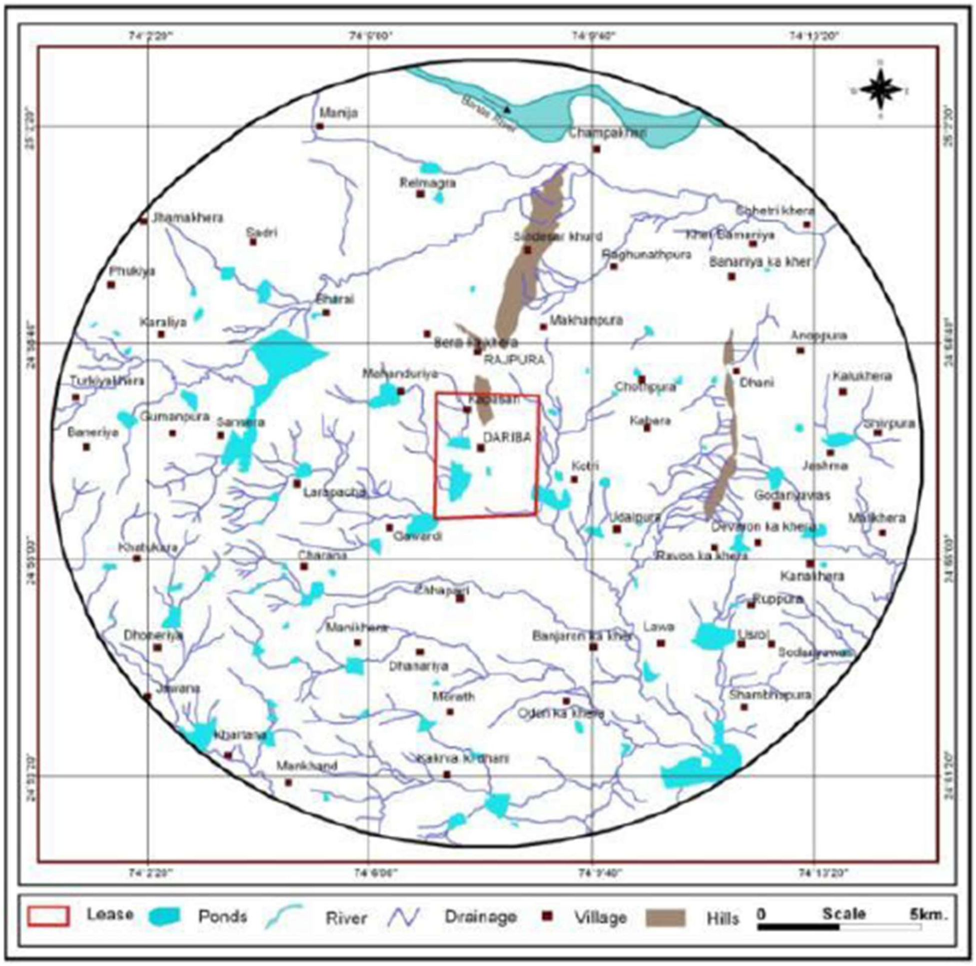

Figure 5: Drainage Map (RDM and SKM)

There is no perennial source of water such as a pond, river or stream running through the lease area. Four first order streams which originate within the lease area on the Eastern and Southern slopes of the hill continue to flow without being disturbed by the underground mining or any surface activity. The area is drained by the Banas River, an ephemeral river, which flows 3 km north of the northern boundary of the lease area.

As underground mining is being carried out, these streams will not be affected and will continue to flow undisturbed by the mining. So, no diversion is required and there will not be any impact on the surface drainage system and surface water resources of the lease area and on any existing users. The drainage pattern of the lease area is shown and the Digital Elevation Model of its buffer zone shows the elevation of hill and drainage pattern. Radius of influence is 200m, there is only one well within radius of influence which shows negligible impact on water level.

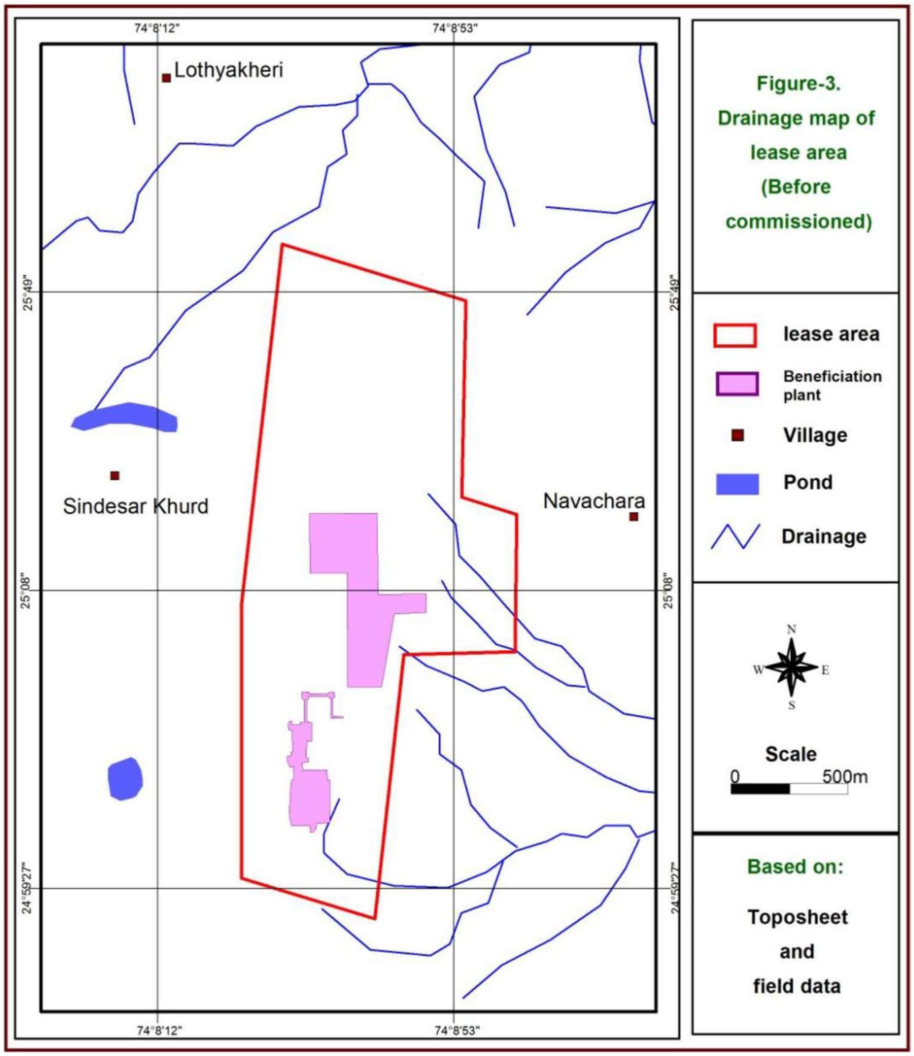

Figure 6: Drainage Map SKM

4.1.3 Vegetation

Natural vegetation is represented by small natural shrubs and herbs such as Calatropis procera, Tridex procumbens, Solanum nigerum, Euphorbia hirta, Indigofera cordifolia, Parthenium hysterophorum and Sida acuta. The naturally occurring tree species are Butea monosperma and Prosopis juliflora. As part of the green belt development plan many individuals of Dalbergia sisso, Cassia siamea, Azadirachta indica and Leucaena leucocephala have been planted. Plantation has been raised using drip irrigation as a part of water conservation measures.

4.2 Accessibility and Transportation to the Property

The nearest railway station and road is Fatehnagar, about 25 km, on Chittorgarh-Udaipur broad gauge line. The deposit is approachable from Rajpura Dariba Mine by a metalled road.

General access to the Sindesar Khurd area is poor with vehicles having to pass through small villages and on poor and narrow roads. It was reported that in the long term a rail line from the SK Mine and the Dariba complex is being considered and this will also assist with the movement of concentrates and metals in addition to handling engineering and plant consumable supplies.

- Nearest Airport- Maharana Pratap Airport (~50 km aerial distance towards SW) from mine lease boundary.
- Nearest Railway Station – Bhupas Sagar Railway Station (10 km aerial distance towards South South-east), Fatehnagar Railway Station (~15 km aerial distance towards SSW) from mine lease boundary.
- Nearest Highway - NH-162A- at a distance of 4.5 km aerial distance towards West and SH-9 (Udaipur-Cittorgarh via Mavli) at a distance of 10 km aerial distance towards south from mine lease boundary.

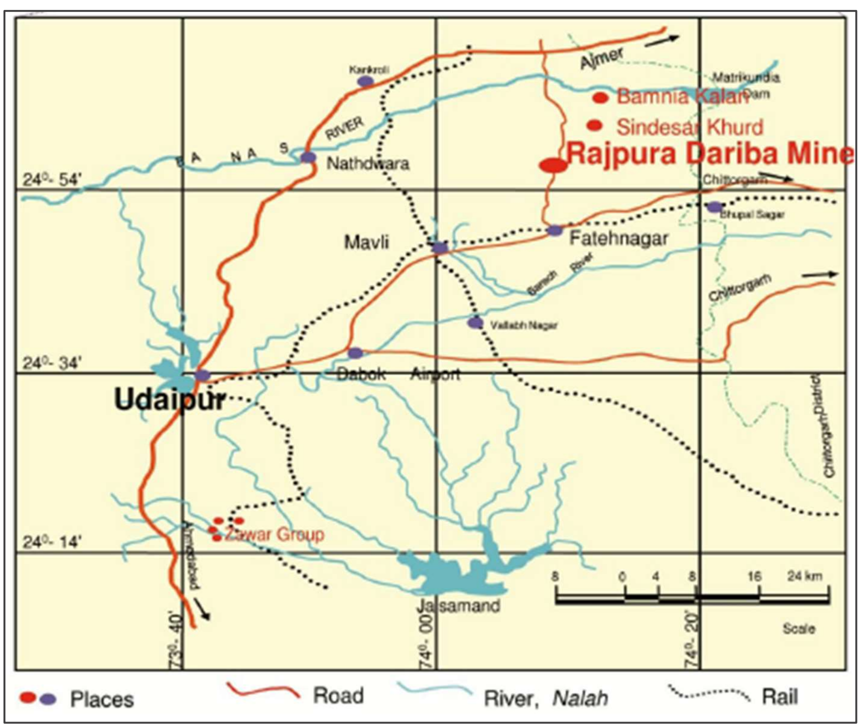

Figure 7: Location of the SK Mine

4.3 Climate and Length of Operating Season

4.3.1 Climate and Meteorology

The climate of the Sindesar Khurd Mine area is a semi-arid type, where seasons can be classified as: summer season from March to May; monsoon season from June to September; post monsoon season from October to December; and winter season from January to February.

During the monitoring period the temperature varied from 20.7 to 48.3^{0}C. The relative humidity during the monitoring season varied from to 3.2 % to 83%. The wind speed observed during the monitoring period varied from 0.0 to 19.0 m/s with an average of 3.1 m/s.

The 24-hourly maximum rainfall observed during the monitoring period was 2.8 mm. The predominant wind direction during the monitoring period was from SSW. Approximately 6.72% of the winds were recorded to be calm. During daytime, the predominant wind direction was from WSW and W, the calm period was recorded as 4.71%. During night-time the predominant direction was from W followed by WSW and WNW. The calm period was recorded as 9.09%.

4.3.2 Rainfall Data

As with the neighbouring RDM, the average rainfall is approximately 800 mm/a, most of which is in the summer period from June to September.

4.4 Infrastructure Availability and Sources

Workshops: At Sindesar Khurd mine, two major HEMM workshops exist where maintenance of major mining equipment like LHD, LPDT, drill jumbos etc. is carried out. Workshops are equipped with Automatic washing systems for LPDT and LHD. Mechanised bay lubrication system, high capacity EOT cranes, hydraulic press for tyre assembly and dismantling, under-chassis washing system and Nitrogen filling system. One Mechanical workshop exists for beneficiation plant which is equipped with all mechanical equipment for all type of fabrication work.

First Aid Centre: First Aid centre is establish at mine Security Gate Building with all first aid facilities. Emergency ambulance facility is available at security gate for 24X7 services.

Vocational Training centre: Initial and Refresher Vocational training facility is established near Rajpura Dariba Mine premises to cater vocational training requirement of both mines. Rescue and Recovery Room has been established in VT centre in the year 2015.

Substations & Diesel Generator Set: The power is supplied by AVVNL & Captive power plant through grid and distributed to mine via sub-station located at Dariba Smelting Complex. In case of any power shortage or failure the captive stand by DG sets at RD mine will provide power and additional DG sets will be installed at SKM. The present power requirement is around 40MW and will be increased to around 46MW for the extended capacity.

Central Store: The Inventory of spares and consumables for mine and mill requirement is maintained at the central store located in mine premises. The used oil and lubricants drums are kept at designated yard near store and dispatched to scrap dealers regularly. Used Oil and Lubricants are returned to central store where it is preserved in designated yard and sold to scrap dealers quarterly or half yearly.

Water Supply: Water supply is being made from Sewage Treatment Plant, Udaipur & Matrikundia dam (Rajsamand) through pipe line. Water is stored in surface pond of 20000 Cum capacity. Fuel Station: At site there exist 2 licensed diesel pumps of 20kL capacity each. The diesel pumps are electronic with RFID tag system that senses the equipment and activates the diesel pump. It reads the diesel filled into the equipment and maintains the electronic log-book.

Hospital: A 16 bed hospital fully furnished with modern therapeutic equipment manned by specialized staff attends to the medical requirements of the employees and their families. The unit hospital is situated in township of Hindustan zinc at Dariba. A well-equipped occupational health monitoring facility with Xray, audiometry, lung function test, & blood lead level monitoring is available in the unit hospital. Initial Medical Examination, Periodical Medical Examination and regular medical checks are done in unit hospital.

5 History

5.1 Production

The Sindesar Khurd Mining lease was granted to HZL on 11.06.1998 and registered on 20.03.1999 for a period of 30 years. This was extended for additional 20 years by the Government of Rajasthan up to 19.03.2049. The total granted lease hold are 199.8425 ha. and no forest area falls within the lease hold.

The Review of the Mining Plan, along-with the Progressive Mine Closure Plan for the period FY 2018-19 to FY 2022-23 was approved by the Indian Bureau of Mines on 31-01-2018. A modified Mining Plan for the period FY 2019-20 to 2022-23 was approved by IBM on 01-08-2019.

Through regular expansion of capacity, improved mining technology and innovation, production continued to increase. The Production Table confirms this with production of 3.66 Mt in 2017 to 5.3 Mt in 2019. Production was down in 2020 and 2021 but that may be due to world market conditions.

Environment clearance was granted for 6.0 Mt/a ore production and 6.5 Mt/a beneficiation (including treatment of 0.5 Mt/a ore from other mines) by MoEF&CC on 31-05-2018.

Table 7: SKM Production 2017 - 2021

Description	Units	F2017 Actual	F2018 Actual	F2019 Actual	F2020 Actual	F2021 Actual
Ore mined	Mt	3.66	4.5	5.31	5.08	4.84
Ore processed	Mt	3.38	4.51	5.13	5.21	5.05
Zn grade	%	3.8	4.1	3.8	3.4	3.4
Pb grade	%	2	2.3	2.4	2.1	2.2
Ag grade	g/t	113	112	78	112	113
Zn recovery	%	91	90.8	90.4	91.3	91.8
Pb recovery	%	88.1	87.8	88.4	88.8	90
Ag recovery	%	89.6	90.7	90.1	89.8	91.9
Zn MIC	kt	117	162.7	174	160.1	157.3
Pb MIC	kt	60.4	83.9	108.8	95	100.1
Ag MIC	koz	10,040	13,393	11,651	15,587	15,426

5.2 Historical Exploration

Underground exploration was immediately started in the year 2000 when 7 holes were drilled for a total of 436 m. The positive results from the 327 samples motivated HZL to continue expanding the drilling, eventually drilling 408,851 m by the end of 2020.

From 2006 HZL started a surface drill program, probably to test the deeper extent of the orebodies.

The early drilling and sampling provided sufficient information for the Indian Bureau of Mines (IBM) to approve the modified mining plan for the period of 1999 – 2029. As developments occur, regular updates of the mining plan have to be approved.

A mining scheme with PMCP for the period 2013-14 to 2017-18 was approved by IBM for the lease period up to 2029, followed by a modified plan, for the lease period up to 2049. This modification of the Approved Mining Plan along with PMCP for the year 2017- 18 was approved by the IBM on 01.12.2017.

Table 8: SKM Underground Drilling

Year	no. of holes	Drilling (m)	Samples prepared	Samples assayed
2000-01	7	436	327	327
2001-02	33	2,023	1,517	1,517
2006-07	22	1,104	828	828
2007-08	38	2,243	1,682	1,682
2008-09	24	1,101	826	826
2009-10	29	1,660	1,245	1,245
2000-11	32	2,233	1,675	1,675
2000-12	65	3,638	2,729	2,729
2000-13	178	9,699	7,274	7,274
2000-14	216	13,136	9,852	9,852
2000-15	281	20,626	15,470	15,470
2000-16	507	42,283	25,292	25,292
2000-17	465	50,070	27,641	27,641
2000-18	543	78,264	33,374	33,374
2000-19	595	94,780	48,961	48,961
2000-20	601	85,555	74,560	74,560
Total	**3636**	**408,851**	**253,253**	**253,253**

Table 9: SKM Surface Drilling

Year	no. of holes	Drilling (m)	Samples prepared	Samples assayed
2000-07	33	20,035	6,493	6,493
2000-08	60	26,233	7,460	7,460
2000-09	27	18,717	9,212	9,212
2000-10	47	16,962	10,014	10,014
2000-11	20	9,264	6,672	6,672
2000-12	32	13,671	4,309	4,309
2000-13	17	6,398	3,772	3,772
2000-14	46	20,513	11,162	11,162
2000-15	73	23,971	14,184	14,184
2000-16	18	10,220	2,592	2,592
2000-17	33	16,169	3,520	3,520
2000-18	76	34,791	19,429	19,429
2000-19	26	17,044	4,555	4,555
2000-20	19	16,371	6,038	5,568
Total	**527**	**250,359**	**109,412**	**108,942**

6 Geological Setting, Mineralization and Deposit

6.1 Regional Geology

The Sindesar Khurd deposit consists of multiple horizons, up to 50 m thick, with a complex folded geometry and internal grade distribution due to intercalation of higher-grade dolomite hosted ore and low-grade mineralisation in mica schists, in addition to discrete narrow 'minor' lenses. The mineralisation has been traced over almost 2 km along strike and 1 km vertical extension. In the mine area of the main deposit, the dip is steep towards the west, which rotates into an easterly direction in the lower-southern part of the deposit. The current "mine block" extends over 1200 m along strike and up to 500 m depth extension.

The mineralisation is a highly folded and faulted strata-bound (in metamorphosed dolomite) sulphide assemblage. The mineralisation has been described as of SEDEX origin; however, the ore seems rather a carbonate-hosted remobilisation than the original SEDEX with blackshale affinity, remainders of which can be found in the stratigraphic footwall of the deposit. As well as the main deposit (SKM), which is generally dolomite hosted, higher grade and elevated in silver, there are a number of separate but important mineralised lenses, namely SKA1, SKA2, SKA4, SKA5, SKA6, SKA7, SKA8, SKA11, and SKA17. These lenses are generally hosted in mica schists, which often have higher graphite which has implications on processing.

The main orebody exhibits a higher lead/zinc ratio in comparison with the other HZL deposits, higher silver (approximately 150g/t Ag on average, although the extension areas exhibit higher grades in the region of 250g/t Ag) and higher pyrrhotite content than the Rajpura Dariba deposit. The grade continuity is more variable than that exhibited at Rajpura Dariba and exhibits a locally highly complex folded structure with highly variable grades.

Unlike the mineralisation seen at Rajpura Dariba, ore contacts are largely diffuse and additional attention to grade control is required. Underground mining at SKM started in 2005/06 and indicated higher than expected local variation of grades and geological contacts. Lead concentrates from Sindesar Khurd typically contain more than 2,200g/t Ag. Together with the higher lead/zinc ratio than in the other HZL mines, silver is a significant contributor to the net revenue.

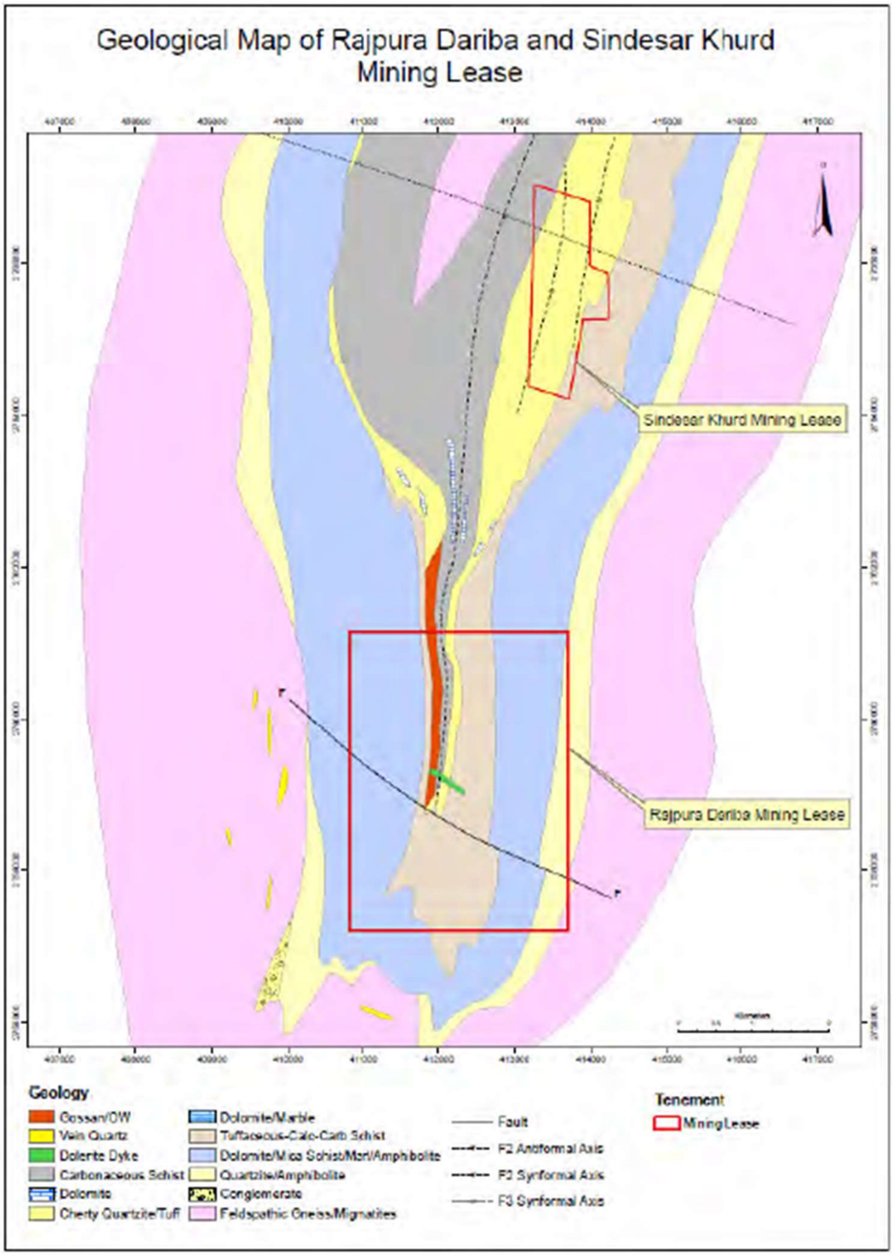

Figure 8: Property Geology Map for RDM and SKM

Table 10: SKM Stratigraphy

Era	Age	Super Group	Group/Formation	Rock Types
Quaternary	Sub-Recent to Recent	Fluvial & Colluvium	Alluvium	Sand, silt, clays, gravel, etc.
------------------- Unconformity -------------------				
Intrusives			Pegmatites, quartz veins	
	Bhilwara Supergroup	Rajpura Dariba Group	Dolomitic marble, Graphitic kyanite shists, quartzites	
Archana		Mangalwar Complex	Migmatite, gneiss, mica,schists, quartzites	
		Banded gneissic complex	Gneisses, shists, etc.	

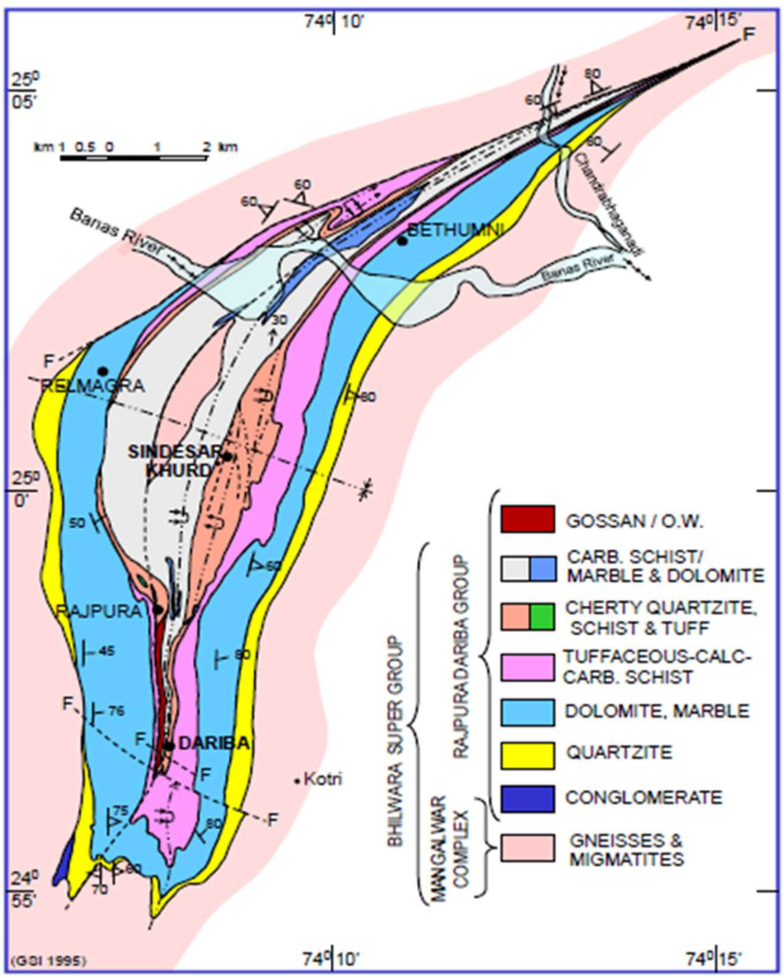

Figure 9: Regional Geology SKM

6.1.1 Property Geology

Sindesar Khurd deposit is in the central part of the eastern limb of the major Dariba-Bethumni synformal fold and the Sindesar Khurd Mine is in the central part of the eastern limb of the fold. The best exposed rock unit in the area is interbedded mica-schist / chert / quartzite and forms a prominent NNE-SSW trending ridge. This is a lenticular orebody with multiple lenses surrounding the main orebody. The economic concentrations of lead-zinc-silver mineralisation are hosted by calc-silicate bearing dolomite and graphite mica schist. The host rock is completely concealed about 100 below the surface. The economic concentrations of lead-zinc-silver mineralisation are hosted by calc-silicate bearing dolomite and graphite mica schist. The host rock is completely concealed about 100 below the above unit. The rock types of the area as follows:

- Quartz Mica Schist with bands of chert/quartzite
- Graphite Mica Schist with Fe-Pb-Zn sulphides
- Calcareous Garnet Biotite Schist with dolomite
- Calc Silicate Bearing Dolomite with Fe-Pb-Zn sulphides
- Calcareous Quartz Biotite Schist
- Basement Rock (Feldspathoid schist/gneisses)

Base metal deposits of various sizes and grades occur throughout the belt in calc-silicate bearing dolomite and graphite mica schist horizons, the latter in general containing low grade disseminated sulphides of large volumes. At the south end of the belt, contains multi-metallic sulpho-salt association.

The Sindesar Khurd deposit consists of multiple horizons, up to 50 m thick, with a complex folded geometry and internal grade distribution due to intercalation of higher-grade dolomite-hosted ore and low-grade mineralisation in mica schists, in addition to discrete narrow 'minor' lenses. The mineralisation has been traced over almost 2 km along strike and 1 km vertical extension. In the mine area of the main deposit, the dip is steep towards the west, which rotates into an easterly direction in the lower-southern part of the deposit. The current "mine block" extends over 1200 m along strike and up to 500 m depth extension.

The main orebody exhibits a higher lead/zinc ratio in comparison with the other HZL deposits, higher silver (approximately 150g/t Ag on average, although the extension areas exhibit higher grades in the region of 250g/t Ag) and higher pyrrhotite content than the Rajpura Dariba deposit. The grade continuity is more variable than that exhibited at Rajpura Dariba and exhibits a locally highly complex folded structure with highly variable grades.

Figure 10: SKM Orebodies

6.1.2 Deposit type

The mineralisation forms the western limb of a concealed NNE-SSW trending broad, open and asymmetric antiformal fold with sub-horizontal to gently northerly plunging fold axis. This is a Lenticular orebody deposit with multiple lenses surrounding the main orebody. The upper limit of mineralisation lies at a depth of about 100m below surface. The recent exploration from surface within leasehold between 5700 – 8200N, revealed the continuity of mineralisation in the southern extension. Besides main lens, 15 auxiliary lenses have also been delineated.

The ore bodies dip westerly in the upper part (up to 200 mRL) and dip changes to steep easterly in the lower part thereafter. The ore body has been proved up to -800 mRL level. The ore body lies close to the contact of quartz mica schist envelope with dolomite/ graphite schist.

The general strike of the ore body is N10°E to N15°E while dips vary from 45° to 60° towards west and in deeper levels steep easterly. Pinching and swelling are also observed in the ore body. The thick footwall barren dolomite, occurring east of mineralisation along the strike, is sparsely mineralised. Average width of the main ore body is about 30 m and shows remarkable variation both along strike and dip. The ore body is open at a depth of 1,200 m below surface in the southern extremity of the leasehold.

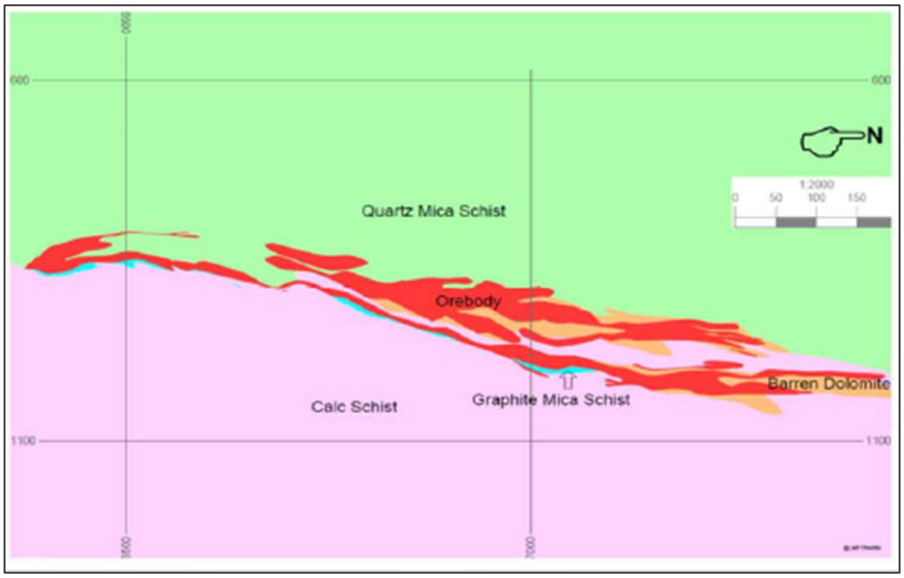

Figure 11: Typical SKM Orebody Plan

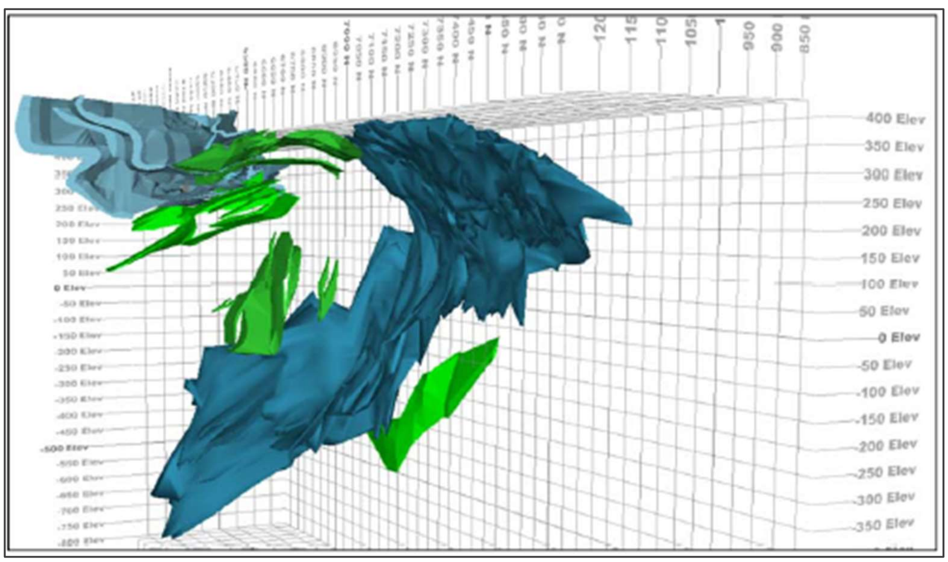

Figure 12: Mineralised Fold Hinge View

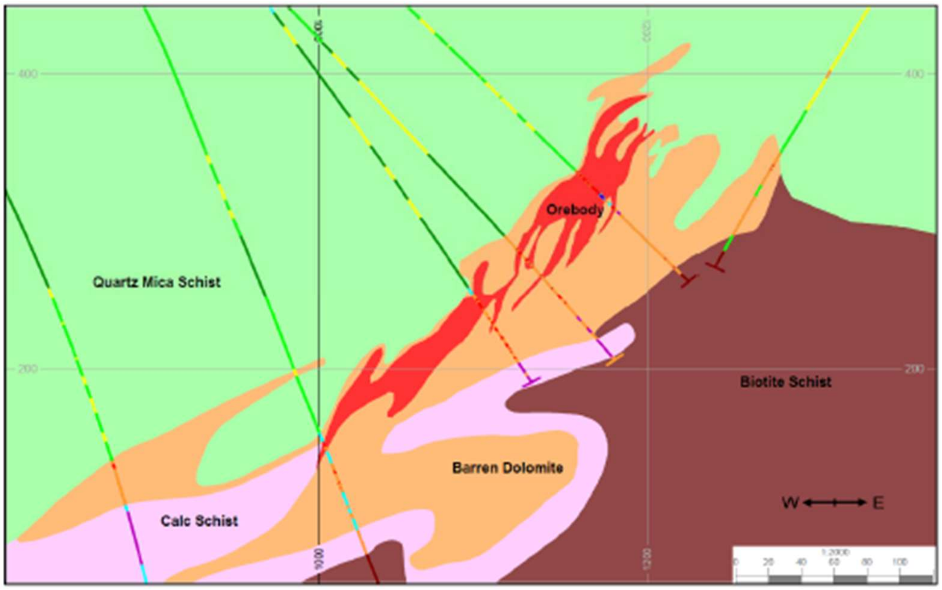

Figure 13: Typical Transverse Section - SKM

6.1.3 Mineralization

Mineralisation exhibits lithological, stratigraphic and structural controls and occurs in the form of fracture-filling veins, stringers and disseminations forming tabular to lenticular ore bodies.

The mineralisation is in a highly folded and faulted strata-bound (in metamorphosed dolomite) sulphide assemblage. The mineralisation has been described as of SEDEX origin; however, the ore seems rather a carbonate-hosted remobilisation than the original SEDEX with blackshale affinity, remainders of which can be found in the stratigraphic footwall of the deposit. In addition to the main deposit, which is generally dolomite hosted, higher grade and elevated in silver, there are a number of separate but important mineralised lenses. The other lenses are: SKA1, SKA2, SKA4, SKA5, SKA6, SKA7, SKA8, SKA11, and SKA17. These lenses are generally hosted in mica schists, which often have higher graphite which has implications on processing

The main economic base metal minerals at SK Mine are sphalerite and galena with a relatively high level of pyrrhotite indicated (12% Fe as pyrrhotite). Two ore types are identified: dolomite hosted, which constitutes the majority of the anticipated ore feed (90%); and graphite mica schist. Typical plant feed grades are 4-6% Zn and around 2-3% Pb. Forecast silver levels at SKM are relatively high, at around 100-200 g/t Ag, making silver a significant revenue contributor from the lead concentrate.

7 Exploration

The HZL complex has undergone extensive exploration since their discovery in the mid-1970's. In the past few years, exploration has been undertaken by means of diamond drilling underground for two purposes, namely grade control and extension of current mineral envelopes to deeper levels.

7.1 Summary of Exploration Activities

In general, the underground exploration drilling is undertaken during the underground mining activities On-reef drilling is carried out by the mine and constitutes the majority of the meterage drilled.

Table 11: Summary of Exploration Drill for HZL Complex (2017-2021)

Mine/Deposit	F2017		F2018		F2019		F2020		F2021		F2022*
	No. Holes	(m)	No. Holes	(m)	No. Holes	(m)	No. Holes	(m)	No. Holes	(m)	(m)
Rampura Agucha	30	10,443	64	7,056	189	27,458	246	32,124	216	30,234	53,500
Kayad	100	16,154	75	46,365	90	46,891	118	37,371	199	44,950	83,000
Rajpura Dariba	37	15,598	89	10,838	168	32,435	203	34,717	98	27,639	43,200
Sindesar Khurd	288	72,912	606	112,906	643	111,824	604	106,670	446	76,657	135,675
Zawar	280	89,550	1,268	126,413	1,292	157,666	1,062	200,032	1,165	177,029	209,700
Bamnia Kalan	-	-	5	3,615	62	28,184	52	25,682			
TOTAL	**735**	**204,657**	**2,107**	**307,193**	**2,444**	**404,458**	**2,285**	**436,596**	**2,124**	**356,509**	**525,075**

*Planned meterage for the financial year

7.2 Exploration Work

Regional exploration at SKM was first undertaken by the GSI, with a number of moderate to higher-grade, but previously uncorrelated, deep intersections known since the 1990s. Follow-up drilling by HZL started in 2005; the first hole drilled by HZL during this campaign returned an intersection of 53.7m at 15.3%Zn and 8.0%Pb (although this interval was sub-parallel to the fold axis). Following a reinterpretation of the results based on a modified geological model, along with drilling from 2007 to the present time, allowed the delineation of significant mineralisation in the down-dip / south-plunge continuation of the SKM deposit.

In total, the historical surface drilling (1979-2002) comprises some 103 boreholes totalling some 40,490m. The drilling database comprises over 3,800 drillholes for over 660 km, including over 3,300 drillholes for over 400 km underground, and over 490 drillholes for over 240 km from surface. Over 600 holes have been drilled on an annual basis for both F2020 and F2021. The drilling summary is provided in Table 12.

Table 12: Exploration Drilling Summary for SKM (2017-2021)

Year	No. Holes	(m)
2017	288	10 443
2018	606	7 056
2019	643	27 458
2020	604	32 124
2021	446	30 234
Total	**2 587**	**107 315**

7.3 Drilling Technique, Spatial Data & Logging

The central portion of the Sindesar Khurd deposit (1400 m along strike and up to 500 m vertical height) has been drilled from underground mine development. The remainder of the mineralisation interpretation has been based on surface drilled exploration holes, providing intersections at spacing of approximately 100 m along strike and 50 m down-dip.

Drill spacing in the mining blocks is now generally 25 m, with some infill drilling at 12.5 m and ranging up to 50 m. Since 2011, significant underground definition drilling has been completed; the annual quantity of which has increase substantially year on year, reflecting the relative complexity of the mining areas.

Directional drilling techniques and can drill several deflections from one master hole. Drilling is generally in NQ core diameter. During 2012-2013 drilling was outsourced to drilling partner Asian Oilfield Services Limited and was mainly conducted from hanging wall benches. Drill core appears to be of extremely high quality with excellent recovery, which is only slightly reduced in faulted/sheared areas.

Gyroscopic downhole surveys are completed using a multi-shot camera (Reflex). Surface Drill Collars are initially located on ground using GPS. Subsequently, these are tied up with Local Grid by the mine survey team using Total Station. Down-hole direction arrows are marked on every core piece by the driller. Similarly run ends and meter pegs are neatly marked and placed. Meter depth is also painted on the core just before the peg. Geologists ensure that run pegs are at the correct locations. UG mine workings are surveyed using Total Station.

Logging practices are adequate for resource estimate purposes. Almost all of the available core, particularly within 100m of the deposit extents on the hanging wall and up to the end of the holes on the footwall side, has been photographed using a digital camera. Only the most basic geotechnical parameters are collected. Geological and geotechnical logging is undertaken on a systematic basis by HZL geologists. All data is logged in hardcopy and entered in to excel before being input into the central database, which is securely stored and backed-up at the office in Udaipur.

Logging is largely qualitative. Certain semi-quantitative metrics are logged: structural data, RQD, fracture frequency and model mineral percentages. Core is well logged and interpreted by competent geologist's onsite. Limited geotechnical data was recorded.

Note: *Recommend more detailed geotechnical logging and recording of structures seeing as this deposit it part of a fold structure, which is most likely to consist of associated faulting and fracturing. Micro structures could also assist in understanding the major structures in terms of orientation and deformation intensity.*

7.4 Sample Preparation

The following sample splitting and preparation methods are employed:

- 1m length core samples in the visible mineralised zones.
- Separate samples for notably different core recoveries in two contiguous runs.
- Separate samples for visibly significant grade variations (Zn and / or Pb).
- Longitudinal split line is marked along the marked sample so as to ensure equal division of ore portion in the two halves.
- Samples are clearly labelled and there is good control of samples through the preparation and analytical process

Note: *Sample preparation is performed diligently and in line with best practices. The dispatch and sample control systems were not outlined but are deemed to be acceptable by previous audits. No clear mention of security, transport and chain of responsibility and custody, but no incidents have been reported either.*

7.5 Sample Analysis and QAQC Protocols

Samples are analysed for the following metals:

- Pb, Zn, Fe, Cd, Cu, Co, Sb, Bi, Ni and Mn

by 4-acid digest and ICPOES finish. Ag and As by aqua regia digestion followed by AAS finish.

The primary analytical laboratory, Shiva, introduces its own standards at 1 in 30 samples and repeats the analysis for our every 10th sample. Sample preparation is undertaken by accredited Shiva Analytical Pvt Ltd, Bangalore.

In accordance with the HZL's QA/QC programme consists of:

- Insertion of blank material (quartz/pegmatite) into the numbered sequence as the first sample at the beginning of the mineralization in each sample batch.
- Systematic insertion of certified reference material ("CRM")(GESTAT and OREAS) at frequency of 1 in 25. The choice of CRM is at the discretion of the logging Geologist.
- Random insertion of duplicate pulp checks, at a frequency of 1 in 10.
- Annual umpire assay in HZL's laboratory at RAM.

Previous audits has reviewed the QAQC data in detail since 2004 and notes that the performance is good.

A weight / volumetric displacement method is used to asses bulk density, which reconcile well against production data. Bulk density for each sample is measured by volumetric method using Archimedes' Principle. Where correlation s between metal and density measurements is well established, and the adequacy of measurements is sufficient, the bulk density is estimated from regression analysis.

Note: *While bulk density data has been reconciled with production data, independent bulk density analyses should be undertaken at an independent laboratory during the exploration phase to avoid errors.*

7.6 Opinion of adequacy

The QP believe that the procedures used in the sampling are adequate for mineral estimation purposes and reporting of mineral resources and reserves

8 Mineral Processing and Metallurgical Testing

The HZL has a network of operations across India and RAM is currently an operating mine with a working CPP with many years of operations behind them. The mineral processing is well understood and there is no need to conduct any metallurgical test work at the current operations.

9 Mineral Resource Estimate

9.1 Introduction

The Mineral Resources described in this Item are based on appropriate geoscientific information, economic and technical parameters, and grade and tonnage estimation processes. The Mineral Resource estimates were determined using ordinary kriging (OK) and Inverse Distance Weighting to the power of two (IDW^2) geostatistical methodologies and considered sample lengths, grade capping / cutting, the spatial distribution of drill holes and the quality assurance and quality control results for the analytical sample grades determined. Geological modelling and grade estimation used Datamine software.

9.2 Geological Models

The zinc (Zn) and lead (Pb) sulphide, and silver (Ag) mineralization at Sindesar Khurd is understood to be a stratabound carbonate-hosted remobilisation deposit type. The deposit forms part of the 17 km long Dariba-Bethumni Mineral Belt. The deposit is hosted by a sequence of mica-graphite schist and meta-carbonate of the Proterozoic Bhilwara Supergroup within an isoclinal fold and is surrounded by gneisses and migmatites of the Mangalwar Complex.

The mineralized zone has an approximate 2,000 m strike length with a northeast-southwest direction but is restricted to ~500 m in the lower portions. The dip varies is steep to the west but rotates eastwards in the lower southern portions of the deposit. . The known depth extent of the mineralized zone is approximately 1,000m vertically and between ~15 to 50 m thickness. The contacts with the above and underlying lithologies are largely diffuse.

The main deposit at Sindesar Khurd is known as SKM where two major mineralised domains have been defined, reflecting the host rock and influenced by geology, statistical and geostatistical properties; these are calc-silicate dolomites (CSD) and graphite-mica schist (GMS). These have then been sub-divided further into four CSD zones and two GMS zones.

A series of separate GMS lenses up to ~50 m thick and parallel to SKM are the SKA1, SKA2, SKA4, SKA5, SKA6, SKA7, SKA8, SKA11, SKA17 and SKA21. The lenses often have higher graphite content than SKM. The dip of SKM is steep towards the west but rotates into an easterly direction at 65° in the lower-southern part of the deposit.

The primary sulphide minerals within the main ore body are sphalerite and galena and the main sulphide gangue minerals are pyrite and pyrrhotite. The higher Pb/Zn ratio at Sindesar Khurd is higher than in the other HZL mines. Silver-bearing fahlore is present and approximately averages 150g/t Ag on average.

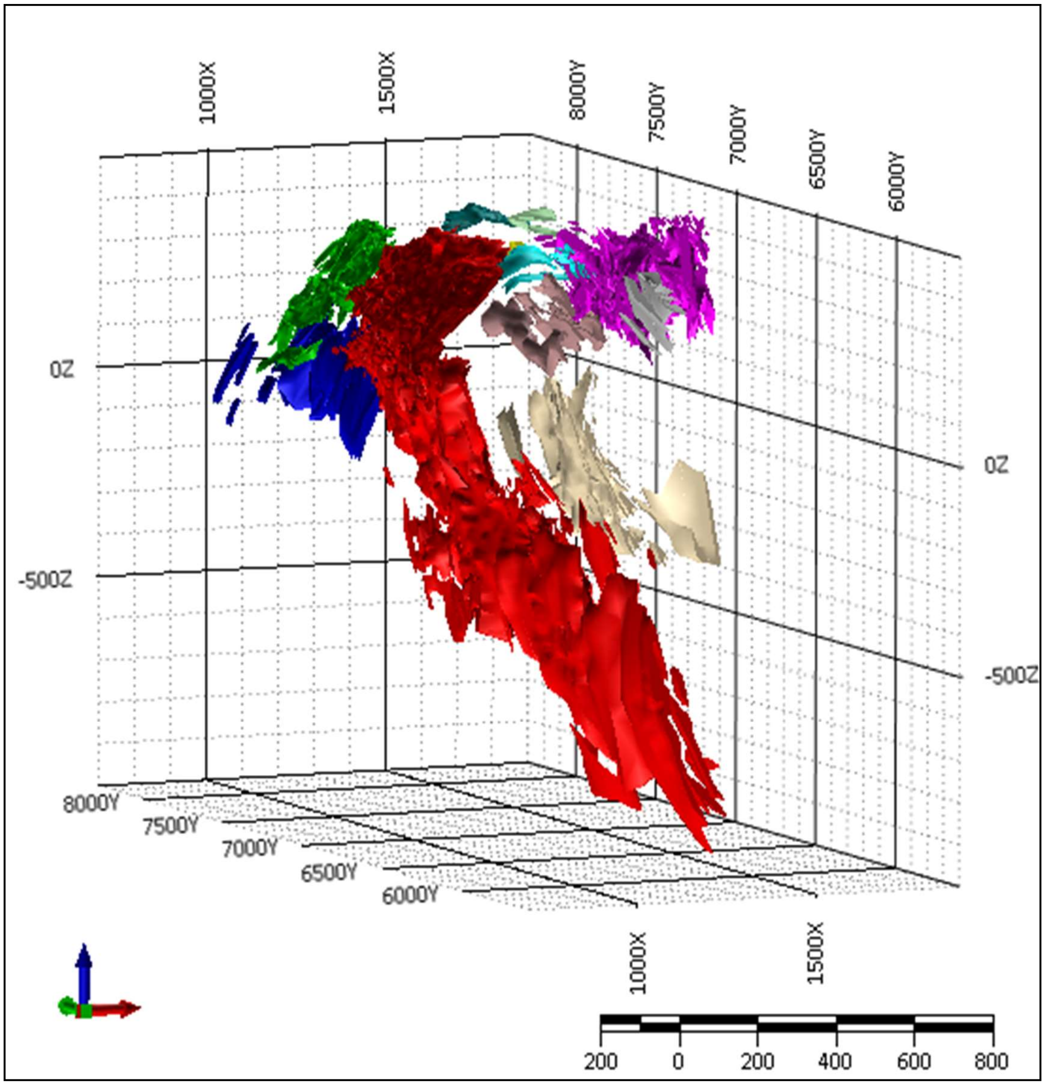

Figure 14: SKM zone and lenses for the Sindesar Khurd deposit

SKM SKA1 SKA2 SKA4 SKA5 SKA6 SKA7 SKA8 SKA11 SKA17 SKA21

9.3 Block Model Orientation and Dimensions

The wireframes were constructed using cross-sections taken across the ore body with principal sections on a 100 m spacing and infill sections at 50 m, 25 m and 12.5 m, where necessary, on a lense-wise basis. A geological cut-off of 3% Zn + Pb cut-off over a 3 m minimum thickness defined the limits of the mineralized zones.

The wireframe for SKM was filled with a block model based on a parent-block size of 5 x 12.5 x 12.5 m and 5 x 50 x 50 m dependent on data spacing (across-strike (X) / along-strike (Y) / vertical height (Z)). The individual lenses were filled with block sizes of 5 x 12.5 x 12.5 m, 5 x 50 x 50 m, 10 x 25 x 25 m, and 10 x 50 x 25 m. Appropriate sub-blocking has been used at mineralisation contacts to honour the geometry and volume.

9.4 Database

The database used for the grade estimates is based on data received from Hindustan Zinc Limited. Between 1979 and 2022, some 103 drill holes totalling ~40,490 m was drilled. Subsequently, over 4,300 drill holes were available for use in generating the wireframes, and grade and tonnage estimates. Over 475 km underground drilling and surface drill holes totalling ~ 266 km have been completed. The cut-off date for the database was the end of F2022.

The surface drill holes have an average grid spacing of 50 x 50 m and 25 x 12.5 m for underground drill holes. In several underground mining blocks the average grid spacing ranges for infill drilling is between 12. 5 m to 50 m.

ABGM has reviewed the drill hole database up to F2022 and concluded that the drill hole data is adequate for use in the Mineral Resource estimation process. The post-2015 drill holes were found to have adequate industry standard quality assurance and quality control (QAQC) quality assurance programmes and procedures which allowed for replication, precision, and accuracy of the sample grades. Historical drill hole assay results were also reviewed by ABGM who concluded that the grade results are satisfactory although short-comings were noted. The reader is directed to Item 8 for sample preparation, analytical techniques and security.

9.5 Exploratory Data Analysis

Table 1-1 summarizes the classical statistics of the sample population distributions per zone.

Table 1-1: Classical statistics of the zones

Zone	Element	Min. Value	Max. Value	No. of Points	Mean	Std Dev.
SKM	Zn (%)	0.00	51.46	62,591	4.87	4.29
SKM	Pb (%)	0.00	139.00	62,592	3.24	4.40
SKM	Ag (g/t)	0.00	3000.00	62,542	176.98	223.59
SKA1	Zn (%)	0.00	44.28	5,732	4.08	3.00
SKA1	Pb (%)	0.00	30.00	5,731	1.41	1.45
SKA1	Ag (g/t)	0.01	1537.00	5,730	62.63	66.47
SKA2	Zn (%)	0.00	28.80	5,683	5.53	3.86
SKA2	Pb (%)	0.00	23.40	5,683	1.33	1.94
SKA2	Ag (g/t)	0.00	1100.00	5,683	75.33	91.16
SKA4	Zn (%)	0.14	10.34	808	3.07	1.36
SKA4	Pb (%)	0.01	14.15	808	1.06	1.05
SKA4	Ag (g/t)	0.50	300.00	805	35.39	27.28
SKA5	Zn (%)	0.13	17.83	100	4.60	2.82
SKA5	Pb (%)	0.04	5.72	100	1.61	1.08
SKA5	Ag (g/t)	4.31	177.11	100	57.95	34.02
SKA6	Zn (%)	0.01	98.00	22,260	3.63	3.24
SKA6	Pb (%)	0.00	38.00	22,260	1.29	1.29
SKA6	Ag (g/t)	0.00	1237.00	22,257	44.73	39.25
SKA7	Zn (%)	0.33	16.83	177	3.62	2.10
SKA7	Pb (%)	0.05	8.18	177	0.91	0.75
SKA7	Ag (g/t)	1.00	230.64	177	29.29	29.06
SKA8	Zn (%)	0.00	37.70	1,556	4.71	4.86
SKA8	Pb (%)	0.01	18.37	1,556	1.41	1.71
SKA8	Ag (g/t)	0.00	728.54	1,556	48.55	57.01
SKA11	Zn (%)	0.01	23.38	1,329	2.59	2.98
SKA11	Pb (%)	0.00	15.57	1,329	1.01	1.67
SKA11	Ag (g/t)	0.01	800.00	1,329	52.38	77.09
SKA17	Zn (%)	0.09	15.70	344	2.53	1.51
SKA17	Pb (%)	0.01	8.92	344	0.96	1.03
SKA17	Ag (g/t)	0.00	154.00	344	29.12	19.88
SKA21	Zn (%)	0.01	6.89	254	2.76	0.93
SKA21	Pb (%)	0.01	1.81	254	0.65	0.23
SKA21	Ag (g/t)	0.50	102.00	254	22.65	11.39

Normal space histograms for the SKM drill hole samples represent strongly skewed distributions indicating that the mean is greater than the median value which is greater than the mode. This indicates that the mean value is influenced by higher grade values.

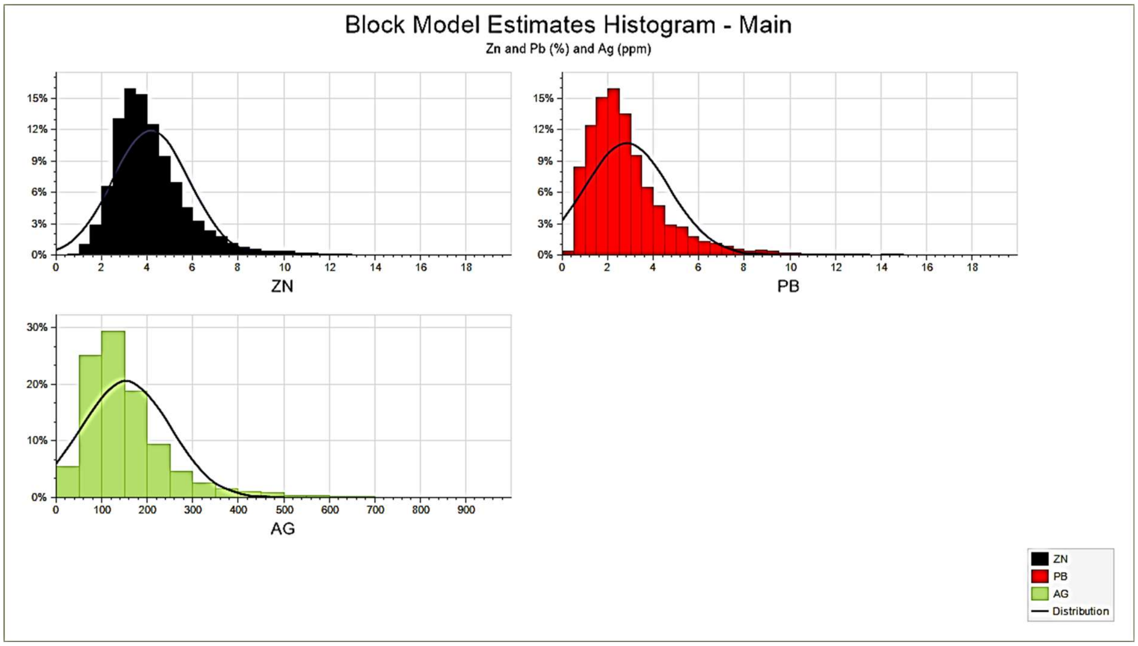

Figure 15: Multi-variate histograms of the SKM drill hole samples for Zn (%), Pb (%), and Ag (g/t)

9.6 Data Compositing

Most of the drill hole samples are 1.0 m in length and were therefore composited to 1.0 m lengths. Data compositing reduces the data population variability and contributes to a more uniform data support for estimation purposes. The drill hole and composite data populations correspond with each other for the normal space histograms drill hole samples demonstrating the data population distribution has been maintained.

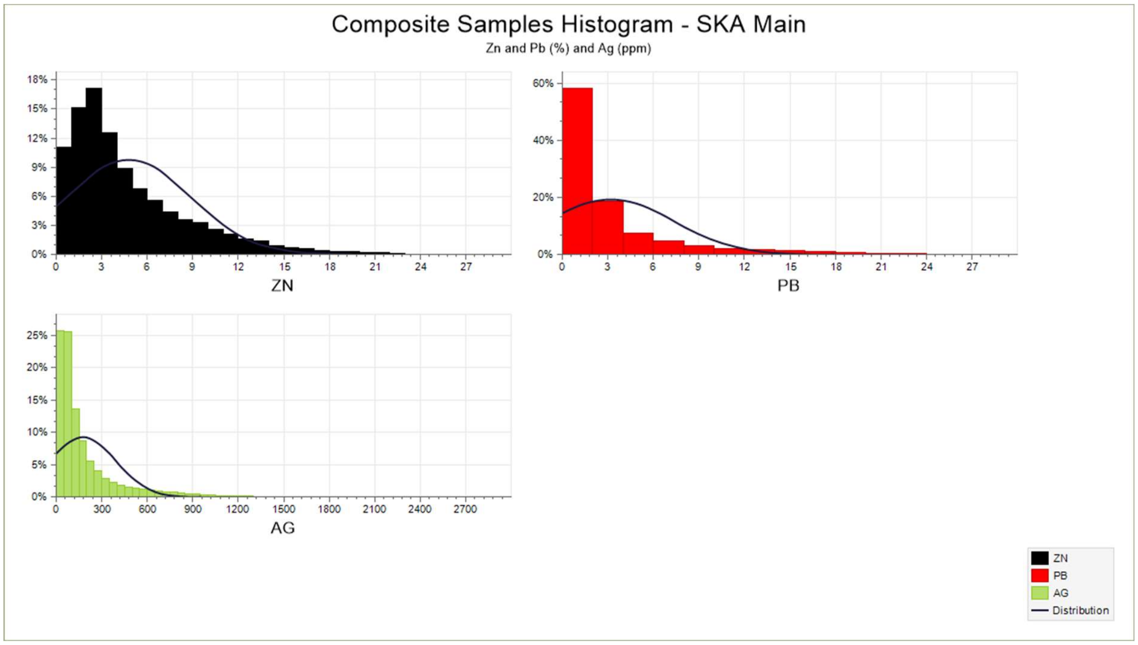

Figure 16: Multi-variate histograms of the composited samples for the SKM zone - Zn (%), Pb (%), and Ag (g/t)

9.7 Density Determination

Specific gravity (density) was analysed using the Archimedes' Principle methodology. XX. The Archimedes' Principle measures the weight / volumetric displacement of a sample within air and water. The correlation between the values reconciles well against production data. The density data was interpolated during the geostatistical estimation process. Where the density values between metal and density values is well established the bulk density is derived from multi-linear regression formulae.

The formula for the CSD zone is:

$$\text{Density } (t/m^3) = 2.668 + (0.02091 * CSDZn) + (0.03208 * CSDPb) + (0.02661 * CSDFe).$$

The formula for the GMS zone is:

$$\text{Density } (t/m^3) = 2.675 + (0.01193 * GMS\_Zn) + (0.03265 * GMS\_Pb) + (0.02173 * GMS\_Fe).$$

The average density values for the individual lenses/zones are:

- SKA1: density of 3.0 t/m^3
- SKA2: density of 3.2 t/m^3
- SKA5: density of 3.0 t/m^3
- SKA7: density of 3.0 t/m^3
- SKA4: density of 3.0 t/m^3
- SKA6: density of 2.9 t/m^3
- SKA8: density of 3.0 t/m^3
- SKA11: density of 3.0 t/m^3
- SKA17: density of 3.0 t/m^3.

For areas which have not been interpolated a density of a density applied of 3.2 t/m^3.

9.8 Grade Capping / Cutting

Grade capping and cutting removes outlier values which will unduly influence the variability in the estimation process. Outlier values were determined via statistical analyses. Cutting removes the values above a threshold whilst capping converts the outlier values to the threshold value.

Grade capping was applied separately to the CSD and GMS samples as follows:

- Zn: 30% for CSD, 30% for GMS
- Pb: 30% for CSD, 20% for GMS
- Ag: 1,500g/t for CSD, 800g/t for GMS.

9.9 Estimation/Interpolation Methods

Inverse Distance Weighting to the power of two (IDW^2) or Ordinary Kriging (OK) methodologies using search ellipsoids with anisotropic weighting that encompasses the geological trends were used to both interpolate and extrapolate the Zn (%) , Pb (%), Ag (g/t) grades. The estimation method chosen per lense are as follows:

- SKA1 - IDW^2
- SKA2 - OK
- SKA4 - IDW^2
- SKA5 and SKA7 - IDW^2

- SKA6 - IDW^2
- SKA11 - IDW^2
- SKA17 - IDW^2.

OK estimates were derived on a proportional basis (a value between 0 and 1) for the CDS and GMS zones. This weight is used to assign the corresponding grade estimates to the individual blocks, for CSD and GMS, respectively. Following the separate estimates for the CSD and GMS, a CSD indicator value based on these separate lithology types have been estimated into the models, to assign a probability/proportion CSD. This value has then been used as a weighting to back-calculate block grades using both the CSD and GMS grade estimates (Mineral Resource and Ore Reserve Audit on the Assets of Hindustan Zinc Limited, India (2021 AUDIT), 2022).

Restricted local search applied to some of the zones are as follows:

- SKA1: 25 x 250 x 100 m search for all elements with minimum of 3 and maximum of 20 samples (dynamic anisotropy), and 5 x 10 x 5 discretisation
- SKA2: 125 x 100 x 25 m search for zinc with minimum of 8 and maximum of 75 samples (122/-18/-59, 3,2,1 rotation), individual samples per drill hole of six, and 5 x 10 x 5 discretisation
- SKA4: 25 x 250 x 100 m search for all elements with minimum of 3 and maximum of 20 (dynamic anisotropy), and 6 x 6 x 6 discretisation
- SKA5 and SKA7: 25 x 250 x 100 m search for all elements with minimum of 3 and maximum of 20 (no rotation applied), and 1 x 1 x 1 discretisation
- SKA6: 75 x 75 x 20 m search for all elements with minimum of 8 and maximum of 75 (no rotation applied), and 1 x 1 x 1 discretisation
- SKA8: 25 x 250 x 100 m search for all elements with minimum of 3 and maximum of 20 (dynamic anisotropy), individual samples per drill hole of six, and 4 x 6 x 6 discretisation
- SKA11: 25 x 250 x 100 m search for all elements with minimum of 1 and maximum of 20 (35 degree around Z), and 1 x 1 x 1 discretisation
- SKA17: 25 x 50 x 50 m search for all elements with minimum of 8 and maximum of 40 (90/49/0, 3,1,3 rotation), individual samples per drill hole of four, and 3 x 3 x 3 discretisation.

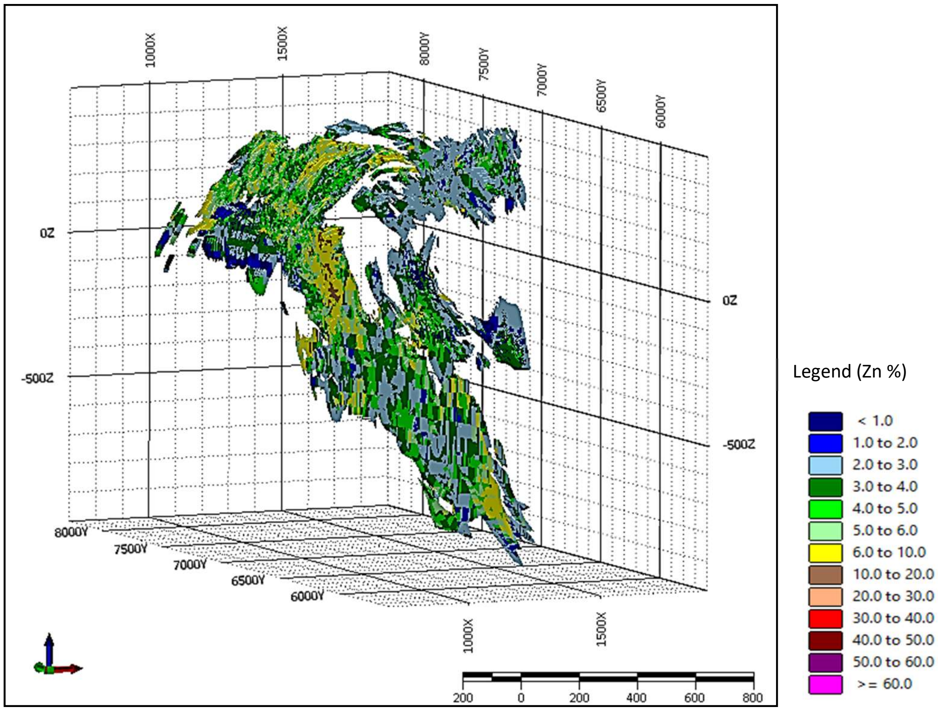

Figure 17: OK estimates for Zn (%) – no economic cut-off grade applied

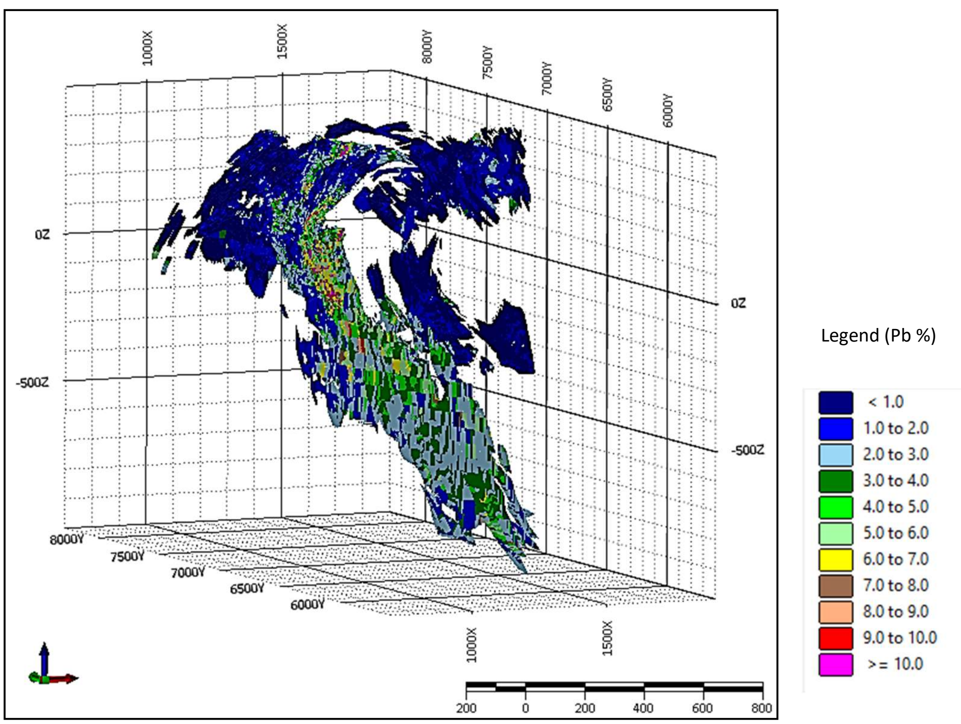

Figure 18: OK estimates for Pb (%) – no economic cut-off grade applied

The cut-off grades (COGs) applied to the Mineral Resources are stated on a Zn equivalent (ZnEQ) basis per zone:

- SKM: 2.58%; ZnEQ = Zn + (0.603 x Pb) + (0.02885 x Ag)
- SKA1: 2.65%; ZnEQ = Zn + (0.608 x Pb) + (0.02863 x Ag)
- SKA2: 3.09% ZnEQ = Zn + (0.608xPb) + (0.02863xAg)
- SKA6; 2.78% ZnEQ = Zn + (0.608xPb) + (0.02863xAg)
- SKA4, SKA5, SKA7, SKA17, and SKA21; 2.65% ZnEQ = Zn + (0.608xPb) + (0.02863xAg)
- SKA8: 2.68%; ZnEQ = Zn + (0.608 x Pb) + (0.02863xAg)
- SKA11: 2.83%; ZnEQ = Zn + (0.608 x Pb) + (0.02863 x Ag).

The COGs used for the Mineral Resource were calculated using on nett smelter return (NSR) values for the individual metals of Pb, Zn and Ag and based on the following:

- at prices of USD 2,057/t, USD 2,759/t and USD 21.24/oz, respectively
- costs based on the F2022 Business Plan
- no mining factors have been applied
- includes planned and unplanned dilution
- no metallurgical factors have been applied; however, metallurgical recoveries were based on metallurgical and smelter performance.

9.10 Classification of Mineral Resources

The level of confidence in the geology and the volume, tonnage and grade estimates determines the classification/s of a Mineral Resource. The lowest level of confidence is an Inferred Mineral Resource and with increasing levels of confidence Indicated followed by a Measured Mineral Resources can be classified. The universal requirement across the three categories is the requirement of reasonable prospects of eventual economic extraction (RPEEE) must exist. There is no uncertainty that all or any part of this Mineral Resource will be converted into Mineral Reserve.

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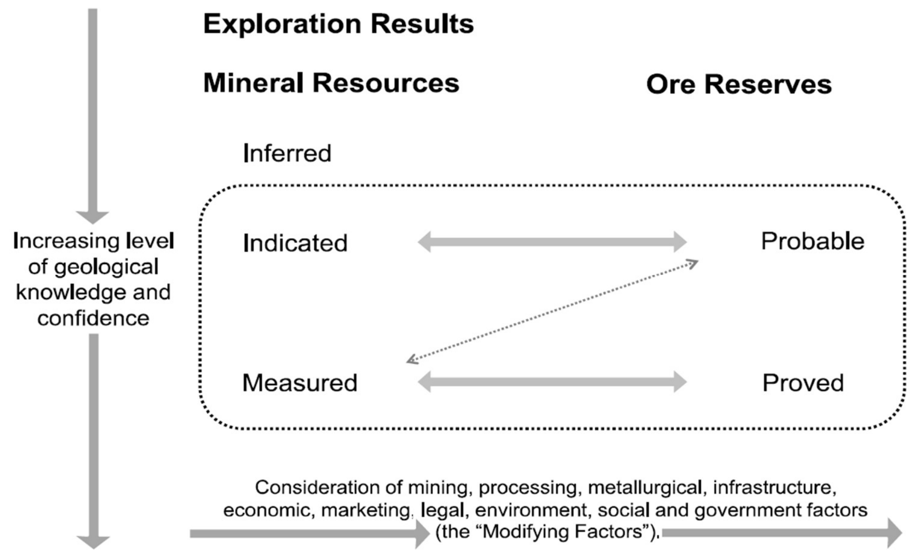


Figure 19: JORC Mineral Resource and Ore Reserve classification framework

Source: The Australasian Code for Reporting Exploration Results, Mineral Resources and Ore Reserves (the JORC Code), p9.

Mineral Resource classification is based on both technical and economic factors, namely:

- geological understanding, continuity and confidence
- grade continuity
- drill hole / sample spatial representativity and spacing
- data quality assurance and control
- appropriate geochemical analytical and bulk density techniques applied
- application of the appropriate estimation methodologies and confidence therein
- RPEEE
- validity and ownership of the relevant government license types such as exploration, and environmental licenses
- consideration of social factors
- legal and governmental risk factors.

Inferred, indicated and Measured classification are based on increasing order of confidence. Various international mineral reporting codes define the criteria required for each confidence category.

An Inferred Mineral Resource is defined as:

- quantity and quality of the grade or quality data is based on 'limited geological evidence and sampling
- geological evidence is sufficient to imply but not verify geological and grade or quality continuity
- has demonstrated RPEEE
- it may not be considered in the assessment of the economic viability of a mining project
- it cannot be converted to Mineral Reserves
- it is expected that most of Inferred Mineral Resources could be upgraded to Indicated Mineral Resources with further exploration (Code of Federal Regulations, 229.1300, 2022).

An Indicated Mineral Resource is defined as:

- quantity and quality of the grade or quality data is sufficient to allow the application of modifying factors in sufficient details that will support mine planning and economic viability
- data has been gathered from adequately detailed and reliable exploration, sampling and testing
- geological evidence is sufficient to assume geological and grade or quality continuity between data points
- has demonstrated RPEEE
- can be converted to a Probable Mineral Reserve with the application of reliable modifying factors (Code of Federal Regulations, 229.1300, 2022).

A Measured Mineral Resource is defined as:

- the confidence in the quantity and quality of the grade and scientific data is sufficient to allow the application of modifying factors to support detailed mine planning and final determination of the economic viability of the deposit
- data has been gathered from detailed and reliable exploration, sampling and testing data
- geological and grade or quality continuity between data points has been demonstrated
- has demonstrated RPEEE
- can be converted to a Probable and Proven Mineral Reserve with the application of reliable modifying factors (Code of Federal Regulations, 229.1300, 2022).

The Mineral Resources stated for the previous and most current completed fiscal years were based on these factors. The data spacing for the Measured classification required a minimum of 25 x 25 m spacing, a grid spacing of 50 m to 100 m for Indicated classification and a spacing of greater than 100 x 100 m for an Inferred classification. The Inferred Mineral Resource was limited to a depth from surface of 500 m.

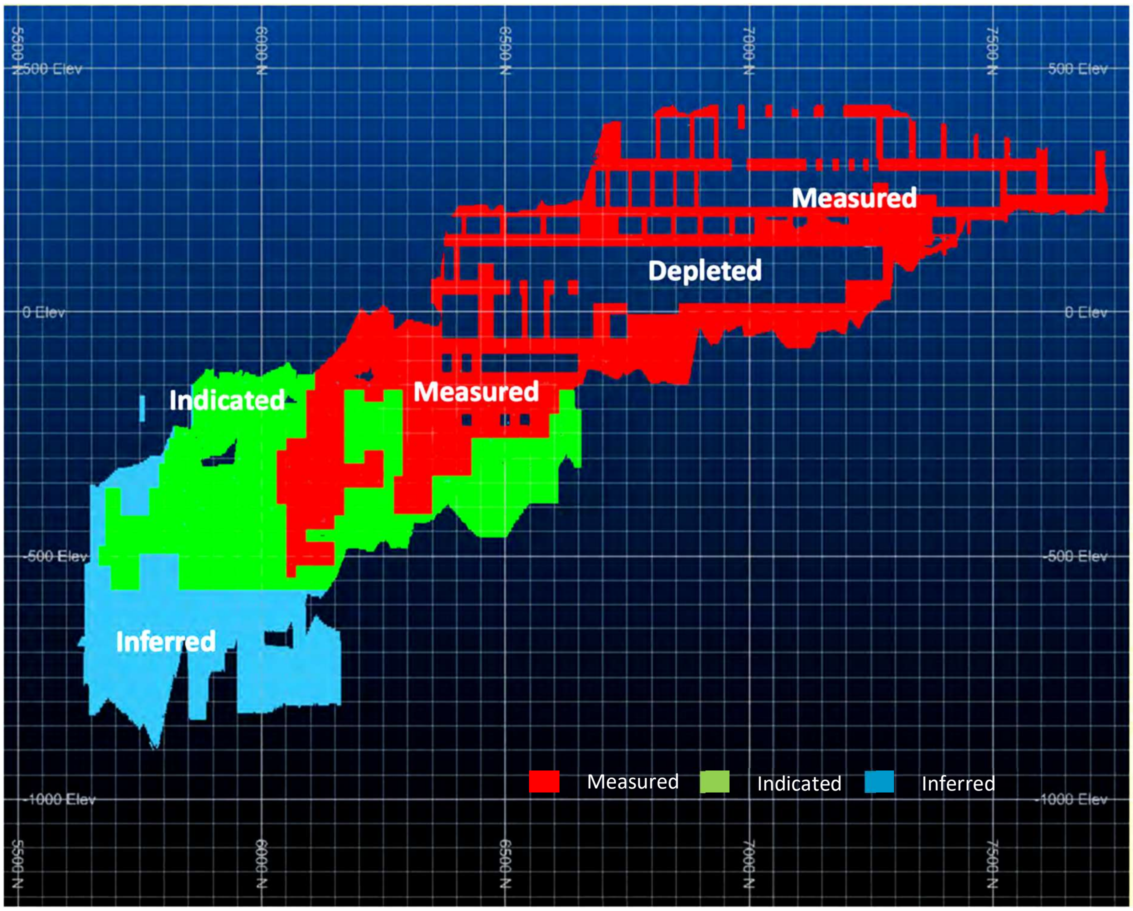


Figure 20: Mineral Resources for Sindesar Khurd– 31 March 2022

9.11 Grade Model Validation

Grade model validation methods included visually and statistically validating the estimated block grades relative against the original sample results and the generation of swath plots. Statistically validation indicated that the data population for the grade estimates mirror those of the sample and composited grades.

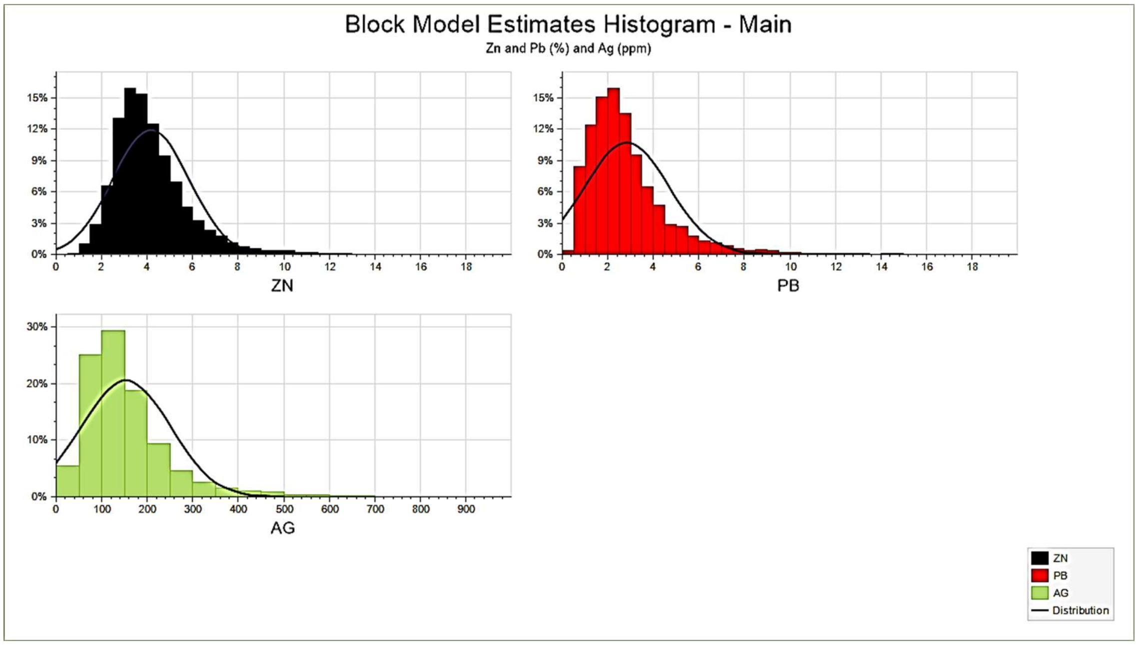


Figure 21: Multi-variate histograms of the estimated grades for the SKM zone - Zn (%), Pb (%), and Ag (g/t)

Swath analysis of the block model estimates for the SKM zone versus the drill hole and composite grades are relatable indicating the estimates honour the input data population.

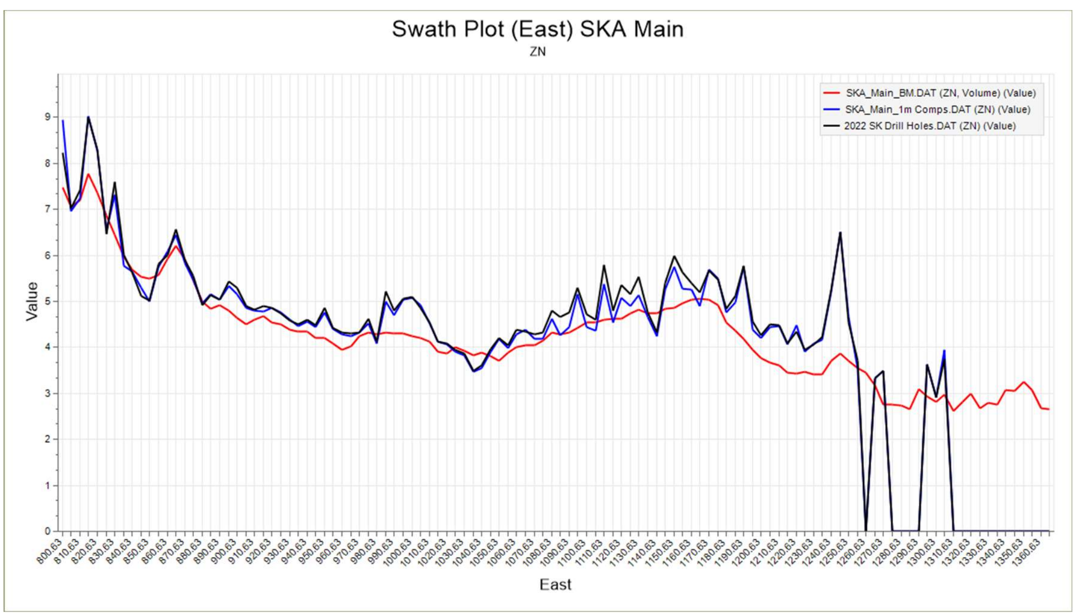


Figure 22: Swath plot (east) for the SKM block model OK Zn (%) estimates versus the composite and drill hole grades

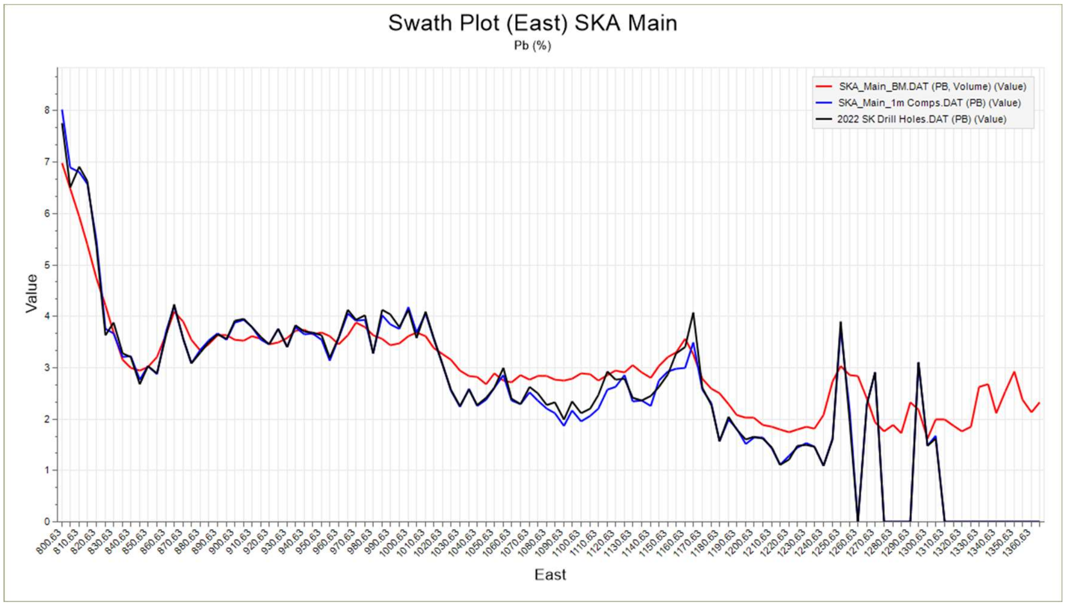


Figure 23: Swath plot (east) for the SKM block model OK Pb (%) estimates versus the composite and drill hole grades

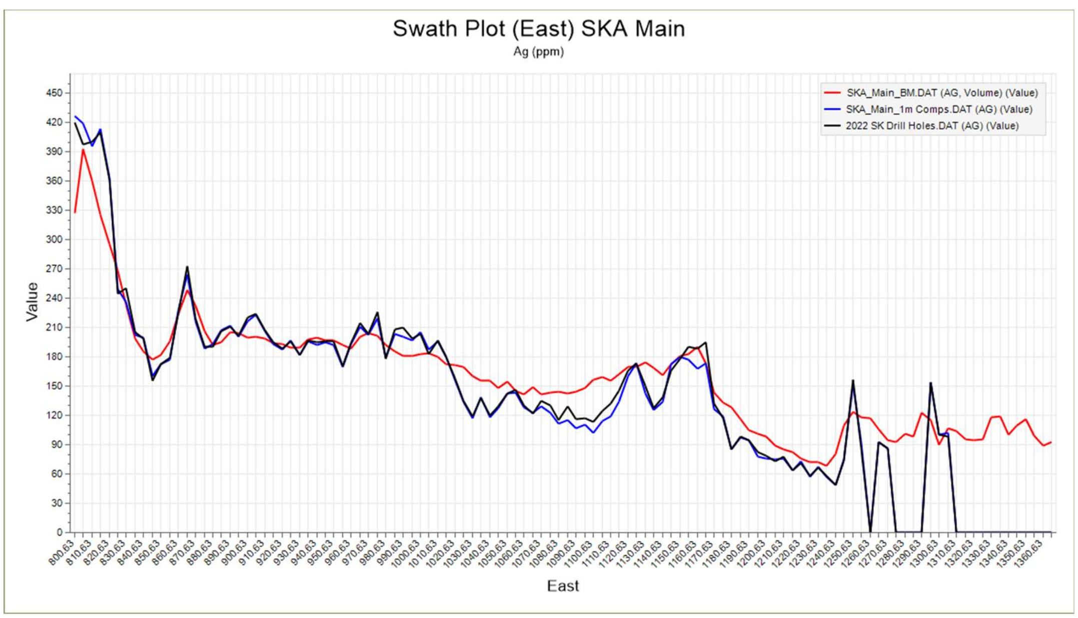


Figure 24: Swath plot (east) for the SKM block model OK Ag (g/t) estimates versus the composite and drill hole grades

ABGM considers that sufficient check calculations have been conducted to conclude that the tonnage and grade estimates are considered valid, however there is room for improvement in terms of the estimation scheme and optimisation of the estimation parameters.

9.12 Mineral Resource Statement

The Mineral Resources exclusive of the Mineral Reserves as at the end of the last fiscal year are summarised in tables below the same period where the Mineral Resources are inclusive of the Mineral Reserves.

The Mineral Resources are reported at a ZnEQ COG of:

- SKM: 2.58%
- SKA1: 2.65%
- SKA2: 3.09%
- SKA6: 2.78%
- SKA4, SKA5, SKA7, SKA17, and SKA21: 2.65%
- SKA8: 2.68%
- SKA11: 2.83%.

Table 13: Mineral Resource Statement (exclusive of Mineral Reserves) – 31 March 2022

Classification	Tonnage	Grade			Metal Content		
	(Mt)	Zn (%)	Pb (%)	Ag (g/t)	Zn (Kt)	Pb (Kt)	Ag (Koz)
Measured	29.9	4.30	2.60	134	1,295	769	129,205
Indicated	13.9	3.30	1.50	62	462	201	27,508
Measured + Indicated	**43.8**	**4.00**	**2.20**	**111**	**1,757**	**970**	**156,713**
Inferred	15.5	3.40	1.90	96	530	292	47,759
Total	**59.3**	**3.90**	**2.10**	**107**	**2,287**	**1,261**	**204,472**

- Stated as exclusive of Mineral Reserves
- Stated as underground Mineral Resources
- Measured classification is drilled at a 25 x 25 m spacing, 50 x 100 m for Indicated classification and a spacing of greater than 100 x 100 m for Inferred classification
- The Mineral Resource is limited to a depth from surface of ~1,400 m
- Mineral Resources are reported on a 100% basis
- Totals may not sum due to rounding

The Measured Mineral Resources as a proportion of the total Inclusive Mineral Resource as of 31 March 2022 accounts for ~51% of the tonnes, the Indicated Mineral Resources is ~33%, and the Inferred at ~16%.

Table 14: Mineral Resource Statement (inclusive of Mineral Reserves) – 31 March 2022

Classification	Tonnage	Grade			Metal Content		
	(Mt)	Zn (%)	Pb (%)	Ag (g/t)	Zn (Kt)	Pb (Kt)	Ag (Koz)
Measured	49.9	4.20	2.70	139	2,101	1,336	223,662
Indicated	32.6	3.40	1.80	85	1,121	587	89,106
Measured + Indicated	**82.6**	**3.90**	**2.30**	**118**	**3,222**	**1,923**	**312,768**
Inferred	15.5	3.40	1.90	96	530	292	47,759
Total	**98.1**	**3.80**	**2.30**	**114**	**3,752**	**2,214**	**360,527**

- Stated as inclusive of Mineral Reserves
- Stated as underground Mineral Resources
- Measured classification is drilled at a 25 x 25 m spacing, 50 x 100 m for Indicated classification and a spacing of greater than 100 x 100 m for Inferred classification
- The Mineral Resource is limited to a depth from surface of ~1,400 m
- Mineral Resources are reported on a 100% basis
- Totals may not sum due to rounding

The net material difference between the Mineral Resource at the end of the 31 March 2022 fiscal year and the preceding fiscal year is demonstrated below. The differences relate to depletion or production, changes in commodity prices, additional resources discovered through exploration, and changes due to the methods employed.

Table 15: Net difference between the 31 March 2022 and 31 March 2021 Minerals Resources exclusive of Mineral Reserves

Classification	Tonnage	Grade			Metal Content		
	(Mt)	Zn (%)	Pb (%)	Ag (g/t)	Zn (Kt)	Pb (Kt)	Ag (Koz)
Measured	1.6	-0.1	0.1	9	59	74	15,240
Indicated	-4.5	0	0.2	2	-141	-46	-7,773
Measured + Indicated	-2.9	0.1	0.2	12	-82	28	7,466
Inferred	-4	-0.1	-0.2	-17	-154	-126	-22,731
Total	-6.9	0.1	0	4	-236	-99	-15,265

(2) The net difference between the mineral resources or reserves at the end of the last completed fiscal year and the preceding fiscal year, as a percentage of the resources or reserves at the end of the fiscal year preceding the last completed one;

(3) An explanation of the causes of any discrepancy in mineral resources including depletion or production, changes in commodity prices, additional resources discovered through exploration, and changes due to the methods employed; and

9.13 Relevant Factors that may affect the Mineral Resource Estimates

It is the opinion of the Qualified Person that the likelihood of high-risk factors affecting the Mineral Resource estimates is low.

Risks that can affect Mineral Resource estimates include:

- Geological model
- Spatial representivity of the drill hole data
- Sample QAQC
- Estimation methodology and assumptions
- Estimation search parameters
- Application of grade capping and/or cutting
- Further drill hole results that may impact the grade and tonnage estimates
- Changes to the parameters used to derive the COGs, such as metal prices, operating costs, metallurgical recoveries.

ABGM is of the opinion that these risks have a low probability of having a material impact on the Mineral Resource estimates.

9.14 Qualified Person's Opinion

Conclusions:

- The geology is understood well and the geological model is sufficiently detailed to estimate reliable Zn, Pb, and Ag grades

- Historical reviews of the data and QAQC and concluded there is sufficient and spatially representative drill holes to estimate reliable grade and tonnage estimates. Shortcomings in QAQC for older data and in documentation were noted and deems it is suitable inclusion in the Mineral Resource estimation.
- The regression method to determine the missing Ag assay results is appropriate
- The use of OK and IDW^2 methodologies are appropriate as is the related estimation parameters applied
- Sufficient estimation model validations have been undertaken and indicate the grade estimates are reliable
- The criteria used to define the Mineral Resource confidence categories are appropriate.
- The parameters used to determine the COGs are appropriate
- The Mineral Resources are amenable to underground mining
- The estimation of the grades and tonnages have been performed to industry best practices and conform to the requirements of international Mineral Resource reporting codes
- Successful brown-fields exploration to replace Mineral Resources depleted by production has occurred and is on-going
- The net differences between the most recent Mineral Resources and the previous fiscal year's Mineral Resources are well understood
- The persons undertaking the estimation and classification of the Mineral Resources are sufficiently experienced to undertake such
- The March 31, 2022, Mineral Resource estimate has been estimated in accordance with the December 26, 2018, SEC S-K1300 regulations.

Dr Heather King who reviewed the Mineral Resource estimates and statements is independent of HZL and registered as a professional with the South African Council for Natural Scientific professions (SACNASP) and the Geological Society of South Africa (GSSA).

The Mineral Resource is based on a geological model prepared by the HZL and Sindesar Khurd technical teams. It has been independently reviewed by the Dr King. Furthermore, the review relies on information provided by HZL, along with technical reports by specialist consultants, and other relevant published and unpublished data, which include relevant geological data and information and reports.

ABGM has endeavoured, by making all reasonable enquiries, to confirm the authenticity and completeness of the technical data upon which the review and Mineral Resource statement has relied. Dr Heather King is suitably qualified and experienced to act as the Qualified Person for the Mineral Resources. Dr Heather King was unable to visit the site.

Recommendations:

- The commodity prices for Zn and Ag be reassessed based on both long-term prices and reliable forecasts
- Consideration of OK methodology to estimate the deposits that used IDW^2
- Alternative geostatistical methodologies be applied in the validation of the OK estimates
- Interpolation and extrapolation of density estimates to facilitate a higher accuracy in the tonnage and metal content estimates
- Consideration of geological and mining loss factors to facilitate a higher accuracy in the tonnage and metal content estimates.

10 Mineral Reserve Estimate

10.1 Basis, Assumptions, Parameters and Methods

The HZL mine operations and technical teams engage on a universal standard that is applied across all the mine operation from the geology resource estimations to applying the mine designs and evaluating the potential Mineral Reserves. The HZL Resources and Reserves technical team has kept extensive data that is used annually to do the annual mineral reserves statements and calculation. Each mine undergoes individual assessments and apply the modifying factors, grade cut-off calculation and assumptions.

10.1.1 Exchange Rates and Financial Assumptions

The exchange rates applied in the cut-off calculation are based on the LME forecasted indicated in the document below. The following rates were used by HZL:

Dollar to INR Conversion	Long term 5yrs
Dollar value in INR	76.65

Information received from HZL indicate the following parameters were used to calculate the cut-off grade.

Historical prices are stipulated in XXX below illustrating the last six years of commodity prices.

Table 16: Historic Commodity Prices

Year	LME Zinc		LME Lead		LBE Silver
(USc/lb)	(USD/t)	(USc/lb)	(USD/t)	(USD/oz)	(USD/oz)
2016	95	2,101	85	1,878	17.1
2017	131	2,892	106	2,327	17.1
2018	131	2,893	102	2,251	15.7
2019	114	2,504	91	2,006	16.2
2020	103	2,278	83	1,836	20.5
2021	120	2,646	88	1,940	23.8

LME Forecast used by HZL for the calculation of the cut-off grades are indicated below. The ten year average of the forecasted prices indicated were used to calculate the cut-off grades.

Table 17: LME Projected Commodity Prices

Particulars	UOM	FY'23	FY'24	FY'25	FY'26	FY'27	FY'28	FY'29	FY'30	FY'31	FY'32	Average
LME - Zinc	$/MT	3,183	2,911	2,684	2,621	2,658	2,706	2,706	2,706	2,706	2,706	2,759
- Lead	$/MT	2,179	2,047	1,974	1,962	1,997	2,082	2,082	2,082	2,082	2,082	2,057
- Silver	$/Troz	22.19	20.47	21.61	21.33	21.30	21.10	21.10	21.10	21.10	21.10	21.24
Ex Rate	Rs/USD	74.94	75.43	76.52	77.73	78.64	79.11	79.51	79.51	79.51	79.51	76.65

The 3 year and 10 year averages is indicated below

Table 18: Next three year average prices

Particulars	UOM	3yr Avg	10yr Avg
LME - Zinc	$/MT	2,926	2,759
- Lead	$/MT	2,067	2,057
- Silver	$/Troz	21.42	21.24
Ex Rate	Rs/USD	75.63	76.65

10.2 Cut-off Grade

A zinc and a lead concentrate are generated at SKM and the principal metals are zinc and silver followed by lead. Silver grades at SKM are very high. The COG and NSR assumptions and values used to support the F2021 Ore Reserve estimate are presented in the tables below:

Table 19: Cut-Off Grades and NSR Calculation inputs

Description	Units	Pb Con	Pb Con	Zn Con
Input Assumptions		Pb	Ag	Zn
Commodity Price	USD/t or USD/oz	2,057	21.24	2,759
Commodity Price	USD/t or USD/g	2,057	0.683	2,759
Exchange rate	USD:INR	76.65	76.65	76.65
Average grade	% or g/t	1.17	56.47	3.19
Concentrator recovery	%	87.20	79.36	90.31
Concentrate grade	% or g/t	57.83	2427.10	48.41
Moisture content	%			
Payability/ smelter rec	%	97.573	99.805	96.158
Minimum deduction	% or g/t			
Treatment charge	USD/dmt	264.76		216.80
Refining charge	USD/lb or USD/g		0.02	
Transport cost	USD/dmt			
Freight cost	USD/dmt	4.50		8.22
Mineral royalty	%	19.76	9.33	13.83
NSR Values		Pb	Ag	Zn
Gross payable	USD/dmt	1,161	1,654	1,284
Treatment charge	USD/dmt	-264.8		-216.8
Refining charge	USD/dmt		-58.0	
Transport cost	USD/dmt			
Freight cost	USD/dmt	-4.5		-8.2
Mineral royalty	USD/dmt	-229.4	-154.3	-177.6
Net payable	**USD/dmt**	**662.1**	**1441.9**	**881.6**
Equivalent Grade Calculation				
Metal values	USD/t or USD/g	998.2	0.5	1644.8
Equivalent grade factors	**no**	**0.6**	**0.0**	**1.0**
Equivalent grade	%Zn or %Pb	0.7	1.6	3.2
Total equivalent grade	%Zn or %Pb			**5.5**
NSR	USD/t rom	11.8	26.8	52.5
Total NSR	USD/t rom			**91.1**

10.2.1.1 Modifying Factors and Reconciliation

The mine has been using CMS for a number of years and all stope voids are regularly surveyed and the results compared with the mine design. The results from 93 stope CMS surveys is tabulated below in terms of the pre-mining planned stope (includes planned dilution and ore loss) and the post-mining stope. Dilution is principally associated with orebody complexity in turn commonly related to intense folding as well as poor hanging wall conditions. For F2021 the planned and external dilution was 8% and 4% respectively. External dilution is modelled according to historical relationships developed for geological complexity and hanging wall condition.

Table 20: CMS Stope Reconciliation

Description	Unit	F2017	F2018	F2019	F2020	F2021
		Actual	Actual	Actual	Actual	Actual
Planned Stopes	Mt	2.03	1.98	1.52	2.4	0.79
Zn grade	%	4.53	5.21	4.65	4.42	4.46
Pb grade	%	2.39	2.9	2.4	3.07	3.36
Ag grade	g/t	139.7	159.4	108.6	162.8	188.3
Mined stopes	Mt	2.14	2.11	1.62	2.52	0.82
Zn grades	%	4.28	4.87	4.37	4.2	4.3
Pb grade	%	2.26	2.71	2.26	2.93	3.24
Ag grade	g/t	132.2	149	102.2	154.9	181.6
Planned dilution	%	12.7	10.1	15.9	13.2	7.6
External dilution	%	5.1	6.1	6.3	5.1	3.5
Mining recovery	%	97.4	72.6	92.5	92.5	94.6

Table 21: Mined versus Processed Grades

Description	Unit	F2017	F2018	F2019	F2020	F2021
		Actual	Actual	Actual	Actual	Actual
Mined	Mt	3.66	4.5	5.31	5.08	4.84
Zn grade	%	1.98	2.18	3.73	3.47	2.28
Pb grade	%	3.97	4.03	2.52	2.12	3.44
Ag grade	g/t	112.5	119.2	135.6	116.1	119.8
Processed		3.41	4.45	5.06	5.1	4.82
Zn grade	%	2.03	2.13	3.75	3.37	2.25
Pb grade	%	3.84	3.99	2.41	2.07	3.38
Ag grade	g/t	112.4	112.9	128.3	112.4	116.5
Tonnes Factor	%	0.93	0.99	0.95	1	1
Zn grade factor	factor	1.02	0.98	1.01	0.97	0.98
Pb grade factor	factor	0.97	0.99	0.96	0.98	0.98
Ag grade factor	factor	1	0.95	0.95	0.97	0.97

10.2.2 Dilution

The grades reported as head feed to the plant compare favourably to that projected. The modifying factors used to generate the Ore Reserves from the stope design contents are given below

Table 22: External Dilution and Mine Recoveries applied

Geology/	External Dilution (%)		Mine Recovery (%)	
HW Condition	Good	Poor	Good	Poor
1	5.0	8.0	93.0	93.0
2	3.0	7.0	95.0	92.0
3	5.0	8.0	96.0	93.0
Ore Dev	0.0	0.0	100.0	100.0

10.3 Mineral Reserves

The classification block model reports developed by HZL was scrutinised and the tonnes were evaluated. This classification model is the start point of the Reserve estimation before external dilution and mine recoveries are applied. The model report suggests there is sufficient tonnes and grade in the model that is used by HZL to develop the Reserve Statement drafted in March 2022, to determine the final Mineral Reserves.

The Mineral Reserve statement (March 2022) suggests SKM has 45.4 Mt at 3.0 g/t Zinc, 2.0% Lead and 100 g/t Silver within the minable Ore Reserve.

Table 23: Mineral Reserves Estimates (2022)

Ore Reserve summary							
Ore Reserve	Tonnage (Mt)	Grade (Zn %)	(Pb %)	(Ag g/t)	Metal (Zn kt)	(Pb kt)	(Ag koz)
Proved	21.4	3.3	2.4	125	701	511	86,001
Probable	24.0	2.8	1.6	78	674	378	59,994
Ore Reserves (Total	45.4	3.0	2.0	100	1,376	889	145,995

The Ore Reserve estimate for SKM is based on a fully engineered stope and development design. There is an opportunity to increase the Ore Reserve estimate for next year by extending the same level of engineering design to the limit of the Measured and Indicated Mineral Resource. A suitable LoM schedule needs to be linked to the mine design and used to support the projections for production and ensure that the mine can continue to meet the high production rates that it has realised and notably the current plant capacity of 6.3 Mtpa.

The Ore Reserve includes estimates for the modifying factors supported by extensive CMS results and reconciliation with the factors modelled according to orebody complexity and hanging wall geotechnical condition. External dilution is in accordance with previous years and indicates good mining control. The mining recovery factor is also in accordance with what is expected, for the orebody and mining methods.

The calculated COG for SKM is 2.17% ZnEq for the Main orebody and 2.22% ZnEq for the Satellite orebodies. Considering the good basmetal grades and high silver grades, there are very few stopes below the COG. The SKM Ore Reserve has the second highest equivalent zinc grade for the HZL mines. The satellite/auxiliary lens orebodies generally have lower grades and a combination of Main Orebody and satellite production should be targeted to maximise the LoM. Also, a combination of shaft hoisting at 4 Mtpa, for reserves below 0 mRL, and decline production, from the upper orebodies, of 2-2.5 Mtpa needs to be planned to match with installed plant capacity. Similar to RAM, the applicable COG should be calculated considering long-term costs at full production and accounting for different mining practices and whether shaft hoisting or decline hauling is used for ore transport.

Although, SKM has demonstrated continued increases in production and is a well operated and highly advanced operation development performance and equipment efficiencies are lower than expected. Geotechnical conditions are poorer in the current areas of mining in the Main Orebody which impacts on the size of the stopes and their productivity. These aspects are being addressed by mine management in order to sustain the long-term production rates of 6.0 Mtpa planned for the mine.

The critical path for sustained full production at SKM is considered, by HZL to be development performance, establishing sufficient mining capacity on the Main Orebody and the success of the new production shaft and the associated ground handling facilities to hoist ore at the planned production rate.

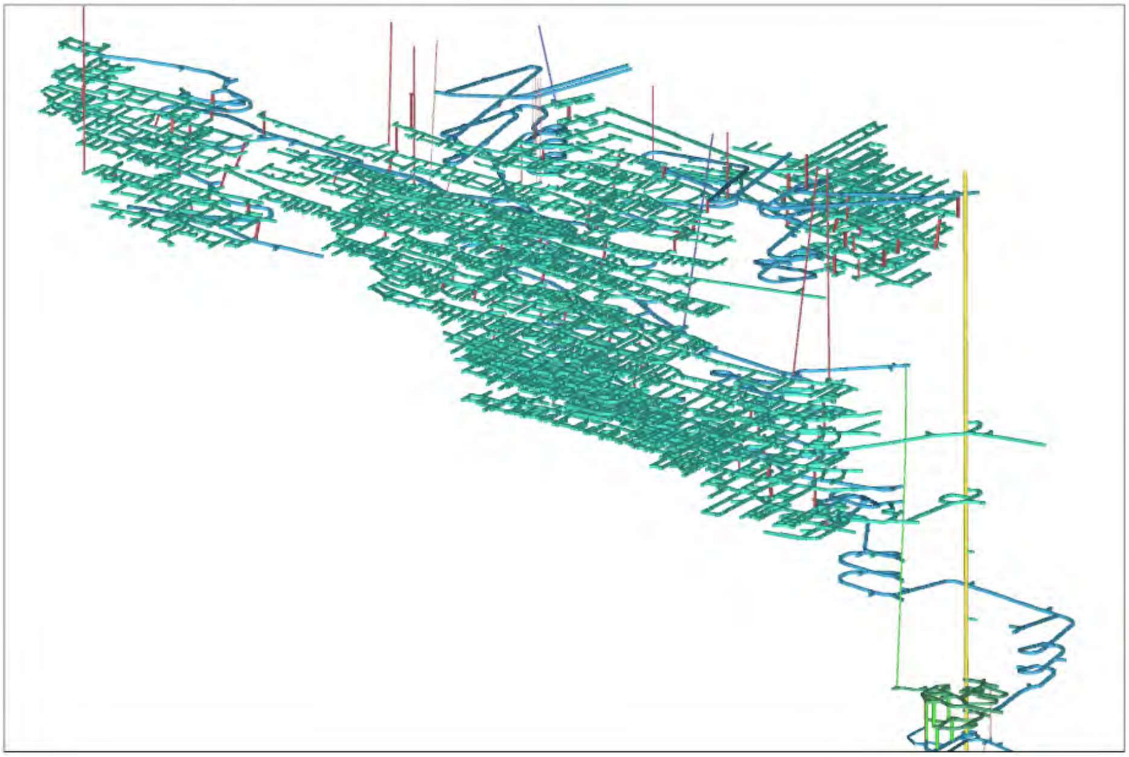


Figure 25: SKM 3D mine design of development and infrastructure

10.4 Relevant Factors

Table 24: Input and calculation parameters

No	Description	Units	SKM ZnEq Average (Res+Rev)			SKM ZnEq SK Main (Res+Rev)		
			Pb Con Pb	Pb Con Ag	Zn Con Zn	Pb Con Pb	Pb Con Ag	Zn Con Zn
1.00	**Input Assumptions**							
1.01	Commodity Price	USD/t or USD/oz	2,057	21.24	2,759	2,057	21.24	2,759
1.02	Commodity Price	USD/t or USD/g	2,057	0.683	2,759	2,057	0.683	2,759
1.03	Exchange rate	USD:INR	76.65	76.65	76.65	76.65	76.65	76.65
1.04	Average grade	% or g/t	1.17	56.47	3.19	2.77	151.3	3.66
1.05	Concentrator recovery	%	87.2	79.4	90.3	88.4	81.5	92.2
1.09	Concentrate grade	% or g/t	57.8	2,427	48.4	57.8	2,638	48.4
1.10	Moisture content	%						
1.11	Payability/ smelter rec	%	97.6	99.8	96.2	97.6	99.8	96.2
1.12	Minimum deduction	% or g/t						
1.13	Treatment charge	USD/dmt	264.8		216.8	264.8		216.8
1.14	Refining charge	USD/lb or USD/g		0			0.024	
1.15	Transport cost	USD/dmt						
1.16	Freight cost	USD/dmt	4.5		8.2	4.5		8.2
1.17	Mineral royalty	%	19.8	9.3	13.8	19.8	9.3	13.8
2.00	**NSR Values**							
2.01	Gross payable	USD/dmt	1,161	1,654	1,284	1,161	1,798	1,284
2.02	Treatment charge	USD/dmt	-265		-217	-265		-217
2.03	Refining charge	USD/dmt		-58			-63	
2.04	Transport cost	USD/dmt						
2.05	Freight cost	USD/dmt	-4		-8	-4		-8
2.06	Mineral royalty	USD/dmt	-229	-154	-178	-229	-168	-178
2.07	**Net payable**	**USD/dmt**	**662**	**1,442**	**882**	**662**	**1,567**	**882**
3.00	**Equivalent Grade Calculation**							
3.01	Metal values	USD/t or USD/g	998	0	1,645	1,012	0.48	1,679
3.02	**Equivalent grade factors**	**no**	**0.607**	**0.029**	**1.000**	**0.603**	**0.02885**	**1.000**
3.03	Equivalent grade	%Zn or %Pb	0.71	1.62	3.19	1.67	4.37	3.66
3.04	Total equivalent grade	%Zn or %Pb			**5.52**			**9.70**
3.05	NSR	USD/t rom	11.8	26.8	52.5	28.1	73.3	61.5
3.06	Total NSR	USD/t rom			**91.1**			**162.8**
4.00	**Costs and COG Calculation**		**F2022 Act**	**F2022 BP**	**F2023 BP**	**F2022 Act**	**F2022 BP**	**F2023 BP**
4.01	Mining	INR/t rom	1,757		1,946	1,757		1,946
4.02	Processing	INR/t rom	497		549	497		549
4.03	Overhead	INR/t rom	0		0	0		0
4.04	Transport	INR/t rom						
4.05	Sub-total operating cost	INR/t rom	2,254		2,495	2,254		2,495
4.06	Corporate, royalty & others	INR/t rom						
4.07	Other costs	INR/t rom						
4.08	Sustaining capex	INR/t rom	534		519	534		519
4.09	Sub-total other costs	INR/t rom	534		519	534		519
4.10	Total cost	INR/t rom	2,789		3,014	2,789		3,014
4.11	Total cost (USD)	USD/t rom	36.4		39.3	36.4		39.3
4.12	Waste development cost	INR/t rom	732		845	732		845
4.13	Economic cut-off margin	%						
4.14	**Diluted %ZnEq Cut-off Grades**							
4.15	Operating cut-off (diluted)	%ZnEq or %PbEq	2.21		2.39	2.17		2.34
4.16	Section cut-off (diluted)	%ZnEq or %PbEq	2.79		3.06	2.74		3.00
4.17	Economic cut-off (diluted)	%ZnEq or %PbEq	2.21		2.39	2.17		2.34
4.18	**Modifying Factors**							
4.19	Planned dilution	%	18.4		18.4	13.3		13.3
4.20	External dilution	%	5.0		5.0	5.2		5.2
4.21	Mining recovery	%	95.3		95.3	96.8		96.8
4.22	**Insitu %ZnEq Cut-off Grades**							
4.23	Operating cut-off (insitu)	%ZnEq or %PbEq	2.75		2.97	2.58		2.79
4.24	Section cut-off (insitu)	%ZnEq or %PbEq	3.47		3.81	3.26		3.57
4.25	Economic cut-off (insitu)	%ZnEq or %PbEq	2.75		2.97	2.58		2.79
5.00	**Cut-off grade formulas**							
5.01			ZnEq for Zn = 1.000 x %Zn			ZnEq for Zn = 1.000 x %Zn		
5.02			ZnEq for Pb = 0.607 x %Pb			ZnEq for Pb = 0.603 x %Pb		
5.03			ZnEq for Cu = 0.000 x %Cu			ZnEq for Cu = 0.000 x %Cu		
5.04			ZnEq for Ag = 0.02866 x g/t Ag			ZnEq for Ag = 0.02885 x g/t Ag		
5.05			Ore Reserve COG = 2.21 %ZnEq (diluted)			Ore Reserve COG = 2.17 %ZnEq (diluted)		
5.06			Mineral Resource COG = 2.75 %ZnEq (insitu)			Mineral Resource COG = 2.58 %ZnEq (insitu)		

11 Mining methods

11.1 Introduction

The deposit is concealed 100m below the surface and thus amenable to underground mining only. The deposit is shallow seated and hence initial feasibility study was carried out for mode of entry and mining method. Due to shallow depth of deposit and low cost of production with decline mining by trackless operations, it was decided to open North decline/ramp for ore production with secondary access via incline. Further, with expansion of mining operation, south decline/ramp was developed to add to ore production capacity.

Mine is having nine openings with two Ramps, six ventilation Raises & one Incline. North Ramp & South Ramp (5.5m x 5.0m, 1 in 7 gradient) are suitable to deploy 50t/63t/65t mine truck & 10t/17t/21t LHDs.

The present three primary entries, Ramps and incline, to the deposit cater the following services/ requirements:

- Hauling mined out ore/waste from underground to surface.
- Provides access for men & material to mine.
- Provide intake & return for ventilating air.
- Supply of mine services like power, compressed air, drilling water, drinking water and dewatering supply line etc.

11.2 Development and Stoping method

The Ramps are connected with Levels by development of an access cross-cut and footwall drives of size 5.5m X 5.0m. In a mining block, footwall drives are developed at all levels in the block. The stopes at levels shall be connected through footwall drives with access crosscuts. Slot X-cut shall be developed at the widest section of the orebody. Number of ore drives for production drilling shall be excavated along the strike depending on the width of the orebody.

Stoping is done by blasthole Stoping method. In the blasthole stoping method, slot is opened at the widest portion of orebody and rings are retreated towards the end of the stope. The muck is then withdrawn at extraction level through LHDs and then directly loaded in to mine trucks for hauling through ramps from underground to surface stock yard. From stock yard, ore is fed to the primary crusher using surface dumpers through haul road after sizing with hydraulic breakers.

Mining will be done using trackless operations up to -55mRL level using both declines for hauling. Mining below this level will be done using shaft hoisting system as the depth of hoisting will be increasing and service ramp will be available for the movement of machineries & services. Ramps will be further developed to lower levels for hauling as well as material movement to the lower block. Shaft will also be commissioned to haul the ore from lower block. Auxiliary lenses will be mined as the mining commences in the levels approximate to them. Mining of Sill/Crown pillar will be planned after due consideration studies of local & regional stability. Post filling will be done in all primary/ secondary stopes to enhance ore recovery keeping in view of mineral conservation.

11.3 Underground layout

The mine is accessed by:

North Ramp: 5.5m width & 5.0m height, Gradient: 1 in 7 and excavated from 512mRL up to 15mRL. North Ramp is connected to SKA2 Ramp at 300mRL through an intermediate ramp. This ramp provides the main access to SKA2 block and also acts as fresh air intake to the block. SKA2 ramp is developed up to 125mRL. Second ramp for SKA6 is being developed from 375mRL. The entry level 512mRL is selected above the HFL.

South Ramp: 5.5m width & 5.0m height, Gradient: 1 in 7 and excavated from 521mRL up to - 405mRL. At 495mRL in South ramp, a dedicated ramp is driven for SKA6 lens to 350mRL at Gradient 1 in 7 connecting all the levels. The entry level 521mRL is selected above the HFL.

Incline: 30° Incline of (3.0m width x 2.2m height section) from 511.5mRL up to 286mRL in about centre of mine strike. The entry level 511.5mRL is selected above the HFL.

Shaft: 7.5m finished diameter production shaft from 511mRL to -540mRL. Sinking completed and equipping in progress and scheduled for commissioning by May-2019. The entry level 511mRL is selected above the HFL..

11.4 System of drilling and blasting

Table 25: Drilling and Blasting Details

Parameters	Value
Drilling pattern in ore (Mineral)	Burn Cut
Drilling pattern in Rock (Host and Waste)	Burn Cut
Drilling pattern in Stopes	Ring / Parallel hole Drilling
Maximum number of holes blasted in a round.	63 Holes
Charge per round	250kg to 1000kg
Charge per hole	35kg to 200kg
Type of explosive	Emulsion Explosive
Powder factor (Norm)	
Rock development (Waste)	0.8 to 1.05 kg/t
Ore development	0.8 to 1.05 kg/t
Stope	0.3 to 0. kg/t
Powder Factor (Actual)	
Rock development (Waste)	0.8 to 1.05 kg/t
Ore development	0.8 to 1.05 kg/t
Stope	0.3 to 0. kg/t

11.5 Method and sequence of stoping

The orebody dips vary from shallow to moderate in all the mining blocks. The ore body configuration & geotechnical parameters of orebody & wall rocks are favourable for adoption of open stoping method as well as open stoping with post filling or for underhand mining. As such, blast hole open stoping method has been adopted for extraction of ore. The lower blocks are proposed to be mined with blast hole stoping with post filling in primary/ secondary sequence to maximize ore recovery or by underhand mining with post filling after suitable geotechnical analysis in primary/secondary sequence.

11.5.1 Blast Hole Stoping Method (BHS)

In blast hole stoping method, the strike length of mining block is divided into 30-55m stope and intervening vertical rib pillars of 10-20 m or in primary-secondary sequence. Stope and pillar dimensions are as per the recommendations of CMIFR, Dhanbad based upon geotechnical modelling. Stopes are being mined using EHS drilling (64mm) for trough drilling at extraction level and DTH/ITH (115mm)/ EHS drill machines (102/89mm) holes for down drilling from upper level. Blasting is done against a slot raise. For preparation of slot at each level in the mining block, a cross cut is developed first across the strike of the ore in full width of the orebody from footwall to hanging wall and later stripped to 6m width. A raise is opened from lower level to drill level by drop raising technique. Subsequently parallel holes are blasted against this raise for making a slot over the width of ore body. This slot provides free face for subsequent blasting of drill rings.

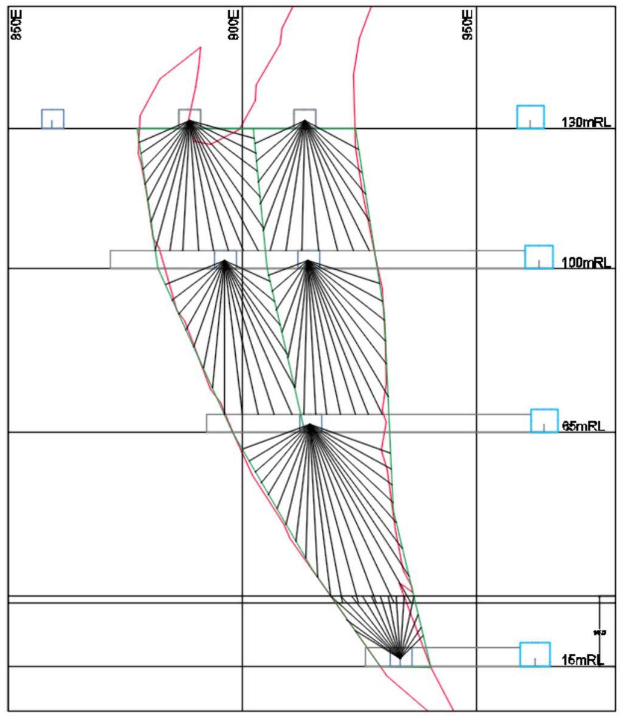


Figure 26: Stope Drilling Pattern

After the stopes are mined out, stopes are back filled and thereafter secondary stopes / rib pillars are mined out, in cases mining is feasible.

11.5.2 Mucking and Haulage

As blasting progresses, the stopes will be emptied of broken ore using 10t/17t/21t capacity diesel LHD. Remote control operation of the LHD will be used to recover ore from the hanging wall side of the slot area at the final clean up stage. For rest of the stope area complete ore is recovered from the trough drives and cross cuts.

The ore will be directly loaded into 50t/63t/65t LPDTs through 10t/17t/21t LHDs. Ore will be hauled out through both the ramps to surface stock pile. Run of mine from stockpile is fed to the primary crusher for ore treatment after secondary breaking. The waste from underground will be either transported to surface or disposed off in void stopes as per requirement.

11.5.3 Filling System

Back filling of stope voids will help increase the extraction of the orebody and stabilize the mining areas. This will be achieved by filling the mined out voids with tailings and adequate cement/binder (Hydraulic filling & Paste Filling) to allow extraction of pillars and adjacent secondary panels. hydraulic fill or paste fill are to be used as per back filling requirement to ensure stability of mine and to meet the back filling requirement of the mine.

Hydraulic Fill: Tailings from floatation stream will be fed hydro cyclones, where classification takes place and fine size overflow fed to HRT tailing thickener, after recovery of water the underflow of tailing thickener is withdrawn at 50-60% solids and sent to tailing dam by pumping in tailing lines. The recovered water will be recycled and used in plant to maintain zero discharge. The Coarser cyclone under flow is being collected in Fill Storage Tank and after cement addition and mixing at around 60% solids pumped in bore hole for mine back fill.

Paste Fill: The plant tailing generated is pumped to paste thickener. The underflow of paste thickener will be fed to the disc filters. The filter cake along with cement will be fed to the mixer unit and paste will be produced. The paste fed to underground reticulation system in mined out stopes.

Paste filling has been commissioned and in operation. Paste fill is defined as dewatered tailings that are non-segregating in nature and bleed little or no water. Paste does not segregate during low velocity transport, making its conveyance through pipes practical.

Paste fill is placed with adequate cement/binder slump to minimize pressure losses in the pipes and maximize the final paste strength.

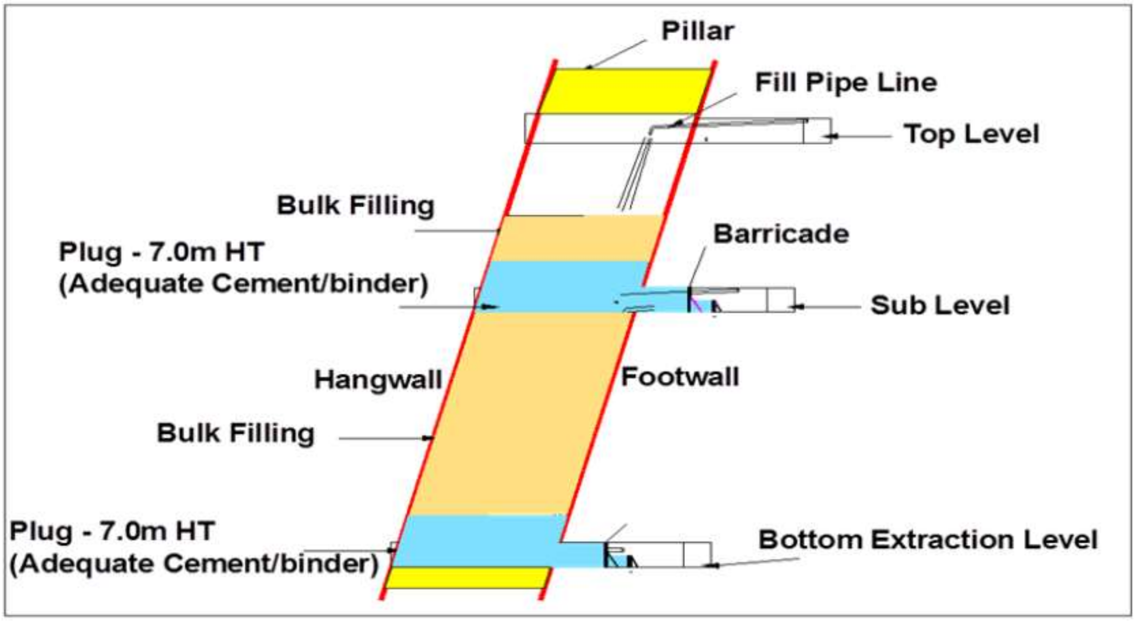


Figure 27: Typical layout of Paste filling in Stope

The paste fill plant process circuit will consist of dewatering of the tails slurry in a conventional thickener to 50 to 60% by weight. The product is further dewatered in a disc filtration plant to produce a wet filter cake comprising of 80-85% solids. Batches of this filter cake are then mixed in a high intensity shear mixture with water and cement/binder as required to make a consistent paste product. The required fill strength is 1000kPa. To achieve the proposed design strength adequate cement/binders will be added.

The paste will be conveyed in the mine through directly dropping into paste holes or pumping to destination. Paste backfill will be reticulated underground from surface plant as shown under. The paste reticulation system would use main levels as the main conduit for the steel and HDPE paste pipes. From the main levels the paste will be reticulated down the central line of each ramp between the sublevel accesses. Each access will have a cut out to receive the paste pipe from above and this pipe will enter the floor of the same cut out to be sent to the sublevel below. It would be from these cut outs that paste would be directed to fill stopes. Paste would be poured into stopes sealed off with barricades made from timber, concrete blocks or shotcrete and mesh.

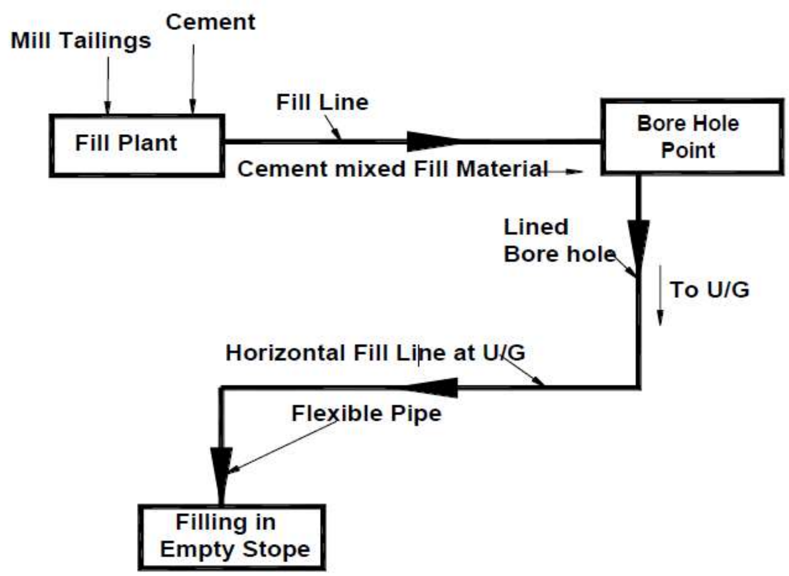


Figure 28: Schematic Flowsheet of Backfilling

11.5.4 System of underground transportation

Mine is having two Ramps, & one Incline. North Ramp & South Ramp (5.5m x 5.0m, 1 in 7 gradient) are suitable to deploy personal carrier of 16 & 32 person's capacity and light moving vehicles for transportation from surface to underground. Manholes, at every 20m are provided in ramp.

11.5.5 Surface Transportation

The ore from underground is stacked at Surface stockpiles. From surface stockpiles, the ore is transported by dumpers of 20t/30t/60t/100t capacity to primary crusher. Rock breaker is also deployed at surface stockpiles for breaking large sized boulders. The Ore is fed to primary crusher and to beneficiation plant. The waste is dumped at surface at temporary dump yard and then transported to Waste dump yard by dumpers of 20t/30t/60t/100t capacity.

11.5.6 System of winding / hoisting

As the ore body is lying at depth & also open in depth, sinking of a production shaft of 7.5m diameter has been completed and commissioned in Dec-2020. The capacity of the shaft is 3.75million tpa. The depth of shaft is 1051.5m. It has twin skip system of 32t capacity each. The shaft hoisting capacity is 700tph with 16 hours operation daily. The underground crusher is installed at -450mRL level. Ore is dumped from -55mRL level into a finger raise connected with ore-pass 1. The orepass-1 is connected between -55mRl level to -395mRL level which is main haulage level. A loader at -395mRL rehandles the muck from ore-pass to Crusher bin. The crushed ore is loaded into skips at -490mRL via conveying system.

After commissioning of the shaft, ore hoisting is also handled through shaft as well as ramps. Ramps provide for inter level ore transfer and function as a second access and also are used for movement of trackless equipment between levels.

11.6 Geotechnical Parameters

The deposit is located in the central part of the eastern limb of the major Dariba-Bethumni synformal fold. Lead-Zinc sulphide mineralization is hosted by two rock types, viz., Calc-silicate bearing dolomite and graphite mica schist. Principal ore forming minerals are sphalerite and galena. Pyrrhotite is the most abundant and ubiquitous sulphide gangue.

The mineralized zone at Sindesar Khurd is concealed below ground and there is no surface exposure in the area because of a regional folding. No old working in the area has been detected till date. The mineralization extends from 425 mRL to 200mRL and below. Out of a strike length of about 900m, about 400m of the central region is thicker. The ore body width in the area varies from a minimum of 15 m to as wide as 60m at 400mRL at the central region. A surface cap of about 100 m to 130 m of vertical thickness is left between the top 425mRL mining horizon and the surface. The cap rock consists of interbanded quartzite and mica schist. Surface level above the mineralized area is between 525mRL to 545 mRL. The footwall rocks are calc quartzite-biotite schist and although two to three sets of joints with minor faults and shearing are present, the joints are almost dry and tightly healed and the general ground seems to be very competent. In the calc-silicate bearing dolomite host rock, there are two to three sets of joints but hard and compact with minor or no infilling. The zone is almost free of any shearing. The hanging wall and footwall contacts are also free of any shearing. The hanging wall rocks are again quartz mica schist with a thin zone of waste dolomite in the immediate contact. In general, in the absence of major shears, folds and graphite schist, the strength characteristics of the area have greatly enhanced.

Although the ground is jointed but the absence of thick and in-filled joints have improved the RMR of the rocks to 79, rated as ‘very good’. The average RMR of the rock ranges from 69-79 whereas it decreases to 55-65 in C- Block and below -55mRL due to change in orebody plunge and dip. Since the response of the rock mass to an excavation is governed by its bulk modulus predominantly, the rock mass does not exhibit large deformations. The pillar dimensions for different upcoming lenses will depend upon their location with respect to shaft, nearby excavations and the presence of a geological structure. The stoping geometry has been designed such that the cap rock, the hang wall and the vertical rib pillars remain intact and stable during the life of the mine. The scientifically designed spacing and geometry of the rib pillars ensure stable wall rocks and isolate the stoping activities. To ensure additional safety all the level developments including that in the waste and ore are systematically supported with rock bolts /cable bolts as per Systematic Support/Code of timbering Rule. For monitoring hang wall movement, multipoint bore hole extensometers (MPBE) have been installed from hang wall drives at 400mRL, 290mRL, 195mRL, 197mRL, 130mRL & 300mRL. The rib pillars are also instrumented with stress meters to monitor the pillar stresses up to 15m depth from 400mRL. Stress monitoring with Uniaxial Borehole Stress meters in pillars. The rock movement is regularly monitored for analysis.

A full-fledged Geotechnical cell provides support system analyses, excavation design analysis and recommendations for mine modelling. Multi Point Borehole Extensometers (MPBEX) and Vibrating Wire Stress meter (Strain gauge type) and support testing instruments are installed to monitor the hanging wall, vertical and crown pillar. Ground vibration analysis, blast charge designing and rock bolt strength determination are also carried out. Mine modelling is done with the help of FLAC-3D, MAP-3D and ROCSCIENCE software.

11.6.1 Support Elements

Rock bolts: Fully encapsulated Rebar bolts of 2.4m length. A 25mm thread bar has a minimum of 200kN yields strength and 145kN shear strength. The rock bolts are full column grouted with Resin capsules of fast setting type with Gel time of 60 seconds.

Mesh: the mesh used for standard surface support of headings is galvanised, 2.3m wide X 4.5m long, 100mm square, 5.6mm diameter welded wire mesh. Minimum Characteristics: tensile strength 400Mpa, weld shear strength 9.3kN, torque 18Nm, weld penetration 10%.

Split sets: Steel Grade AB4121, Load bearing capacity: 6-8 Tons, Diameter 41mm, Length- 1500mm, Yield strength 470MPa, tensile strength 520MPa, Elongation rate 24%.

Cable bolts: All cable bolts used are seven strand type 15.5mm diameter with a minimum yields strength of 234kN. Cable bolts are grouted with water/cement ratio of between 0.35-0.40 using Ordinary Portland Cement (grade 43). The typical cable length is 6-10m. Cable bolts are installed in a staged process during 3-way or 4-way intersection development, in all extraction cross-cuts and in all crown pillars.

Self-drilled anchors: Grouted self-drilled anchors (SDA), or fore poles, are utilized to reinforce shear zone ground prior to development. SDA rods specification- length 3.0m, OD/ID – 32/18mm.
W- Straps: Length 4.5m X Width 0.28m X thickness 0.02m with a yield strength of 180kN, are utilize for pillar reinforcement. W-straps are used for stabilising highly stratified ground, where drive axis is parallel to stratification
Fibre reinforced Shotcrete (FRS): FRS is required to support very poor ground. It should have a thickness of 50mm and a minimum UCS strength of 35MPa.

11.7 Hydrogeological Parameters

11.7.1 Ground Water and Conceptual Model

Ground water movement is controlled mainly by the hydraulic conductivity of the crystalline metamorphic and hydraulic gradient. The ground water movement mainly takes place through the fractures and foliations of the crystalline.
A review of the topography and drainage pattern of the buffer zone reveals that there is a drainage divide passing in the central part of the buffer zone demarcating two water sheds, Banas river water shed forms a major part of the buffer zone covering northern part while a small area in the southern area of the buffer zone belongs to Berach river water shed. The ground water flow, which follows in general the surface topography has flow in two directions. The main ground water flow direction is towards the north east and towards Banas river while the southern part has ground water flow direction in southern direction.

11.7.2 Groundwater Flow Model

Ground water occurs under water table conditions and is transmitted through fractures, joints and foliations. Mica schist is impervious in nature and has developed secondary porosity only due to joints and fractures. There is very limited thickness of weathered zone and generally it lies above the zone of saturation. The depth to water in crystalline metamorphics in core zone, during post monsoon period ranges from 10 metres to 12 metres below the land surface. It is shallow near the river courses, surface water reservoirs and ponds while it is deeper in the area away from these sources. The depth to water ranges from 15 to 20 metres below the land surface during pre-monsoon period in lease area. The depth to water in buffer zone ranges from 5 metres to 12 metres during post monsoon period and 15 metres to 25 metres during pre-monsoon period. The fluctuations due to rainfall and ground water withdrawal are significant as the rocks have very low fracture porosity and hydraulic conductivity.

Water flow through lease area: The ground water flow, which follows in general the surface topography has flow in two directions. The main ground water flow direction is towards the north east and towards Banas river while the southern part has ground water flow direction in southern direction. The hydraulic gradient of ground water flow on the western side of the hill is towards Banas river with value of 2.32 m/km while in the eastern side is 5.76 m/km. The lower hydraulic gradient in the western part of Banas river water shed is due to ground water flow mainly through alluvial zone while in the eastern part, it is through mica schist which has lower hydraulic conductivity. The hydraulic gradient in the southern part is 6.97 m/km towards the south indicating ground water flow through metamorphic with very low hydraulic conductivity.

The hydraulic conductivity is very low. The depth of productive hydraulic conductivity has been observed up to maximum depth of 110m in the metamorphics, beyond which there are hardly any secondary openings making the metamorphics completely barren for ground water. Bore wells, drilled deeper than 110 metres did not release any additional discharge. It is therefore expected that in the underground mine also, the main aquifer zone from the depth of 10 metres to 110 metres from the general ground water will contribute the major component of inflow of ground water.

The main source of ground water recharge is by the rainfall by direct percolation to the zone of saturation. There is well developed drainage in the area, and significant part of the rainfall is lost as run-off from the area. A limited percentage of rainfall therefore reaches zone of saturation and becomes the part of ground water storage after meeting the evaporation and evapo-transpiration losses.

11.8 Mine Design Parameters

S No.	Particulars	Stope Parameters
1	Number of working stopes	7 - 15
2	Size of the panel	25 – 115m (H) x 20 – 45 m(L) x 15 – 85m (W)
3	Level interval	25m – 50m
4	Thickness of crown pillar	18m - 35m
5	Thickness of Sill Pillar	18m - 35m
6	Thickness of Rib Pillar	10m - 20m
7	Size/shape of man way	1.8m (H) x 1.2m (D) x 1.0m (W)
8	Size/shape of ore pass	Circular, 3.5m diameter
9	Method of stowing/back filling	Hydraulic filling, paste filling & waste filling
10	Method of drainage of stowed water	Hydraulic filling- Perforated pipes installed in stopes

11.9 Mine Schedule

11.10 Mining Fleet Requirements

The mine has been looking optimising the mining fleet in recent years and this is the detailed summary of proposed replacement strategies.

Table 26: Details of Existing and Proposed Machineries

Equipment	Numbers			Size /Capacity	Make	Motive Power	HP / kW
	Existing	Proposed	Conceptual				
Single boom Jumbo	3	0	0	32/45mm	Sandvik	Electricity	94 hp
Double boom Jumbo	18	26	26	32/45mm	Sandvik/ Epiroc/Resemin	Electricity	181 hp
Production Drill (EHS)	7	9	10	64/89/102mm	Sandvik	Electricity	98 hp
Production Drill (V30)	1	1	1	115/165/282/762mm	Sandvik	Electricity	125 hp
Production Drill (ITH)	2	1	0	102/115/165mm	KLR	Electricity	161 hp
LHD 10t	2	1	0	10t	Sandvik/Epiroc	Diesel	295 hp
LHD 17t	10	8	0	17t	Sandvik	Diesel	400 hp
LHD 21t	10	15	24	21t	Sandvik	Diesel	479 hp
LPDT 30t	0	0	0	30t	Sandvik/ Epiroc	Diesel	322 hp
LPDT 50t	8	4	0	50t	Sandvik	Diesel	575 hp
LPDT 63t	19	24	27	63t	Sandvik	Diesel	760 hp
LPDT 65t	2	2	2	65t	Epiroc	Diesel	760 hp
MCR	3	3	3		Epiroc	Electricity	69 hp
Road grader	2	3	3		Caterpillar	Diesel	100 hp
Explosive carrier	3	3	3	3-4t	Normet	Diesel	100 hp
Personal carrier	5	3	0	16 Persons	Normet	Diesel	100 hp
Personal carrier	11	11	12	32 Persons	Normet	Diesel	160 hp
Utility vehicle	22	25	25	3000kg	Normet	Diesel	100 hp
Charmec	5	6	6	2500kg	Normet	Electricity	148 hp
Cable Bolter	1	2	3		Normet	Diesel	75 kW
Water Sprinkler	3	4	4	3.5KL,10 KL	Normet	Diesel	100 hp
Light Motor vehicles	10	18	20	8 Person	Mahindra	Diesel	170 hp
RBO	8	12	12	5 Persons+1t	Normet	Diesel	129 hp
Mine pumps	21	25	30	300/400m head	Mather & Plate	Electricity	90 hp
Compressor	10	14	10	500/1000cfm	Ingersoll Rand	Electricity	200 hp
Total	**186**	**220**	**221**				

11.10.1 Equipment Productivity and Usage

Maximum Jumbo Drilling required for Development in proposed plan is 29,79,015 m in year 2021-22. The Productivity of Jumbo may be taken as 70m/hour for single boom jumbo and 100m/hour double boom jumbo for adequacy calculation. The proposed number of jumbos are adequate for conceptual ore production of 6.0 million tpa. The adequacy of number of drill jumbos is calculated in following table:

Table 27: Adequacy of Drill Jumbo equipment

Type	No. of Machines	Availability %	Utilization %	Productivity (m/hour)	Capacity (m/annum)	Requirement (m/Annum)
Single boom	3	0.75	0.25	70	344925	2979015
Double boom	18	0.75	0.25	100	2956500	
Total	21				3301425	
					Capacity	**111%**

The existing number of drill jumbos are adequate with the mine development requirement. The old equipment shall be replaced as per maintenance schedule, if required.

Adequacy of Production drilling: For Ore Production from Stope, it is required to carry out large diameter drilling (89mm to 165 mm dia) drilling, called production drilling. The drilling is to be undertaken between Sub levels at an interval of maximum 50 m and in the ore body dipping at 50-60˚. The drilling in stope can be divided into two types:

Downhole Drilling: Holes drilled in Stopes from Top level downwards to lower level either parallel to dip, for Slot or in Ring pattern vertically in transverse section

Uphole drilling: Holes drilled from extraction/haulage level ore drive at 80˚ inclination towards slot in upward direction, called trough rings. The holes for trough rings are 64mm in diameter and blasted against free face of slot.

Table 28: Statement of Production drills capacity and requirement

Type	No. of Machines	Scheduled Hours/annum	Availability	Utilization	Productivity (m/hour)	Capacity (m/annum)	Requirement (m/Annum)
EHS	7	8760	75%	45%	30	620865	600000
V30	1	8760	75%	45%	12	35478	
ITH	2	8760	75%	45%	6	35478	
Total	**10**	**26280**				**691821**	**115%**

The production drilling machines have capacity of 115% of requirement which is adequate for annual requirement for ore production of 6.0million tpa.

Adequacy of Loading & Hauling:

The Load haul dumpers will be utilized to load the dumpers and also to dump the ore/waste into the orepasses/waste passes for inter-level transfer of rock.

Table 29: Adequacy of Loading Equipment

Type	No. of Machines	Schedule Hours/annum	Availability	Utilization	Productivity (tonnes/hour)	Capacity (tonnes/annum)	Requirement (tonnes/Annum)
17t	10	8760	75%	68%	100	4467600	9750000
21t	10	8760	75%	68%	125	5584500	
Total	**20**	**17520**				**10052100**	**103%**

The Low profile dump trucks (LPDTs) will be used for hauling of ore/waste to surface or the Orepasses/

waste passes at unloading points which will be hoisted through shaft. The Shaft is having rock hoisting capacity of 3.75 million tpa. Shaft will be utilized at its full capacity from FY 2020-21 at 3.75 million tpa and remaining ore/waste will be hauled to surface via declines by LPDTs.

Table 30: Adequacy of Hauling Equipment

Type	No. of Machines	Schedule Hours/annum/machine	Availability	Utilization	Productivity (tonnes/hour)	Capacity (tonnes/annum)	Requirement (tonnes/Annum)
50t	8	8760	75%	70%	50	1839600	7775186
63t	19	8760	80%	70%	60	5592384	
65t	2	8760	80%	70%	62	608294	
	29					**8040278**	**103%**

11.10.2 Mine Personnel Requirements

The Sindesar Khurd Mine is under the charge of Associate Vice President & Unit Head (SK Mine) who reports to SBU Head (Dariba Mining Complex). The Mine Manger is assisted by mining engineers, geologists, mechanical engineers, electrical engineers, mine surveyor for direct supervision & control of mines. The mill manager is assisted by ore dressing engineers, mechanical engineers, electrical engineers and instrumentation engineers.

The contractors are engaged for mine development, drilling, blasting, exploration drilling, mucking, hauling, hoisting and other allied activities. The contractual manpower consists mostly of persons from nearby areas/villages.

The contractors work under control of mines manager and direction/ supervision of qualified executives.

Table 31: Details of Supervisory staff

Designation	Function/Section	Nos
Agent		1
Mine Manager		1
Safety Officer		1
Surveyor		1
Assistant Manager		11
	Ventilation Officer	1
	Shift in-charge	4
	Upper Section	1
	Middle Section	1
	Lower Section	3
	Shaft	1
Graduate Mining Engineer		60
Geologist		8

Survey Assistant	5
Other administration & Technical Supervisor staff	184
Grand Total	**272**

Table 32: Labour skill level compliment (2018)

Category	Manpower Nos.
Highly Skilled	20
Skilled	500
Semi-Skilled	880
Un-Skilled	400
Total	**1800**

11.11 Mine Ventilation

Numerous ventilation studies have been conducted over several years as the mine continues to get deeper and expand production that requires additional fleet and the increase in strata heat that occurs naturally underground. Extracts from the last Ventilation study associated with a PFS study is included below. In SKM, air typically is down cast via intake airways, consisting of a combination of haul ramps, dedicated intake declines, ventilation holings to surface and dedicated downcast shaft and intake air passes, as applicable and relevant.

11.11.1 Auto-compression and Inlet Air Condition

In considering the current mine design, use is fully generally made of the existing airways and systems possible whilst still maintaining reasonable control over the overall air distribution throughout the mine to and from the working places.

An air temperature increase occurs in the down-casting air due to adiabatic compression.

The increment in temperature typically is 10°C dry bulb per 1 000 metres and 2.3 °C wet bulb per 1 000 metres vertical depth. Considering the generally very hot ambient conditions in this area (Udaipur and surrounds) during the summer months, this factor would be significant as some of the mines are developed deeper.

Offsetting this factor is the fact that the cooler rock mass in the upper areas of the mine serves as a heat sink which effectively offsets some of the increased temperatures in summer (April through July) and therefore not all the heat associated with auto compression will necessarily manifest in the heat balance. An allowance based on initial thermal modelling of the mine which also considers the effect of the diurnal temperature variations indicates that this source can be expected to contribute between 5 and 6 MW to the air stream.

When operating deeper and potentially hotter mines, especially where large diesel driven fleets are contemplated, it is good and generally accepted practice to evaluate the mine from a mid-summer, mid-afternoon perspective in order to determine projected conditions underground. This implies a limited residual cooling capacity in the air. As previously implied, there is a lag in the impact of these temperatures in the underground workings (due to the rock mass heat sink effect) and therefore the model used for MKS also incorporates a tool to model the diurnal cycle into the average condition projection in the mine, so that the outputs are not significantly skewed w.r.t. the maximum average input temperatures.

Table 6-7 below reflects the annual figures (mean, mean maxima and mean minima) for Udaipur and from these, there is a peak maximum average dry bulb temperature around April leading into May of approximately 38 °C (with an average minimum of approximately 24°C).

For the planning of thermal conditions for SKM, a mean mid-summer dry-bulb temperature of 38 °C should therefore be considered, with a mean wet bulb temperature at the same time of the day of approximately 24 °C (mean humidity approximately 28%) as the quality of 'air during summer w.r.t. heat removal capacity would be significantly compromised.

11.11.2 Strata Heat

Strata heat due to the incipient virgin rock temperature (VRT) also plays a role. There is one verbally reported VRT increment for the Vedanta, India Group of mines of 1.0 °C per 100m vertical depth. Table 6-8 below is a composite graph of several thermal gradients from around the world. The graph for India (brown, annotated curve) reflects the anticipated temperature increment.

Depending on depth below surface, this varies from approximately 1.5°C per 100m for the first 1000 metres with an average of 1.1 °C per 100m for depths below this elevation for deeper mines. For the purpose of planning the mines below 1 000 metres vertical depth, the latter figure was therefore used for SKM.

11.11.3 Heat from Diesel Driven Equipment

Diesel driven equipment give rise to heat emissions. This is since, under optimum efficiencies, diesel engines convert approximately 30 to 35% of the calorific value of diesel fuel into mechanical power, depending on the engine design and management system, the balance appearing as heat. This implies that a simple calculation can be affected to determine the heat produced by diesel driven equipment. This factor is universally accepted as being 3. In addition, it is also accepted that diesel driven equipment is only partially effectively utilized, and often at part loading only.

Typically, LHD’s and haul trucks are used to approximately 60% of their full capacity in relatively well managed mines (and less in poorly managed mines). Similarly, roof bolters and drill rigs will only use their diesel driven engines 15 to 20% of the time to travel from one site to another. When generically applying these values to a fleet, it is possible to predict to a reasonably accurate level, the overall heat generated. Study of Table 1 reveals that for SKM, the planned mechanical energy output based on the fleet composition and utilisation therefore is anticipated to be to the order of 13.9 MW and the heat generation by this fleet therefore will therefore amount to approximately 42 MW.

From these calculations it can be seen in table below that the air volume circulated - approximately 1 685 m3/s at the mean air density of 1.11 kg/m3 as required for the maximum anticipated fleet size - would be insufficient to dilute and remove the anticipated heat load imposed on this mine (during the hottest part of the afternoon, on average, under summer conditions).

Table 33: Calculations for the Dilution and Removal of Diesel Driven Exhaust Contaminants (Current Mine)

SKM - LOM Mine Design: Full Production, 7Mtpa with Hoisting, FY31											
Vehicle Fleet		Heat Calculations						Diesel Engine Air Requirement Calcs - DPM			
										CANMET/MSHA STANDARD	
Diesel Fleet Composition	Operating FY31	kW	UF	Equivalent kW - after Utilization	Tot kW	Residual kW Utilised	Diesel Heat kW	Factor 0.06m³/s/kW, m³/s nil leakages (Directive 7.3)	Factor 0.06m³/s/kW, m³/s nil leakages, excl. "Small" Engine (Directive 7.4)	CANMET/ MSHA Standard per engine) m³/s/kW	CANMET/ MSHA Standard to achieve 100 µg/m³ Elemental Carbon
Jumbo	20	74	0.2	15	1480	296	888	89	89	0.037	94
Production Drill	13	74	0.2	15	962	192	577	58	58	0.037	61
Sandvik - LH621	6	211	0.6	127	1266	760	2279	76	76	0.037	81
Sandvik - LH621	14	450	0.6	270	6300	3780	11340	378	378	0.037	402
Sandvik - TH663	0	565	0.6	339	0	0	0	0	0	0.037	0
Sandvik - TH663	32	565	0.6	339	18080	10848	32544	1085	1085	0.037	1153
Scissor Lift	20	75	0.2	15	1500	300	900	90	0	0.037	96
Explosive Carrier	14	75	0.2	15	1050	210	630	63	0	0.037	67
Personnel carrier	15	75	0.5	38	1125	563	1688	68	0	0.037	72
Shotcreter	6	74	0.2	15	444	89	266	27	0	0.037	28
Lube/fuel Truck	4	125	0.25	31	500	125	375	30	30	0.037	32
Cable Bolter DS421	4	70	0.5	35	280	140	420	17	0	0.037	18
Total Underground	**148**		–		**30545**	**16814**	**50442**	**1833**	**1569**	–	**1949**

In this tabulation there is also is an allowance of approximately 7 000 kW for heat generated by "other" sources, such as partial auto compression, broken rock, pumping, etc. to complete the mass-energy balance estimate.

As can be seen from this balance a further 30 MW of cooling will be required for this air volume to effectively cool and remove the heat (predominantly generated by the diesel driven fleet component) from the mine. As a comparison, for the same air volume currently circulated. Table below reflects the refrigeration required to achieve the same results during mean mid-winter conditions.

Table 34: SKM Conceptual Mine Design, Heat Balance (Mid-summer, Mid-afternoon), Inclusive of all

Heat Balance, Summer (Required Air Flow) @ 0.06m³/s/kW (Directive 7.3)		
Sigma heat: Intake #	73.5	
Sigma heat: Upcast	90	
Air circulated, m^3/s @ 1.11 kg/m^3	1833	
Mass flow, kg/s	2034	
Heat removal capacity, Air	33566	
Diurnal Flywheel (est)	5000	
Strata heat (est)		1200
Fan heat		9160
Diesel heat		50442
Other (est.) (incl backfill)		7000
Totals	38566	67802
Residual Air Cooling Power, kW	**-29236**	
Refrigeration Required, kW	**35000**	

Table 35: SKM, Heat Balance (Mid-winter average temperatures), Inclusive of all Principal Sources

Heat Balance, Winter, at Planned Air Circulation Rates (Directive 7.3)		
Sigma heat: Intake #	52.5	
Sigma heat: Upcast	90	
Air circulated, m^3/s @ 1.11 kg/m^3	1833	
Mass flow, kg/s	2035	
Heat removal capacity, Air	76299	
Diurnal Flywheel (est)	5000	
Strata heat (est)		1200
Fan heat		9160
Diesel heat		50442
Other (est.) (incl backfill)		7000
Totals	81299	67802
Residual Air Cooling Power, kW	**13497**	
Refrigeration Required, kW	**NIL**	

11.12 Ventilation Modelling

11.12.1 Input Parameters

Input parameters specific to the Vedanta properties were evaluated and then selected to suit where required. These include, amongst others, the following:

- Surface ambient conditions, which are based on meteorological data for the region – as discussed;
- Rock mass characteristics (rock mass density, heat conductivity, diffusivity and emissivity values) thus allowing for in situ virgin rock temperature estimation as per the graph provided;
- Mining elevations (surface and underground);
- Geological features such as faults and dykes, fissure water, etc. (none identified in this case);
- Shaft design details (size, length, level of equipping, etc.);
- Airway parameters (dimensions, roughness, etc.)
- Layout/configuration of shaft areas, workshops and the general mine;
- Sealing quality/leakage losses;
- Mining method;
- Mining equipment (diesels, conveyor installations, etc.);
- Contaminants such as dust/particulates, gases, fumes, vapours, blast products, heat, etc.
- Ventilation appliances, e.g. main and auxiliary fans, seals, regulators, airlocks, ventilation cross-overs, etc.
- Other factors as may apply, such as workplace layouts, barrier pillars, dedicated travelling and hauling roads, face advance rates, production rates, etc.

11.12.2 Intake and Up cast Shafts

Cognizance was taken of shaft sizes, geographic position relative to the orebody and overburden, the main fan capacities and potential leakage losses.

As this is a "brown fields" project, it is not possible to simply discount the available infrastructure and, because of this, the approach adopted here was fully to utilise possible all existing shaft capacities to achieve the planned ventilation throughput of approximately 1 660 m3/s. Where necessary, some shafts are repurposed (i.e. converted from up cast to downcast configuration, etc.) to achieve the ventilation volumes at the appropriate workplaces and to ensure enough ventilating volumes in especially the haul ramps, as these will be required to carry a large fleet of dump trucks.

11.12.3 Main Fan Specifications

For the purpose of this exercise, the existing main and booster fans as selected and present for ventilating the mines were evaluated and accounted for. These fans were considered from a suitability perspective for future planned mining operations and appropriate recommendations regarding their ongoing use or upgrading and/or replacement made to suit the LOM design.

In general, it should firstly be borne in mind that the main air pass dimensions (other than the vertical hoisting shaft and decline ramps) are 3.5m diameter. This applies to both intake and up cast shaft systems. At the design air carrying capacities, these shafts should therefore be able to carry between 200 and 250 m3/s, up casting. Currently, these quantities are generally not achieved.

below reflects the proposed fan upgrades required to achieve the desired rate of ventilation and the proposed shaft and main fan positions and volumes for the LOM conceptual design.

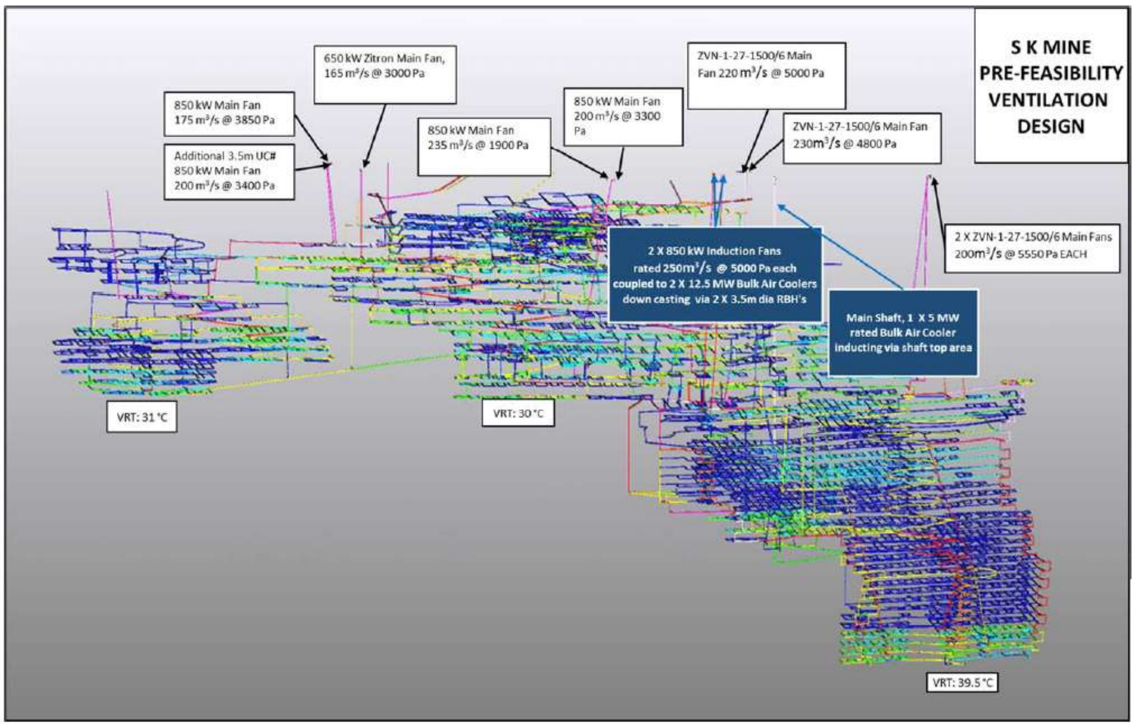


Figure 29: Ventsim® Model, LOM Design reflecting Main Fan Sizing and Positions and Nominal Capacities at Full production, Full Extent and Depth

11.12.4 VentSim

The modelling program used by the mine and for the purposes of this study is VentSim®, which is an advanced, computerised program utilising known and proven principles and processes to derive outcomes. It considers all important parameters and factors to predict heat flux rates, the effects of heat sources, moisture and daily (diurnal) temperature fluctuations, thereby smoothing out results to more accurately reflect practical conditions in workplaces. It does, however, still only effectively provide snapshots in time and space and, as such, cognizance must be taken of the fact that variations around the predicted conditions can and will occur. One example is the fact that, during modelling, diesel driven equipment is inserted in specific localities which generally are dispersed throughout the mine. However, at times, this equipment tends to congregate around strategic positions, e.g. main tipping areas, in workshops etc., during which time conditions in those areas will degrade accordingly.

The Life-of-Mine (LOM) design these impacts as well as the size and localities of the refrigeration plant will therefore be specifically addressed in the next series of exercises and will be dealt with in a subsequent report.

As with all modelling of this nature, the input data is critical in determining confidence limits in the outputs derived and therefore all due care was taken during this process to utilise best available information and to standardise this for the mine. This information is derived from reputable resources and is also based on extensive experience gained in managing and modelling similar mines (e.g. four Glencore copper mines in Zambia, Jabal Said in Saudi Arabia as well as several other zinc mines in the Middle East and Southern Africa).

11.12.5 Mine Design Outputs

Table 6-19 reflects the calculated air requirements to meet the 0.06m3/s/kW rated diesel power ventilation design criterion for particulates and gases, which is estimated at approximately 1 670 m3/s. The anticipated refrigeration requirement to meet the mine's cooling requirements is approximately 30 MW cooling capacity for mid-summer conditions. During mid-winter it is predicted that the cooler intake air should be enough to deal with the heat load and, because of this and in order to reduce overall ventilating and refrigeration operating costs, SKM is a strong candidate for Ventilation-on-Demand (VOD) management systems into the future. The purpose of this would be to manage air flow and (especially) refrigeration requirements based on the number and type of diesel driven vehicle present in the mine at any given time. In this way these costly resources (ventilation and refrigeration) can be optimally managed from an OPEX perspective.

11.12.6 Refrigeration Strategy

The refrigeration strategy proposed for SKM is to bulk cool air on surface, utilising modular refrigeration plant. These self-contained modular units (typically 2 to 2.5 MW capacity each) can be purchased over time to smooth cash flow requirements, are simple to install and operate on a "plug-and-play" basis and allow for ease of operating at peak efficiencies as seasonal and diurnal cycles vary.

Cooling is to be provided at two dedicated 12.5 MW Bulk Air Coolers situated atop two dedicated 3.5m diameter dedicated raise bored shafts situated approximately 80m from the Zitron 1500kW Main Fans. The cooling is inducted into the dedicated 3.5m downcast RBH's at a rate of 250 m3/s/per shaft (i.e. 500 m3/s, total). The mean mid-summer discharge temperature from the BAC's is approximately 11.0 °C WB and 12°C DB.

In order to counter the auto compression effect in the main downcast shaft and to keep the shaft station areas and workshops within design specifications, it is recommended that the possibility of inducting approximately 4MW of refrigeration via the shaft sub bank be investigated. This would require an induction duct of approximately 9m2 equipped with a low-pressure induction fan handing approximately 70 to 80 m3/s of air and a BAC rated at 4 MW capacity, discharging at approximately 7 °C.

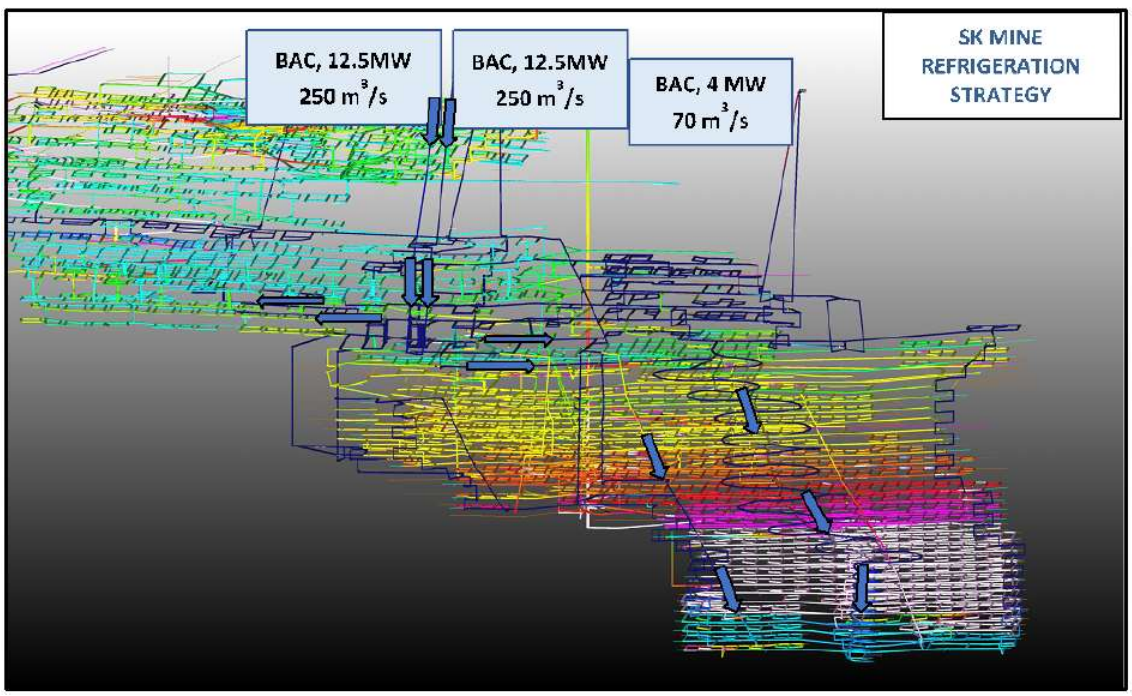


Figure 30: SK Mine Refrigeration Strategy

12 Processing and Recovery Methods

12.1 Introduction

Existing beneficiation capacity at Sindesar Khurd Lead Zinc Mine is 6.5mtpa with Plant-1 having capacity of 3.0 mtpa, Plant-2 and capacity of 2.0 mtpa. A new beneficiation plant with a 1.5mtpa capacity with similar specifications the existing 2mtpa plant was commissioned in FY 2018-19 which brings the capacity to 6.5mtpa.

The ROM ore from the mine is being dumped into primary crusher. After primary crushing, the ore is being stacked at coarse ore stockpile.

The Plant includes following sub-sections:

- Crushing & screening section
- Grinding section
- Lead flotation section
- Zinc flotation & regrinding section
- Lead & zinc concentrate thickening & filtration section
- Tailing Thickener, dewatering & disposal.
- Reagent section

12.2 Process Flow maps

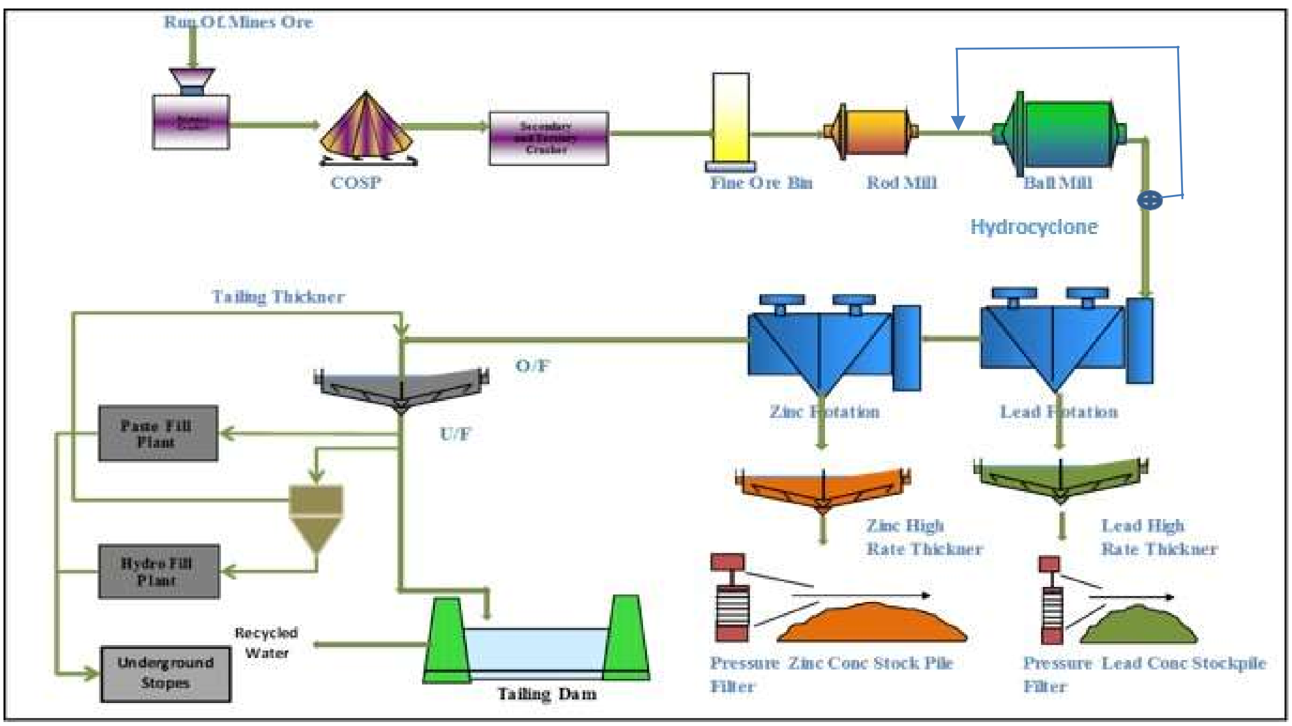


Figure 31: Mill Flow Sheet

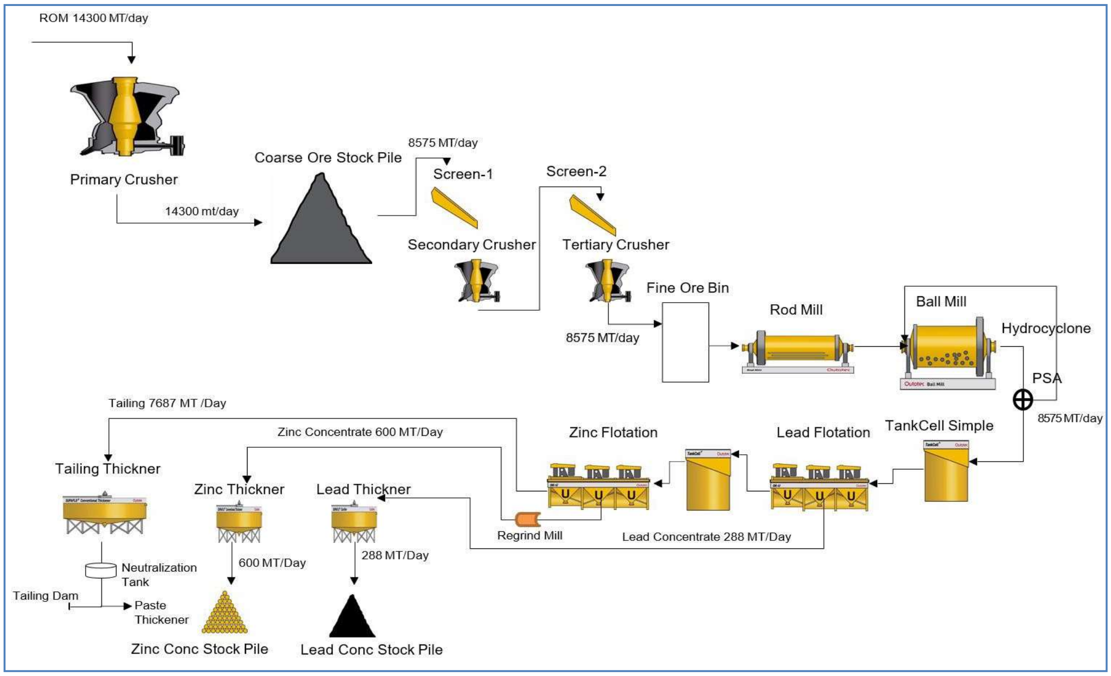


Figure 32: Material balance Flow chart of 3.0mtpa plant

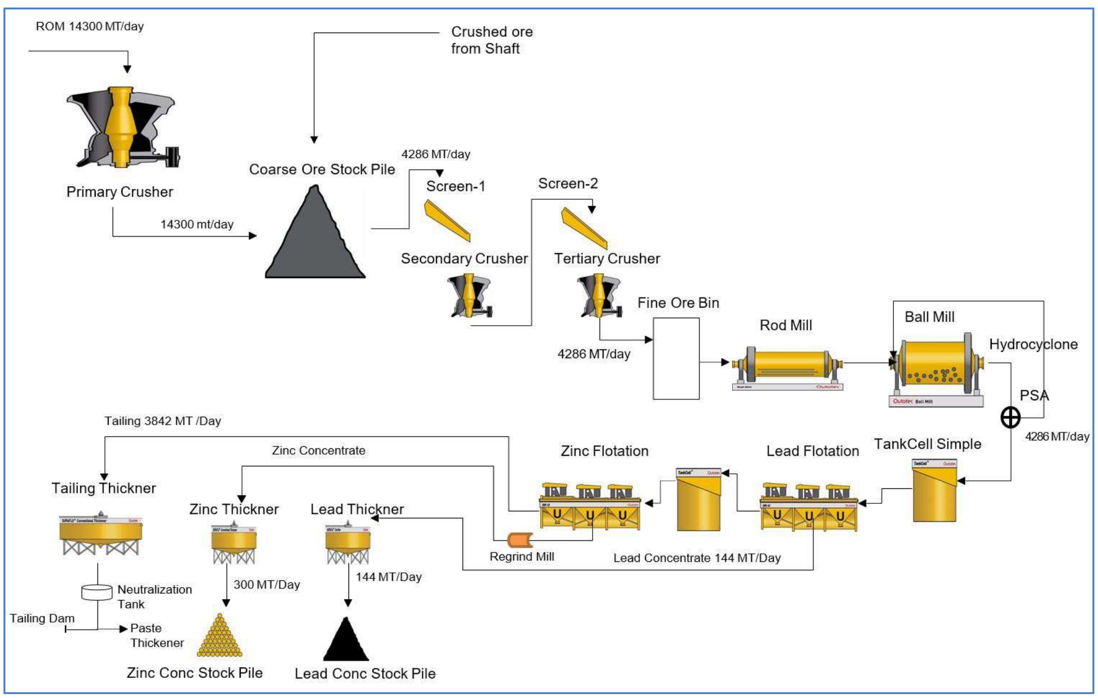


Figure 33: Material balance Flow chart for 2.0Mtpa

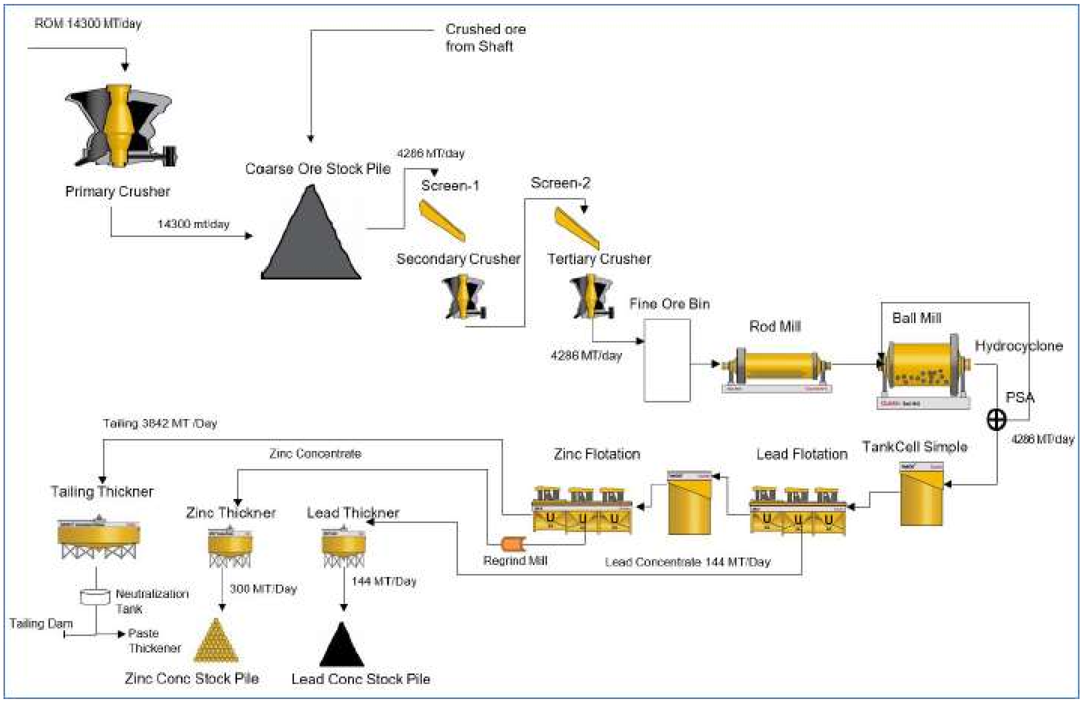


Figure 34: Material Balance Flow chart for 1.5mtpa Plant

12.3 Crushing, Screening, Ore flow

Run-of-mine (ROM) ore is dumped into a hopper ahead of the primary gyratory crusher with capacity of 800 t/hr. The crusher reduces ROM ore to approximately -150mm size (output size). Crushed ore is transported to the coarse ore stockpile by a belt conveyor. The belt conveyor is provided with belt weigher to get record & control the amount of ore transported.

The primary crusher house (PCH) has been provided with dust suppression system where water is being added in mist form at different points to suppress dust.

The primary crushed ore from COSP (Coarse Ore Stock Pile) is fed to double deck scalping screen. Oversize of this screen is fed to the secondary crusher (output size is -19mm) with capacities 460 t/hr in plant-1 & 350 t/hr in plant-2. The capacity of secondary crusher in plant-3 is 315 t/hr. The intermediate product is being fed to the secondary crusher product conveyor. Screen under size is fed to fine ore bins through belt conveyors. Secondary crusher output is fed to a tertiary crusher. The material from tertiary silo bin is being fed to two tertiary crushers. Tertiary screen undersize sent to fine ore bins. Tertiary screen over size is fed to tertiary crushers. Tertiary crusher output (throughput same as Secondary crusher) recycled back to tertiary screen & crusher.

A wet type dust extraction system provided in COSP tunnel, Secondary & tertiary. Crusher house and Fine Ore Bin (FOB) to remove fugitive dust at dust generation points. Dust slurry pumped to the grinding circuit.

12.3.1 Secondary and Tertiary Crushing

150 mm size material feed to double deck scalping screen having upper deck opening of 50 mm and lower deck opening of 19 mm so -19 mm size material directly report to fine ore bin overflow of scalping screen will feed to secondary crusher ,product of secondary crusher collected in silos and feed to tertiary screen where -19 mm will report to fine ore bin and oversize will report in territory crusher this work in close loop as per following flow chart:

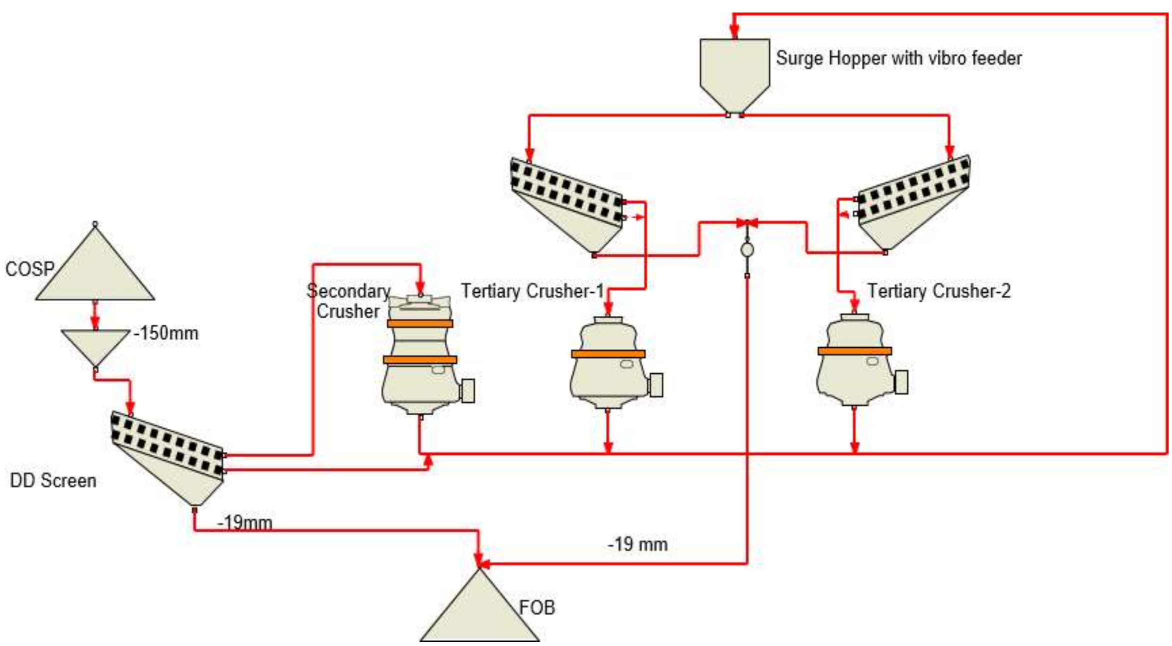


Figure 35: Flow Chart of Crushing Section

12.3.2 Grinding section

The fine ore of P80 20mm size from FOB. Extracted by belt feeders and fed to the Rod mill by feed conveyors. The mill feed conveyor provided with a belt weigher to measure the ore treatment. Bond work index is 9.8 and power consumption is 30kW/t of ore treatment.

1st stage grinding carried out in a Rod mill in open circuit & 2nd stage grinding carried out in a Ball mill in closed circuit with hydro cyclone classification system. By design, rod mill and ball mill are placed in series and hence their output is discharged into a common sump and pumped to the cyclone cluster from where underflow return to ball mill and the overflow from cyclone cluster constitute feed to the flotation circuit. During operation, process parameters have been adjusted to produce a Mesh Off Grind (MOG) of 80% passing 75 microns.

Control of cyclone overflow particle size through PSI (Particle Size In-stream analyser): PSI analyser is installed after cyclone overflow. PSI will measure the 80% passing size cyclones o/f which is ideally be 75 microns. If PSI detects that the cyclone o/f 80% passing is below 75 microns, it will increase the speed of belt feeder below FOB to add more ore in rod mill feed. Vice versa, if PSI detects that the cyclone o/f 80% passing is coarser than 75 microns, it will decrease the speed of belt feeder below FOB to lower the feed in rod mill. The output size of rod mill is less than 1 mm and the capacity of Rod mill & Ball mill (work in circuit) is mention below:

- Plant-1 2 set of 182 Mt/Hr. (2x182=364 Mt/Hr.)
- Plant-2 243 Mt/Hr.
- Plant-3 182 Mt/Hr.

12.4 Flotation

12.4.1 Lead flotation section

The lead flotation stream comprises of conditioning, roughing, scavenging and 3-stages of cleaning. The hydro cyclones overflow from the grinding along with the lead scavenger concentrate & lead 1st cleaner tails conditioned with reagents in a conditioner and subjected to flotation in lead rougher scavenger bank. The rougher concentrate is being cleaned in 3 stages of lead cleaners. The lead rougher concentrate fed to the 1st cleaner cells. The concentrate from the 1st cleaner shall be pumped to the 2nd stage flotation cells and the concentrate from the 2nd stage cleaners shall be fed to the 3rd cleaner flotation cells. The 3rd stage cleaner concentrate is the final lead concentrate. Stage-wise volume of plant-1: Stage-wise volume of plant-2: Lead rougher-280m^3, lead scavanger-140m^3, lead cleaner-110m^3, zinc rougher-280m^3, zinc scavanger-210m^3, zinc cleaner-270m^3.

- Capacity of Conditioning tank is 70 m^3 and flotation cell is given below:
  - Plant-1- Rougher & Scavenger -38 m^3 & Cleaners- 16 m^3 & 8 m^3
  - Plant-2 Rougher & Scavengers- 70 m^3 & Cleaners- 36 m^3 & 16 m^3
  - Plant-3 Rougher & Scavengers- 70 m^3 & Cleaners- 36 m^3 & 16 m^3

12.4.2 Reagent addition point as mentioned below:

- SIPX: at Lead Conditioner, lead scavenger, Zinc Conditioner and zinc scavenger
- MIBC: at Lead Conditioner, lead scavenger, Zinc Conditioner and zinc scavenger
- Nigrosine: Lead Cleaner
- Copper sulphate: Zinc conditioner and Zinc scavenger
- Lime: Zinc conditioner

12.4.3 Zinc flotation & regrinding section

The Zinc flotation section treating lead scavenger tails from the lead flotation circuit shall comprise of conditioning, roughing, scavenging, 3 stages of cleaning and regrinding. The lead scavenger tails along with the reground Zinc scavenger concentrate and Zinc Cleaner-1 tailings has been conditioned with

reagents in two stages of conditioning and subjected to flotation in Zinc rougher-scavenger banks of cells. The zinc rougher concentrate fed to the 1st cleaner cells. The concentrate from the 1st cleaner

pumped to the 2nd stage flotation cells and the concentrate from the 2nd stage cleaners fed to the 3rd cleaner flotation cells. The 3rd stage cleaner concentrate shall be the final zinc concentrate.

12.5 Concentrate Thickening and Filtration

12.5.1 Zinc and Lead concentrate thickening & filtration section

Lead and zinc concentrates sent to their respective high rate thickeners installed each for lead concentrate & zinc concentrate generated from the plant.

The underflow of Lead and Zinc thickeners pumped to their respective holding tanks and from holding tanks report to plate filter for further moisture reduction finally concentrate of 9.0% moisture store in respective lead and zinc stockyard.

Overflow from lead thickener collected in suitable tank which will have at least one partition to take out sedimented lead in overflow coming from lead high rate thickener. The partition has suitable drain arrangement with drain valve from where the deposited lead shall be collected from time to time. The lead thickener overflow pump shall discharge to main process water tank i.e. tailing thickener o/f tank.

Overflow from zinc thickener collected in suitable tanks which will have at least two partitions to take out sedimented zinc in overflow coming from zinc high rate thickener. The partitions have suitable drain arrangement with drain valve from where the deposited zinc collected from time to time. The zinc thickener overflow pump gives discharge to zinc circuit in floatation area.

Each plant is equipped with suitable capacity filters of lead and zinc to reduce moisture in concentrate to 9.0% the filtration capacity of each plant is mention below:

	Lead	Zinc
Plant – 1	20.0 t/hr	36 t/hr
Plant – 2	13.0 t/hr	24 t/hr
Plant – 3	10 t/hr	18t/hr

There is suitable flocculent system for thickeners,

12.5.2 Metal Distribution in concentrate and tailing

	Metric Tons (MT)	% Pb	% Zn	Ag (PPM)	Metal Distribution		
					Pb	Zn	Ag
Feed	5050	2.16	3.90	116.00	100.00%	100.00%	100.00%
Pb Conct Tonnage	182	53.16	3.87	2686.00	90.84%	3.66%	85.47%
Zn Conct Tonnage	348	0.79	51.49	78.00	2.54%	91.75%	4.67%
Tailing	4520	0.16	0.20	12.00	6.62%	4.58%	9.24%

12.6 Tailings, Thickening and Filtration

12.6.1 Tailing dewatering and disposal

Tailing dewatering & disposal section comprise of tailing thickener, neutralization tank, pumping of tailing to tailing pond/dam and reclaimed water pumping.

There are three tailing disposal lines each capable of handling the tailing generated from 6.5 million tpa plant capacity. Tailing is pumped through 12" MS pipeline from beneficiation plant to tailing dam. Three parallel lines are installed from which two lines are active at a time.

Water is being reclaimed from tailing pond and pumped back to process water tank (i.e. tailing thickener o/f tank). Makeup water is fed from the 2000- cum reservoir to process water tank by gravity and zinc thickener o/f tank.

The pH of water is above 7.0 as attached in Table 86: Quality of Tailing dam water Upstream and Downstream) so neutralisation is not required.

12.7 Reagents and Water

12.7.1 Reagents

Reagents Zinc Sulphate ($ZnSO4$), Sodium Isopropyl Xanthates (SIPX), Copper Sulphate ($CuSO4$), Methyl isobutyl carbinol (MIBC), Aero3410, Nigrosine and lime are used in the main process plant. The reagent system comprises of preparation tank, storage tank & day tank. There are agitators in the preparation & storage tanks.

For all reagents being supplied from day tanks, there are two pumps (1 op + 1standby). MIBC does not require preparation.

All reagents are added at required points at the required dosages in the flotation circuits by use of flow meter and control valve in closed loop. There are suitable metering types dosing pumps (8 op+ 2 standbys) for control of MIBC flow.

Lime slurry prepared in ground level sump pump and transferred to holding tank after suitable classification in cyclones to take out grits.

From the holding tank, the lime solution transferred to the lime distribution tanks. From this distribution tank, lime pumped through a ring main with return line to the respective addition points.

12.7.2 Water

Fresh water requirement for the project will be 2000 cum/ day in addition to existing 14000 cum/ day, sourced from STP Udaipur and matrikundia dam. NOC issued by CGWA for inflow of ground water of 121m^3/day, stipulated water recharge 88,330m^3/year. No groundwater will be extracted for meeting the water requirement.

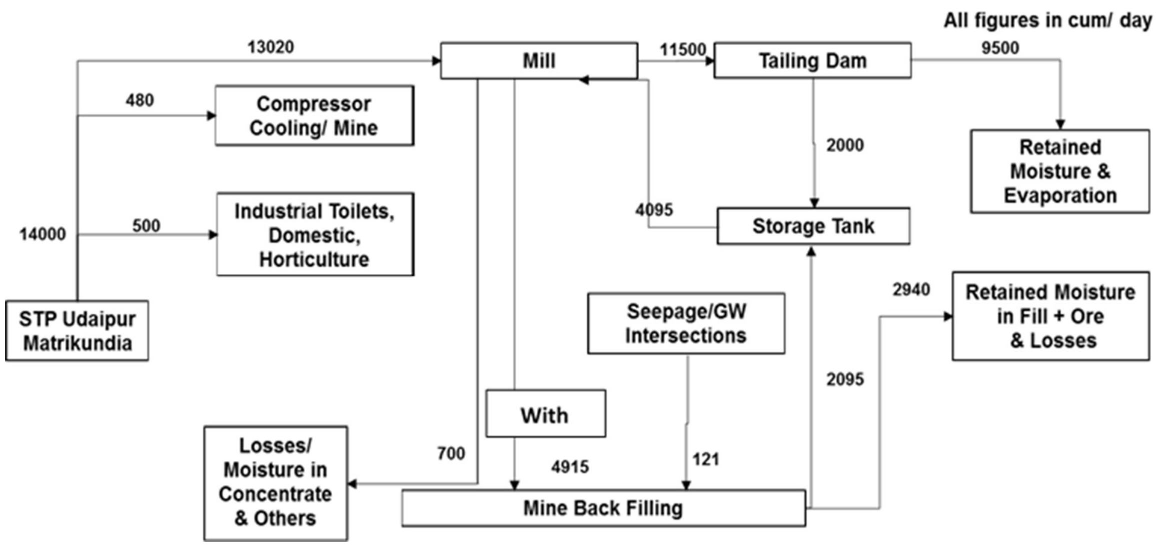


Figure 36: Water Balance

12.8 Process Control Philosophy

A highly automated and instrumented process control has been envisaged in the beneficiation plant.
On-line Stream Analysis System for measurement of elements concentration in slurries to control metal losses. Advanced Process Control operating system is designed to optimize, stabilize and control individual unit operations as well as the entire plant for optimum metal recovery.
Froth Camera System makes use of machine vision technologies to measure the speed of the froth.
Particle Size Analyzer is a sizing system installed in grinding circuit for mineral slurries. It takes automatic samples from streams and measures their particle size distribution for liberation of

minerals. Magnetic Proflot system for fine particle recovery in zinc flotation. Any drive will be in running condition if all the start permissive conditions are simultaneously fulfilled.

12.9 Conclusions and Recommendations

From above details we can conclude that SK Mine has state of the art processing plants to treat run of mine ore and produce Lead and Zinc concentrates. Plants have all process controls required for optimum plant operations. Further, it can be recommended that the mine could consider having a on-site mineral dressing laboratory to further analyse minerology of ore prior to feeding the mills

12.10 Risks and Opportunities

The Mine has state of the art processing facilities hence there is no major risk. The process water seems to be bit heavy, could lead to plant deteriorations. There is substantial debottlenecking opportunity to further expand processing capacities.

13 Primary Surface Infrastructure

13.1 Roads

General access to the Sindesar Khurd area is poor with vehicles having to pass through small villages and on poor and narrow roads. It was reported that in the long term a rail line from the SK Mine and the Dariba complex is being considered and this will also assist with the movement of concentrates and metals in addition to handling engineering and plant consumable supplies.

Table 36: Local roads and access to the mine

13.2 Stockpile and Storage Facilities

Presently, there is only one waste dump of total area 6.09 ha in the mine area. With the proposed expansion, it is required to increase the capacity of the waste dump to 8.0 ha and this will remain active during the period of proposal. The total waste generation and disposal of waste to waste dump during mine life has been discussed in chapter 4.0 (c) above. The waste will be utilized for height raising of tailing dam after obtaining prior permission from concerned authorities under Rule 12(1)(k) of MCR-2016 and EC from MoEF&CC. Following protective measures are proposed for waste dump:

- Garland drain around the waste dump along with pond for collection of rainwater
- The greenbelt will be developed on the non-moving waste dumps, which will improve the stability of the dump and aesthetics of the area

13.3 Tailings Disposal

Tailing dam is lined with HDPE lining. The water in the tailing dam allowed to settle is reclaimed on continuous basis and pumped to reuse for the process. No water is allowed to discharge outside the dam to maintain zero discharge. The quality of the water is regularly monitored in the upstream and downstream of the tailing dam. It is proposed to adopt dry stacking disposal method for tailing disposal after technical study and statutory approvals.

Tailing has been categories as low effect waste due to its composition as mention in table below and water associated with tailing is basic in nature.

Table 37: Quality of Tailing dam water Upstream and Downstream

S No.	Parameter	Upstream	Downstream
1	ph.	8	7.5
2	Total Dissolve Solids	4650	4020
3	Total Hardness (as CaCO3)	1460	1368
4	Max. Alkalinity	128	144
5	Total Chlorides (as Cl)	684	648
6	Sulphates	1244	1367
7	Lead	3.59	0.47
8	Zinc	1.87	0.26
9	Iron	0.35	3.44
10	Cadmium	0.18	0.05

Except pH, all values are in ppm

Tailing dam embankment height will be increased by 4 mtr each time, present level is 17.0 mtrs and it proposed to raise height of the dam further, so next volume generation due to height raise will be as under:

Table 38: Tailing generation per annum

Parameter	Value	Uom
Total average Ore treatment	65,000,000	tonnes per annum
Tailing generated	5,720,000	tonnes per annum
Tailing used in backfilling	3,432,000	tonnes per annum
Volume of tailing disposed in tailing dam	1,430,000	cum per annum
	2,288,000	tonnes per annum
Life of tailing dam 31 years		

13.4 Power and Water

Electrical power for the Sindesar Khurd mining and milling operation is obtained from a nearby 80MW coal-fired power station (CPP). The MV Distribution System is serviced by primary 220kV transmission and secondary 33 kV distribution voltages. Mine Shaft power distribution is arranged at 6.6kV to underground. Power on site at the SK Mine is via one 60MVA, 220/33kV main transformer unit. The 33/6.6kV supply is from two 25MVA transformers installed to the 6.6kV Shaft Substation with feeders for the complete surface and underground workings. The 6.6kV substation switchgear has two incomers each from the 25kVA transformers 1 and 2 with a Bus-section breaker installed and interlocked with the two incomer breakers. The SK Mine consumed an average 38MVA to achieve their business plan of BP2020. This load will increase steadily as the LOM tonnage profile increases. There are two 2500kVAR Power Factor Correction units installed at the Shaft 6.6kV substation.

The planned increase in tons for SK Mine to 8.9Mtpa Ore and waste, will result in an increase of additional 28.9MVA which includes ventilation and refrigeration on surface, underground de-watering, underground ventilation and mining loads. It must be noted that no additional loading was allowed for the milling operations on surface due to the increase in production tonnes.

SKM has brought in alternative power generation units to ensure shortfalls are catered for. The power is supplied by AVVNL & Captive power plant through grid and distributed to mine via sub-station located at Dariba Smelting Complex. In case of any power shortage or failure the captive stand by DG sets at RD mine will provide power and additional DG sets will be installed at SKM. The present power requirement is around 40MW and will be increased to around 46MW for the extended capacity.

Water supply is being made from Sewage Treatment Plant, Udaipur & Matrikundia dam (Rajsamand) through pipe line. Water is stored in surface pond of 20000 Cum capacity. Fuel Station: At site there exist 2 licensed diesel pumps of 20kL capacity each. The diesel pumps are electronic with RFID tag system that senses the equipment and activates the diesel pump. It reads the diesel filled into the equipment and maintains the electronic log-book.

14 Market Studies

14.1 Introduction

Hindustan Zinc (HZL) is India's largest and world's second largest zinc-lead miner. With more than 50 years of operational experience, they have a reserve base of 161.2 million MT and an average zinc-lead grade of 5.9% and mineral resources of 286.7 million MT, our mine life is over 25 years. Their fully integrated zinc operations hold 78% market share in India's primary zinc industry, and they are the 6th largest silver producers globally with an annual production of 913,000t.

The market was negatively impacted by COVID-19 in 2020 and 2021. Considering the pandemic scenario, the construction activities were stopped temporarily during the lockdown to curb the spread of new COVID-19 cases, thereby decreasing the demand for zinc and lead-based products such as galvanised metal, lead sheets, and others from the construction industry. Furthermore, the demand for lead-acid batteries decreased due to the temporary pause of the automotive manufacturing units during the lockdown. However, the demand for lead-acid batteries, especially valve-regulated lead-acid (VRLA) batteries, from the electronics and telecommunication industry increased during this period, as people opted to work online from their residence, which enhanced the demand in the market studied. With the lifting of restrictions, companies are keen to see a return to pre-2020 levels of activity.

14.2 Zinc

14.2.1 Application Of Zinc

Approximately 14% is used in the production of zinc die casting alloys. Nearly 9% of the zinc is utilized for oxides and chemicals and approximately 10% is used in alloys and castings. Some of the most common applications of zinc are listed below:

- **Galvanising**: Zinc offers one of the best forms of protection for steel against corrosion. It is used extensively in building & construction, infrastructure, household appliances, automobiles, steel furniture and other applications where lasting steel products are required.
- **Zinc Oxide**: The most widely used zinc compound, zinc oxide is used in the vulcanisation of rubber, as well as in ceramics, paints, animal feed, pharmaceuticals and several other products and processes. A special grade of zinc oxide has long been used in photocopiers.
- **Die Castings**: Zinc is an ideal material for die casting and is extensively used in hardware, electrical equipment, automotive and electronic components. Zinc die cast alloys are used in production of highly durable and visually appealing hardware fittings.
- **Alloys**: Zinc is extensively used in making alloys, especially brass, which is an alloy of copper and zinc.

14.2.2 Supply and Demand

The price of zinc is driven mostly by these five factors:

- Chinese Demand
- Chinese Supply
- Global Stocks
- US Demand

As with most industrial commodities, China plays a pivotal role in determining zinc prices. China is the top consumer of refined zinc used in galvanized steel. Therefore, a key indicator of zinc demand in China and elsewhere is steel demand. Decisions about whether to undertake or hold off on infrastructure projects can create huge fluctuations in steel demand. Ultimately, these decisions can flow through to the zinc market. A key factor impacting zinc output in China is the country's increasing environmental awareness. Poor air quality has forced the government to take a harder look at the mining industry as a contributor to pollution. If China curbs the production of zinc to deal with this problem, then the country will be more reliant on imports. This could drive prices higher. The London Metals Exchange (LME) keeps track of global stock levels for zinc and other industrial metals.
Current world production is approximately 13 million tonnes. HZL produces approximately 913,000t of zinc per year and is well established in the market.

Table 39: HZL Product Range

Product	Form	Weight
Special High Grade (SHG)	Standard Ingot	25 kgs
	Jumbo Ingots	1000kgs
Continuous Galvanising Grade (CGG)	Jumbo Ingots	1000kgs
High Grade (HG)	Standard Ingot	25 kgs
	Jumbo Ingots	600 kgs
Prime Western (PW)	Standard Ingot	25 kgs
Electro-Plating SHG (EPG SHG)	Standard Ingot	25 kgs
Hindustan Zinc Die-Cast Alloy (AZDA)	Standard Ingot	9 kgs

14.2.3 Prices

As with all commodities, prices fluctuate. Prices in general are Zinc price predictions from the leading international agencies for the next few years are as follows:

- **The World Bank** in its commodity forecast report estimated that the average spot price for zinc will fall to $2,400 per metric ton (t) in 2022, down from $2,700/t at the end of 2021. After that, a slow growth period will start.
- **The IMF'**s report indicated a completely different expectation: a rise from $2,828/t in the end of 2021 to $2,859 in 2022. For the following period, IMF experts expect a smooth, gradual decline. They predict the price will drop to $2,818/t by 2026.
- **The Industry Innovation and Science Australia**'s prediction is like the World Bank's predictions: they expect a decrease in the zinc spot price from $2,686 at the end of 2021 to $2,362 in 2022, with further slow increase through 2026.
- HZL is using prices as projected by LME as listed below:

Table 40: HZL Financial Model Prices

Particulars	UOM	FY'23	FY'24	FY'25	FY'26	FY'27	FY'28	FY'29	FY'30	FY'31	FY'32	Average
LME - Zinc	$/MT	3,183	2,911	2,684	2,621	2,658	2,706	2,706	2,706	2,706	2,706	2,759
- Lead	$/MT	2,179	2,047	1,974	1,962	1,997	2,082	2,082	2,082	2,082	2,082	2,057
- Silver	$/Troz	22.19	20.47	21.61	21.33	21.30	21.10	21.10	21.10	21.10	21.10	21.24
Ex Rate	Rs/USD	74.94	75.43	76.52	77.73	78.64	79.11	79.51	79.51	79.51	79.51	76.65

The figure below displays the price for zinc over the last five years. The price projections above agree in general with the historic average prices although it has been as low as US$1,500/t in January 2016 and as high as US$ 4,000/t in April 2022. In our opinion, the recent high price may be because of stock shortages created by the pandemic. These high levels are not sustainable, and we already see a substantial drop in prices which should stabilise at the levels projected by the LME, World Bank and others.

Figure 37: 5-Year Zinc Price in US Dollars

Source: Trading Economics

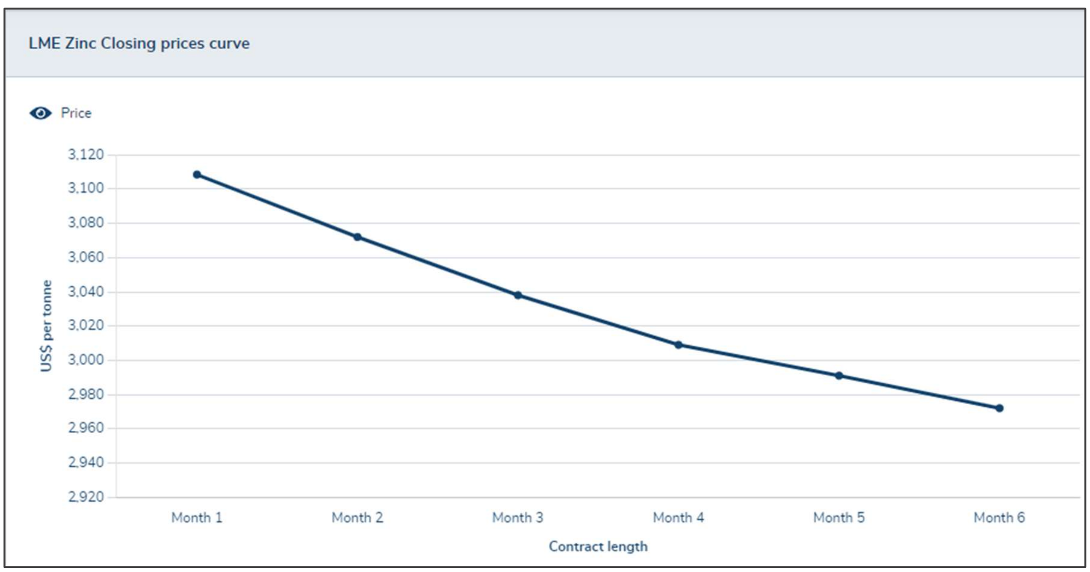


Figure 38: LME Zinc Contract Prices

Source: LME Website 12 July 2012.

Chemical Composition

Component	Guaranteed Content	HZL Typical
Zinc Zn)	99.9950%Min	99.9960% Min
Lead (Pb)	0.0030% Max	0.0020% Max
Copper (Cu)	0.0010% Max	0.0003% Max
Cadmium (Cd)	0.0030% Max	0.0002% Max
Iron(Fe)	0.0020% Max	0.0010% Max
Aluminium (Al)	0.0010% Max	0.0001% Max
Tin (Sn)	0.0010% Max	0.0001% Max

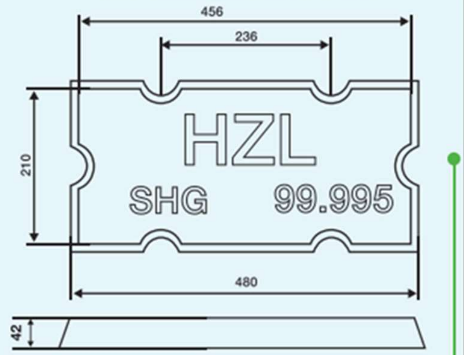
Hindustan Zinc Special High Grade Zinc 99.995% conforms the following standards:

ASTM B6-SHG Z13001 Grade
BS EN 1179:2003 – ZI Grade
ISO 752:2004 – ZN – Grade

Hindustan Zinc's – LME Registered Brands:

"HZL SHG 99.995%"
"HZL Zn SHG 99.995%"
"VEDANTA SHG 99.995%"
"VEDANTA Zn SHG 99.995%"

SHG Slab Dimensions and View



Physical Specifications : All Dimensions in mm

Figure 39: HZL Zinc Specifications

14.3 Lead

14.3.1 Applications for Lead

The battery sector is the single largest consumer of lead, accounting for around three-quarters of the demand. It can be sub-divided into the following groups:

- **SLI (Starting-Lighting-Ignition) batteries**, which currently accounts for over half of the total lead demand. These are mainly used in cars and light vehicles but are also found in other applications such as golf carts and boats. SLI battery demand in turn can be split into original equipment and replacement, with replacement demand outstripping original equipment demand by about 4:1 in mature markets.
- **Industrial batteries**, which currently consumes around a quarter of the total lead produced. This sector can be split roughly 50:50 into stationery and traction batteries. Stationary batteries are principally used in back up power supply systems; traction batteries are used for motive power in equipment such as forklift trucks and motorised wheelchairs.

- The remainder is used in non-battery applications. The second largest current end use of lead for non-battery applications, accounting for around 20% of lead consumption, is the alloys and chemical industry. Principal markets are for cathode ray tubes used in television screens and computer monitors, for Poly Vinyl Chloride (PVC) stabilisers and for making pigments for industrial use. Cable and other industries account for the remaining 5% of lead demand.

14.3.2 Supply and Demand

Growth in the construction industries was driving the overall market growth for a long time. High demand from renovation in the construction sector, including gutter and gutter joints and metal for roofing materials were propelling the market demand. Now, high demand for the electrical vehicle is influencing lead acid batteries demand emerging as the key driving factor for the market growth. Additionally, vigorous investment in improving telecom networks along with significant development in data centres are expected to enhance the industry position.

However, high production cost with stringent challenging processes is inhibiting the growth of lead market globally.

By the application segment, batteries segment is expected to dominate the market during the forecast period. As lead-acid battery is utilised in the form of stationary batteries, SLI batteries, portable batteries which includes electronics, consumers, telecom, energy storage system and others. SLI batteries have vast application in automobile designing and installation specifically with the automobile’s charging system, that allow continuous cycle of charge and discharge in the battery each time the vehicle is in use. Furthermore, development in construction, machineries, and other battery dependent end-product is helping the market to grow.

Regionally, Asia Pacific is expected to dominate the lead market and is expected to grow during the forecast period. Developing countries like Japan, China, and India have boosted the market growth due to an increase in manufactures for machinery and tools across the world. This is expected to drive the market demand in this region.

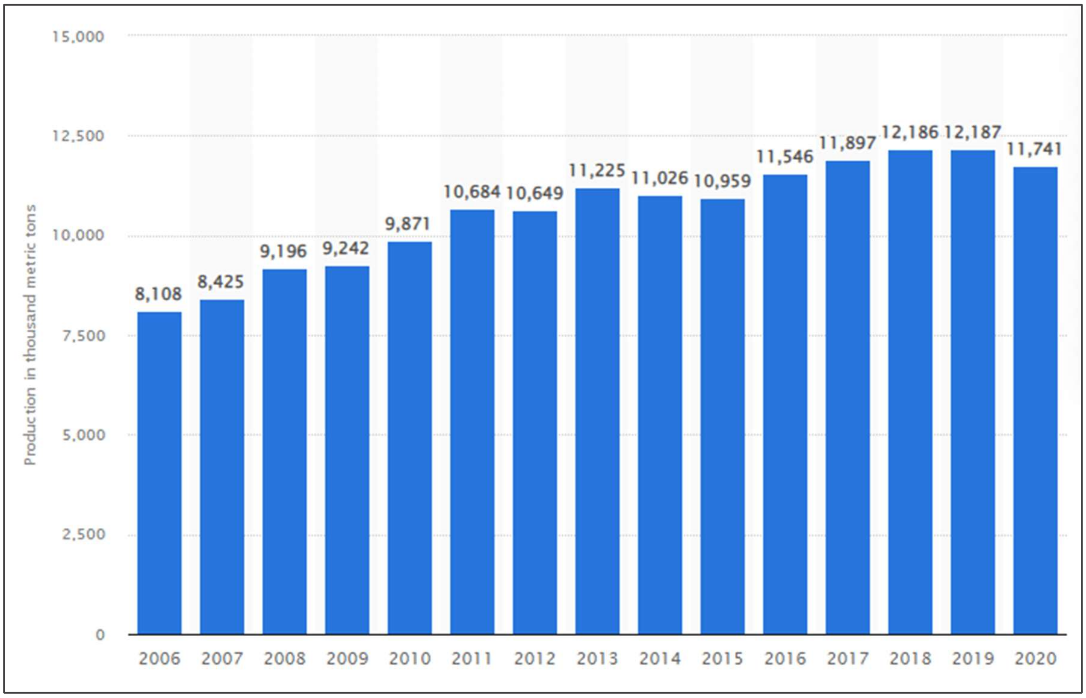


Figure 40: World Production of Lead

Figures above indicates a slow growth over the last 5 years with a slight dip in 2020, possibly due to COVID 19 restrictions. In our opinion, the production will recover and continue the slow growth of pre-pandemic years.

HZL produces lead ingots with a minimum of 99.99% purity which are registered with LME at a level of 210,000 t/a. This is expected to continue for the forecast period.

14.3.3 Prices

As with almost all commodities, prices are cyclical. Based on the 12-month price chart, there appears to be a severe reduction in price from around US$2,400/t to US$1,971 in July 2022. The 10-year price curve indicates that this is probably only a market correction. It is too early to guess at what level the price would stabilise.

Figure 41: 12-Month Price of Lead

Source – Trading Economics

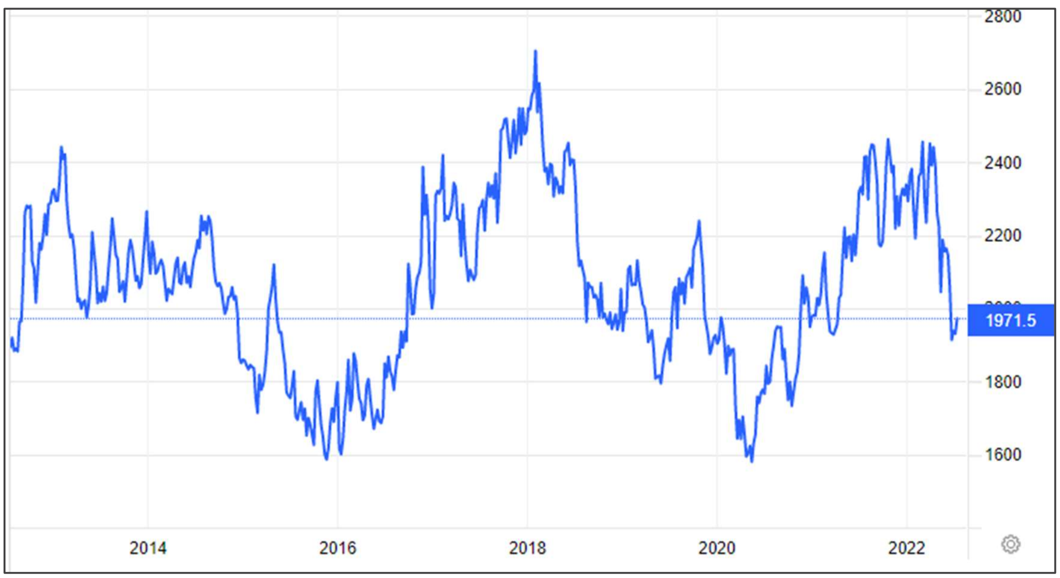


Figure 42: 5-Year Price of Lead

Source – Trading Economics

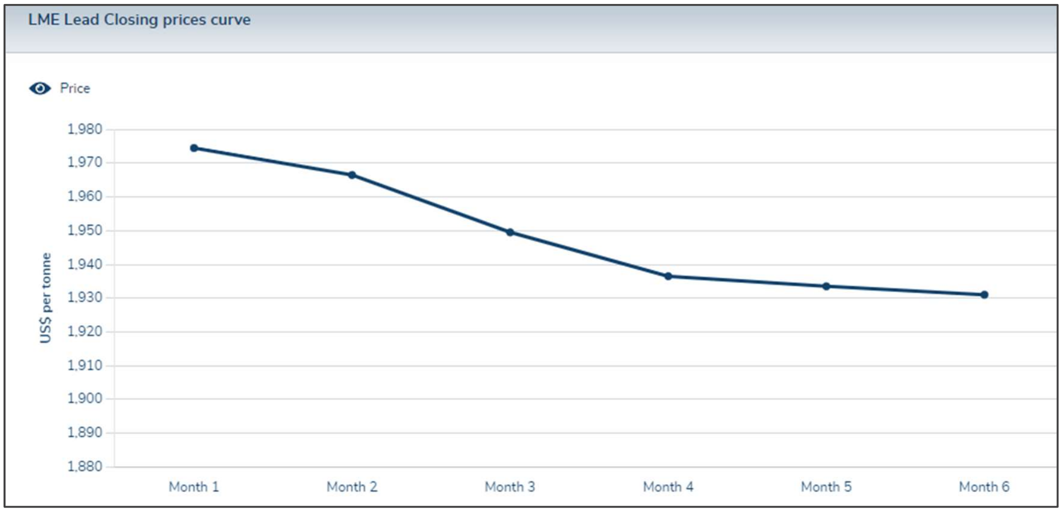


Figure 43: LME Contract Price on July 2022.

Source: LME July 2022

Chemical Composition — **LME Brand : Vedanta 99.99**

Component	Composition- BS EN 12659 : 1999 PB990R	HZL Typical
Lead(Pb)	99.99% Min	99.993%
Silver(Ag)	0.0015% Max	<0.0005%
Arsenic(As)	0.0005% Max	<0.0003%
Bismuth(Bi)	0.0100% Max	<0.0050%
Cadmium(Cd)	0.0002% Max	<0.0002%
Copper (Cu)	0.0005% Max	<0.0005%
Nickel (Ni)	0.0002% Max	<0.0002%
Antimony(Sb)	0.0005% Max	<0.0005%
Tin (Sn)	0.0005% Max	<0.0005%
Zinc(Zn)	0.0002% Max	<0.0002%

Vedanta 99.99% (Bundle Specification)

Ingot Weight	25 Kg (+/- 1.2 Kg)
Ingot Dimensions	85 (+/-2)mm Width | 535(+/-2)mm Length | 75(+/-2) mm Height
Bundle Weight	1050 Kg (+/-50 Kg)
Bundle Configuration	6 ingots/layer x 7 layers | 42 ingots
Bundle Dimension	510(+/-12)mm Width | 535(+/-2) mm Length | 520(+/-14) mm Heig
Strapping	32 mm Tenax strap | 2*2 strapping

Vedanta 99.99 & Vedanta Pb 99.99- Hindustan Zinc Lead Ingots are LME Registere

Figure 44: HZL Lead Specifications

14.4 Silver

The extraordinary events of 2020 have had a profound effect on virtually all markets around the globe and silver has been no exception. The metal's supply/demand fundamentals, investment, prices, trade-flows and inventories have all experienced sensational fluctuations over the past 12 months or so. The effect of the pandemic is set to remain relevant to silver for some time to come. Several key silver mining countries were hit hard by lockdown restrictions, and global silver supply declined. This was more than offset, however, by losses across most of silver's physical demand segments, which suffered as a result of restrictions to economic activity as well as depressed consumer sentiment and/or income loss. This resulted in a large silver market surplus. One notable exception was physical investment. A growing appetite for safe haven assets and, initially, the strength of the gold price all boosted investors' appetite for silver bars and coins last year, culminating in an 8% rise overall.

14.4.1 Applications for Silver

Silver metal has been known since ancient times for its brilliant white metallic lustre with high ductility and malleability properties. The precious metal has varied uses backed by its excellent heat and electrical conductivity levels.

In India, the highest usage of silver is in jewellery, followed by coins & bars silverware and industrial fabrication. With growing Indian economy, silver demand especially in the industrial sector is expected to follow a healthy growth in the coming years with an increased off take especially in electrical and electronics as well as brazing alloys and solders.

14.4.2 Supply and Demand

According to the Silver Institutes report "World Silver Survey 2021", In 2020, global mine production suffered its biggest decline of the last decade, falling by 5.9% y/y to 784.4Moz (24,399t). This was caused by temporary mine closures in several major silver producing countries in the first half of the year as a direct result of the COVID-19 pandemic. Output from primary silver mines declined by 11.9% y/y to 209.4Moz (6,513t). This exceeded the drop that silver by-product output from lead-zinc and gold mines suffered, which fell by 7.4% to 248.3Moz (7,724t) and by 5.7% to 123.3Moz (3,834t), respectively. Countering this trend, silver production from copper mines increased by 3.5% y/y to 198.3Moz (6,169t).

At the county level, the largest declines were in nations which implemented COVID-19 lockdowns that required mines to temporarily halt operations. This led to substantially lower silver production in Peru (-26.1Moz, 810t), Argentina (-10.0Moz, 311t), Mexico (-9.6Moz, 299t) and Bolivia (-7.2Moz, 223t). Despite the disruption caused by the pandemic, mines in other countries were able to continue operating at full capacity throughout the year and output increased in Chile (+9.1Moz, 284t), India (+1.2Moz, 38t) and Australia (+1.2Moz, 37t).

Chemical Composition

Silver Ingot Specification

Ingot Weight	:	30 Kg
Length (Top)	:	310 mm
Length (Bottom)	:	280 mm
Width (Top)	:	150 mm
Width (Bottom)	:	120 mm
Height	:	75 mm

LBMA Accredited Good Delivery Bars.

Component	Composition
Silver (Ag)	99.99 % Min
Antimony (Sb)	0.0020 % Max
Lead (Pb)	0.0020 % Max
Copper (Cu)	0.0020 % Max
Iron (Fe)	0.0020 % Max
Bismuth (Bi)	0.0015 % Max
Zinc (Zn)	0.0020 % Max
Selenium (Se)	0.0001 % Max
Telurium (Te)	0.0002 % Max
Calcium (Ca)	0.0001 % Max
Magnesium (Mg)	0.0001 % Max
Silicon (Si)	0.0001 % Max
Aluminium (Al)	0.0001 % Max
Arsenic (As)	0.0001 % Max
Cadmium (Cd)	0.0001 % Max
Chromium (Cr)	0.0001 % Max
Cobalt (Co)	0.0001 % Max
Nickel (ni)	0.0001 % Max
Gold (Au)	0.0001 % Max
Platinium (Pt)	0.0001 % Max
Palladium (Pd)	0.0001 % Max
Tin (Sn)	0.0001 % Max
Indium (In)	0.0001 % Max
Manganese (Mn)	0.0001 % Max

Figure 45: HZL Silver Specifications

After rising for two years, global silver demand weakened by 10% in 2020 to 896.1Moz (27,872t) as the impressive gains in physical investment were more than offset by heavy losses in jewellery and silverware. After falling just short of record levels in 2019, industrial fabrication fell 5% last year to a five-year low of 486.8Moz (15,142t). Unsurprisingly, this was overwhelmingly due to the impact of the COVID-19 pandemic on economic activity and, in turn, many silver end-users. Regional performances diverged, with Europe suffering a notable 8% decline, while North America rose by 2%, chiefly through higher demand in such areas as silver powder for photovoltaic (PV) ends. Demand in East Asia also fell overall, although performances were very mixed at the country-level; losses were seen in China, but Japan and Taiwan enjoyed gains.

On a sectoral basis, electronics & electrical demand fell a modest 4% as gains for PV offset losses elsewhere. Other industrial offtake in turn fell 7% as a strong showing for EO catalysts could only partially counter India's heavy losses in this segment. In general, thrifting and substitution had a limited impact on silver use as the price was insufficiently high for long enough to trigger interest and as many areas present little room for further savings.

Strong growth in mine production this year is expected to be followed by continued growth in the medium term. This will be driven by increased output from a number of major operating mines alongside new projects, with a significant contribution coming from primary silver operations in Mexico.

14.4.3 Price

Figure 46: 5-Year Silver Price

(Source – Trading Economics)

In the period 2015 to 2020, the price varied around an average of approximately US$16.5/oz. During the world pandemic, silver offered a haven for storing wealth which is reflected in the average price shooting up to an average above US$24/oz. With the acceptance that the pandemic was over in mid-July 2022, the price is starting to return to earlier levels and may stabilise near to the pre-2020 levels.

15 Environmental Studies, Permitting and Social or Community Impact

15.1 Introduction

The knowledge of present environment of the core and buffer zone of the existing mining area is important to assess the impact of various project activities on environment. The knowledge of present-day environment is also helpful in planning management of environment and planning of mitigation measures. To assess the composite baseline of mine and processing facilities related to the environmental quality of the area, field assessment has been conducted considering following components of the environment, viz. land, meteorology, air, noise, water, soil, biological and socio-economic. The relevant information and data (both primary and secondary) were collected in core as well as buffer zone (10 km distance from the Mine Lease boundary) in accordance with the guidelines of MoEF&CC for undertaking EIA Studies and preparation of Draft EIA/EMP reports.

The Rajasthan State falls in a region of low Seismic hazard zone with the exception being moderate hazard in areas along west state border. It mainly lies in Zones II and III. Several faults have been identified in this region out of which many show evidence of movement during the Holocene epoch.

15.2 Environmental Studies

The projects should not cause any significant impact on the environment of the area, as adequate preventive measures have been adopted to contain various pollutants generated due to the proposed current and proposed expansion projects within permissible limits. Development of Greenbelt / Plantation around the mining lease will minimize the environment pollution and improve the overall aesthetic beauty.

Environmental Monitoring Programme has been and will be continued for various environmental components as per conditions stipulated in Environmental Clearance Letters issued by MoEFCC & Consent to Operate issued by SPCB. Six monthly compliance reports will be submitted every year to Regional Office by 1st of June & 1st of December. Quarterly compliance Report for conditions stipulated in Consent to Operate will be submitted to SPCB on regular basis.

15.2.1 Land Use

Land use studies, delineating forest area, agricultural land, grazing land, wildlife sanctuary, national park, migratory routes of fauna, water bodies, human settlements and other ecological features were completed. Land use plans of mine lease areas were prepared to encompass preoperational, operational and post operational phases.

15.2.2 Climatology

The climate is similar to the nearby RDM and is characterized by sub-tropical dry climate with distinct hot summer, cold winter and rainy monsoon. The maximum temperature rises above 47°C in May-June and down as low as 2°C in December-January.

15.2.3 Air Quality

Ambient air quality monitoring has been carried out within the study areas to determine the baseline concentration of various air pollutants in the ambient air. The ambient air quality depends upon the emission sources, meteorological conditions, and the background concentration of specific pollutants. This helps in providing a data base for predicting impact on the surrounding area due to a project activity. It is a standard to ensure the quality of air environment is in conformity to standards of the ambient air quality during operation phase of the projects.

- The mine sites have provided mechanical ventilators for air circulation
- Wet drilling is being used to suppress the dust generation
- The trucks are being covered with tarpaulin sheets
- Dust generation during working will be minimized by adoption of dust suppression systems at working faces.
- Water spraying on haul road.
- During transportation and unloading points, water sprinkling is being/ will be done to suppress the fugitive emissions.
- The crusher and Screens houses are provided with dust extraction system with outlets
- Development of green belt within lease area & plantation within ML Area is being done.
- Regular monitoring of air quality
- On surface, blacktop paved/ concrete roads
- Deployment of mechanized vacuum road sweeper on surface roads

The mine is currently ventilated using the surface ramps as intake airways and a series of return air raises to surface located at the north, centre and south of the deposit which currently, collectively provide some 820 m^3/s of ventilation capacity on an exhaust basis. A further 3.5 m diameter return air ventilation raise is planned to be developed for the deeper mine to increase the ventilation capacity to 925 m^3/sec and a further ventilation pass and 650 kW fan for the SKA6 and C Blocks which will lead to a ventilation capacity of 1,200 m^3/sec.

15.2.4 Noise Pollution

As most mining activities are restricted to underground, the effect on the surrounding population is limited. Regardless, HZL has taken all necessary measures to minimise the noise effects:

- Compressors are installed in isolated building with acoustic enclosures.

- Ventilation fans are provided with silencers
- DG sets have acoustic enclosures.
- All vehicles and machineries used have noise emissions within permissible limits through regular maintenance.
- Improved design of chutes and mill liners.
- Good grindability due to soft ore.
- Regular monitoring of noise level of mining & milling equipment.
- UG HEMM are procured with latest emission standard engines.
- UG HEMMs are equipped with airconditioned cabins thereby attenuating noise level while operating the equipment.
- A green belt is developed to attenuate the noise levels
- Reducing the exposure time of workers to the higher levels of noise
- Provision of personnel protective equipment such as ear plugs, earmuffs etc

The mining activity involves use of compressors, drill machines, dumpers, loaders, excavators, and ventilation fans. The source noise levels of this equipment are in the range of 80 to 90 dB(A). The following mitigation measures are taken:

- Silencers are provided for stationary machinery such as compressors, DG set, etc.
- Noise insulation is provided to the equipment such as DG sets and enclosures wherever required for reducing the noise created.
- Transport and mining machinery maintenance are undertaken periodically to reduce vibration, induced noise generations during movement of vehicles.
- Workers are provided with noise protective ear plugs/muffs and its usage shall be compulsory.
- The Greenbelt in and around the mine area to intercept and deflect noise transmission.

15.2.5 Surface Water and Wetlands

The study area is drained by the Banas River and its tributaries towards the north, northwest, east and by the Berach River towards the south. The river as well as tributaries are ephemeral and flow only in response to heavy precipitation. The Banas originates in Aravalli Hills, approximately 5 km from Kumbhalgarh Fort and flowing southwards, and meets the Gogunda Plateau. It flows through Rajsamand and Relmagra Tehsils and crosses into Chittorgarh and Bhilwara Districts. The predominant drainage pattern in the Western hill ranges is rectangular to sub-rectangular and it is dendritic to sub-dendritic in rest of the area. Drainage pattern in the western hill region is controlled by fractures & joints and in the rest of the area by subsurface lineaments. The lease area is devoid of any surface waterbody such as lake, dam or river. The Banas River flows about 5 km towards NNE of the lease.

15.2.6 Groundwater

The principal source of water in the study area is groundwater. Ground water is the accumulation of water below the ground surface, caused by percolation of rainfall through pores and crevices. Percolated water accumulates when it reaches some impervious strata consisting of confined clay or confined rocks. Open wells and hand pumps are the major groundwater source of drinking water and are also used for limited irrigation.

The occurrence of ground water in the study area is mainly controlled by the topographic and structural features present in the geological formations. The principal source of ground water is precipitation. Out of the total rainfall received, a major part of it is lost as run-off and by evapo-transpiration through soil and vegetation. Only a small part of rainfall infiltrates down to reach ground water body.

The important water bearing formation besides alluvium is the granite gneisses, schists, limestone and phyllites. In the hard rocks the occurrence and movement of ground water is controlled through the foliation/bedding planes, fissures, joints, solution cavities and other structural weak planes. The weathered mantle of the hard rocks yields good discharge of water. In alluvium, ground water occurs in the interstices of unconsolidated sand and gravel. Locally semi-confined conditions are encountered both in hard rock and alluvium.

The ground water movement is controlled mainly by the hydraulic conductivity of the aquifer. A review of the topography and drainage pattern reveals that the general slope of the area is towards southeast, and ranges from 6 m/km to about 7 m/km. The ground water flow also follows the topography and surface water flow direction and moves in southeast direction. However, the hydraulic gradient is moderate and has been observed as 5.75 m/km as calculated from the monitoring of wells of the area.

15.2.7 Soil

The information on soil quality has been arrived by collection and analysis of soil samples from representative locations. To assess the base line characteristics of soil profile of the mine lease area representing project and nearby areas, the samples were analysed for key and chemical parameters. The sampling locations were finalized with the following considerations:

- To enable information on baseline characteristics and,
- To determine the impact of mining activities on soil characteristics.
- To determine the type of plantation

The types of soil occurring in the district are similar to those at the neighbouring KDM:

- Sandy loam in Bhim, Deogargh and Amet blocks
- Clay Loam in Rajsamand, Relmagra and Khamnor blocks and
- Heavy clay in Kumbalgarh block.

Broadly, the northern, southern and eastern part of the district possesses loam, foot hill soils and black cotton soil with moderate run off, whereas in the western part of the district lithosols and regosols of hills and rocky outcrops having very high run off are prevalent.

Soil infiltration rate varied from 0.6 cm/hr to 4.2 cm/hr with average infiltration rate of 2.35 cm/hr. The cumulative depth to which vertical infiltration took place varied from 3.6 to 16.2 cm by which time, constant infiltration rate was also achieved. Based on National Bureau of Soil Sciences and Land Use Planning (NBSS & LUP) Regional Centre, Udaipur, the soil of the study area is classified as deep and medium brown loamy soils.

The soil analysis indicates that the soil is sandy loam in texture and neutral in nature. The nutrient and organic matter contents are medium and the soil is normally fertile.

15.2.8 Biological Environment

There is no forest area in the study area. No endemic and endangered flora species recorded/ reported as per botanical survey of India records in the study area and leasehold area. Detailed ecological studies were conducted to assess the present biological resources in and around the mine lease area. Species majorly recorded during study period are Achyranthes aspera, Ageratum conyzoides, Cassia tora, Physalis angulate, Tridax procumbens and Physalis angulate are the herbaceous species and Azadirachta indica, Peltoforrum ferrusinum, Carissa spinarum, Anogeissus pendula, Phoenix aculis and Butea monosperma of perennial vegetation and also mainly dominated by Therophytes followed phanerophytes. Primary faunal studies were conducted in eight locations and no major wild life exists in study area. Literature survey and data collected from forest department confirms that there are no wild life sanctuaries, national parks and biospheres and no migratory bird path or animal corridors exist within 10 km radius study area.

15.3 Requirements and Plans for Waste and Tailings Disposal, Site Monitoring, and Water Management

15.3.1 Waste and Tailings Disposal

Excess tailings from the SK Mine plant are deposited in the existing RD Mine TSF. Tailings from SK Mine are routed to the opposite side of the dam to those from the RD Mine plant.

15.3.2 Tailing Disposal

Currently, the tails from plant is being pumped to exiting tailing dam of Rajpura-Dariba mine through pipelines. It is also proposed to utilize 50-65% of the tailings in the stope backfill. Tailing generated from 6.5 million tpa plant capacity is handled by increasing size of line from 8” to 12” and capacity enhancement in pumping system battery of 2 pumps is upgraded with 3 pumps battery and then dump in existing tailing dam after 50-65% utilization in backfilling.

Tailing thickener diameter is 38 meter and it is high rate thickener. Paste fill thickener has a diameter of 26 metre. It receives input from high rate thickener installed for plant tailing.

Most of the tailing generated from the mill will be utilized for preparation of paste for mine back fill. The balance quantity will be disposed by pumping through pipe line to tailing dam.

The Tailing generated are about 88% of the total ore treatment. The average daily ore treatment at 6.5 million tpa capacity is 17800 tons per day (tpd), tailing generation of 15670 tpd and concentrate generation of 2135 tpd.

15.3.3 Site Monitoring

Monitoring will be carried out at the site as per the norms of CPCB. An Environmental Monitoring Programme is conducted for various environmental components as per conditions stipulated in Environmental Clearance Letter issued by MOEF & Consent to Operate issued by SPCB. Six monthly compliance reports are be submitted every year to Regional office of MoEF on 1st of June & 1st of December. Quarterly compliance Report for conditions stipulated in Consent to Operate are submitted to SPCB on regular basis. Monitoring ensures that commitments are being met with. This takes the form of direct measurement and recording of quantitative information, such as amounts and concentrations of discharges, emissions and wastes, for measurement against corporate or statutory standards, consent limits or targets. It also requires measurement of ambient environmental quality in the vicinity of a site using ecological/ biological, physical and chemical indicators. Monitoring includes socio-economic interaction, through local liaison activities or even assessment of complaints.

Table 41: Frequency of Monitoring

Description	Frequency of Monitoring
Meteorological Data	Daily
Ambient Air Quality at mine site	Monthly
Water Quality	Monthly
Noise Level Monitoring	Monthly
Soil Quality	Once in six months

15.3.4 Water Management

There is no perennial source of water like pond, river, stream or nallah running through the lease area. Four first order streams which originate within the lease area on the Eastern and Southern slopes of the hill will continue to flow without being disturbed by the underground mining or any surface activity. The area is drained by Banas river, an ephemeral river, which flows at distance of 3 km north of the northern boundary of the lease area.

The lease area is drained by Banas river in the northern part of the buffer zone while the southern part forms the catchment area of Berach river. Almost all the streams have been harnessed by village tanks within the buffer zone while the major stream meets Bhopalsagar dam, just outside the buffer zone in south.

The pH of water is above 7.0. Quality of Tailing dam water Upstream and Downstream) so neutralisation is not required. Process water is provided from the SKM TSF return and from the tailings thickener with fresh water supplied by a pipeline from Debari; water consumption is approximately 0.7 m^3/t.

Tailing dam is lined with HDPE lining. The water in the tailing dam allowed to settle is reclaimed on continuous basis and pumped to reuse for the process. No water is allowed to discharge outside the dam to maintain zero discharge. The quality of the water is regularly monitored in the upstream and downstream of the tailing dam. It is proposed to adopt dry stacking disposal method for tailing disposal after technical study and statutory approvals.

15.4 Community Engagement

An essential part of environmental study which includes demographic structure of the area, provision of basic amenities viz., housing, education, health and medical services, occupation, water supply, sanitation, communication, transportation, prevailing diseases pattern as well as feature of aesthetic significance such as temples, historical monuments etc. at the baseline level. This composite baseline assessment of mine and CPP helps in visualizing and predicting the possible impact, depending upon the nature and magnitude of the project.

The study area (10-km radius) area has a total population of 95,566 according to 2011 census. Total male population is about 50.59 % and total female population is around 49.40%. The average literacy rate 50.65 % in the region.

In addition to the direct and indirect employment opportunity, HZL is already, providing various skills development opportunity through vocational training that would enable people become self-employed or entrepreneurs. Self-help group activities is also implemented to empower rural women and make them self-sufficient. Assistance being provided to the village population for access to banking facility has helped further increase the access to cheaper funds and financial facilities. Various health camps are being organized with distribution of essential medicines to improve the basic health of the village population in the vicinity of the project site. Educational material, uniform and scholarship incentives are being distributed to the village school children to motivate them through the CSR initiatives, The project proponent kept 2.5% of the total cost of the project based on local needs.

15.5 Mine Closure

According to the baseline study in EIA Report, the existing land use pattern indicates that the area has been mined and already degraded.

15.5.1.1 Water Regime

The EIA Report states that the mining activities don’t affect the quality of surface and ground water. Mine water is constituted by the seepage of percolating ground water and water added due to mining activities such as drilling. This water is collected underground in sumps, from where it is pumped to surface into storage tanks and recirculated for industrial use. There is no acid drainage. The mill discharge is pumped to a tailings dam.

15.5.1.2 Surface Subsidense

The mining is fully confined to underground at depths that should not affect the surface due to subsidence. As an additional precaution, mined-out stopes are backfilled to protect the underground infrastructure as well as for prevention of potential subsidence.

15.5.1.3 Mined out Land

The mining activity is fully confined to underground. After extraction of the ore, stopes are backfilled with waste, classified tailings and cement.

15.5.1.4 Topsoil Management

No change in the topsoil is anticipated due to the underground mining. The topsoil available around the Rajpura Dariba Mine has been used for plantation purposes when required.

15.5.1.5 Tailings Dam Management

Not applicable as the tailings dam is outside the lease boundary.

15.5.1.6 Tailings Disposal

Currently the tailings from the plant is being pumped to existing tailings dam. It has been proposed that 50% of the tailings be used in the stope backfill.

16 Capital and Operating Costs

16.1 Operating Cost Estimate

ABGM did not undertake any techno-economic assessments on the mining costs, processing costs and fixed royalties. The following operating cost estimates was received from HZL that is used in their financial and budget planning for FY2022 – 2029

Table 42: Summary of Operating Costs (source HZL)

Particulars	UoM	Yr 2022	Yr2023	Yr 2024	Yr 2025	Yr 2026	Yr 2027	Yr 2028	Yr 2029
Mining Cost	$/MT Ore	22.9	24.1	25.3	26.5	27.9	29.3	30.7	32.3
Processing Costs	$/MT Ore	6.5	6.8	7.2	7.5	7.9	8.3	8.7	9.1
Development	$/MT Ore	9.5	10.0	10.5	11.1	11.6	12.2	12.8	13.4
Smelter Cost									
Zn Metal	$/MT Metal	448	448	448	448	448	448	448	448
Lead Metal	$/MT Metal	458	458	458	458	458	458	458	458
Silver Metal	$/MT Metal	24	24	24	24	24	24	24	24
Overall Cost									
Mining Cost	$ Mn	219	245	301	316	331	348	300	64
Smelter Cost	$ Mn	114	121	139	139	137	142	119	14
Royalty Cost	$ Mn	95	101	115	115	114	118	99	11

16.2 Capital Cost Estimate

No capital cost estimates was evaluated in the limited timeframe of this technical review.

17 Economic Analysis

ABGM did not undertake any techno-economic assessments on the reserves and only evaluated the mining cost and applied the high level mining cost, processing costs and fixed royalties to determine a nominal cashflow with some limited sensitivities.

17.1 Model Parameters

Table 43: Costing and Financial Inputs per annum (supplied by HZL)

Assumption	Yr 2022	Yr2023	Yr 2024	Yr 2025	Yr 2026	Yr 2027	Yr 2028	Yr 2029
Grade								
Zn	3.1	3.1	3.0	3.0	3.0	3.0	3.1	2.2
Pb	2.0	2.0	1.9	1.9	1.9	2.0	2.2	0.7
Silver	102	105	99	99	98	104	112	40
Recovery-Mill								
Zn	92	92	92	92	92	92	92	92
Pb	89	89	89	89	89	89	89	89
Silver	91	91	91	91	91	91	91	91
Recovery-Smelter								
Zn	96	96	96	96	96	96	96	96
Pb	98	98	98	98	98	98	98	98
Silver	100	100	100	100	100	100	100	100
Impact on Cost								
Mining	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%
Zn Premium	180	180	180	180	180	180	180	180
Pb Premium	150	150	150	150	150	150	150	150
Ag Premium	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4

17.2 Taxes, Royalties, Depreciation and Depletion

The normal government taxes have been applied to the models indicated below. The exact percentages were not disclosed by HZL. The royalties applied in the models are indicated in the start of document but can be seen below.

- The Royalty for Lead is 14.5% of London Metal Exchange lead metal price chargeable on the contained lead metal in the concentrate produced.
- The Royalty for Zinc is 10% of London Metal Exchange Zinc metal price on ad valorem basis chargeable on contained zinc metal in the concentrate produced.

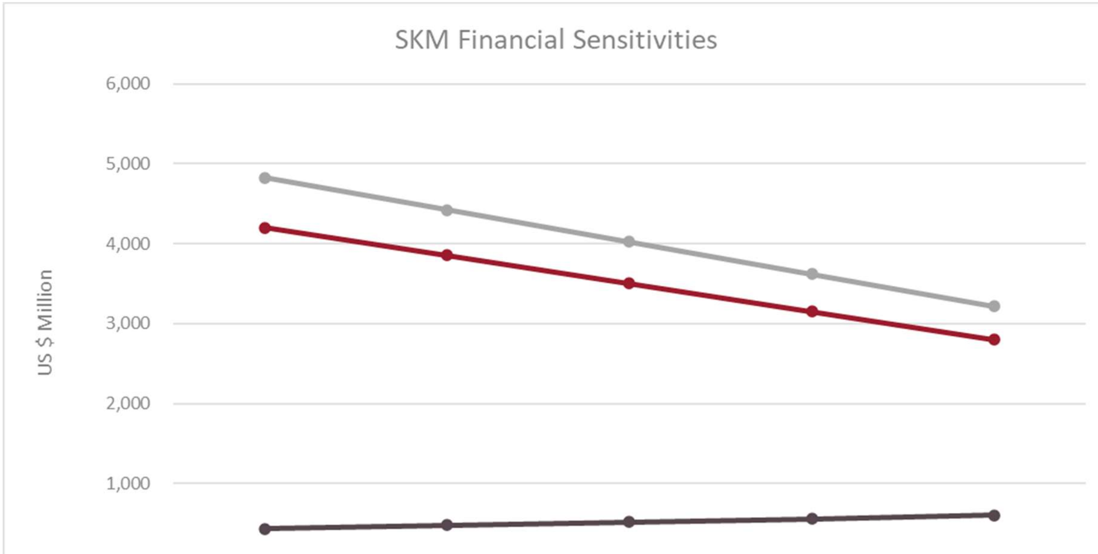
17.3 Cashflow Forecasts and Annual Production Forecasts

Table 44: Financial model outcome (2023 - 2029)

Particulars	UoM	Yr 2022	Yr2023	Yr 2024	Yr 2025	Yr 2026	Yr 2027	Yr 2028	Yr 2029
Ore production	MT	5,630,000	6,000,000	7,000,000	7,000,000	7,000,000	7,000,000	5,750,000	1,161,390
Zn Metal in Concentrate	MT	161,243	168,924	196,697	196,697	194,916	196,739	161,835	23,840
Lead Metal in Concentrate	MT	100,056	108,603	120,522	120,522	119,566	127,122	110,296	7,532
Silver Metal in Concentrate	KG	524	574	634	634	625	668	590	42
Zn Metal	MT	155,049	162,435	189,140	189,140	187,428	189,181	155,618	22,924
Lead Metal	MT	97,628	105,968	117,597	117,597	116,664	124,036	107,619	7,349
Silver Metal	KG	523	572	633	633	624	667	589	42
Mining Cost	$/MT Ore	23	24	25	27	28	29	31	32
Processing Costs	$/MT Ore	6	7	7	8	8	8	9	9
Development	$/MT Ore	10	10	11	11	12	12	13	13
Smelter Cost									
Zn Metal	$/MT Metal	448	448	448	448	448	448	448	448
Lead Metal	$/MT Metal	458	458	458	458	458	458	458	458
Silver Metal	$/MT Metal	24	24	24	24	24	24	24	24
Royalty									
Zinc	$/MT Metal	364	364	364	364	364	364	364	364
Lead	$/MT Metal	394	394	394	394	394	394	394	394
Silver	$/MT Metal	60	60	60	60	60	60	60	60
Zn LME	$/MT	2,759	2,759	2,759	2,759	2,759	2,759	2,759	2,759
Pb LME	$/MT	2,057	2,057	2,057	2,057	2,057	2,057	2,057	2,057
Ag LBMA	$/Troz	21.24	21.24	21.24	21.24	21.24	21.24	21.24	21.24
Ex Rate	Rs/USD	76.65	76.65	76.65	76.65	76.65	76.65	76.65	76.65
Revenues									
Zn	$ Mn	456	477	556	556	551	556	457	67
Pb	$ Mn	215	234	260	260	257	274	238	16
Ag	$ Mn	397	435	481	481	474	507	447	32
Mining Cost	$ Mn	219	245	301	316	331	348	300	64
Smelter Cost	$ Mn	114	121	139	139	137	142	119	14
Royalty Cost	$ Mn	95	101	115	115	114	118	99	11
Net Cashflow	**$ Mn**	**640**	**679**	**742**	**727**	**699**	**729**	**624**	**27**

17.4 Sensitivity Analysis

A high level sensitivity analysis is illustrated below that indicates the RAM mining operations is in good position with up to 20% variation illustrate and overall positive financial outcome.



	20%	10%	100%	-10%	-20%
Cashflow	4,203	3,853	3,503	3,152	2,802
Cost	438	479	521	562	603
Revenue	4,828	4,426	4,023	3,621	3,219

Figure 47: SKM Financial Sensitivity Analysis (unit: Million US $)

18 Adjacent Properties

There are no other mine operation located adjacent to the SKM operations, however the RD Mine is in close proximity and they do in some cases share the same environmental monitoring stations and also employ from the same local area and share common infrastructures.

19 Other Relevant Data and Information

There is an abundance of information and other data that was not fully reviewed by ABGM during this review process as there was not enough time to conduct thorough investigation in all the data sets and documents. However, the key aspects were addressed as far as possible to ensure the relevant data and information required for this technical review was addressed.

20 Interpretation and Conclusions

20.1 Results

The results of the technical review indicate that the property contains a Mineral Resource, and a significant portion of that Mineral Resource converts to a Mineral Reserve. The project / operation has a positive economic outcome given the data, parameters and estimates outlined in the TRS. Due to the short time allocated to conduct this review.

ABGM is satisfied that the mine operation is conducting the required annual statutory work and reviews and submits to the IBM (Indian Bureau of Mines). The mine is compliant in order to develop the data, scrutinize and report on information for the development of Mineral Resources and Reserves in conjunction with their current consultancy professionals.

20.2 Significant Risks

No significant risks was observed during the site visits and neither were any picked up in the data and information provided by HZL.

20.3 Significant Opportunities

No significant opportunities was observed during the site visits and neither were any picked up in the data and information provided by HZL. However some suggestions will be listed in the consolidated report.

21 Recommendations

21.1.1 Pricing assumptions

Comparing the market research and the current trend of commodity pricing. The assumptions used by HZL seem to be on the higher side to establish the cut-off grades. However, running the sensitivities, all the operations seem to be well established and not sensitive to volatile changes. HZL used the 10 year pricing average in their estimates, the three year LME forecast average seems to be higher than the last 3 year average.

21.1.2 Environmental, Social Studies

Where information is available, environmental studies are done to an acceptable level for the Indian authorities. In some cases exemplary work is being done, beyond what is strictly necessary. Sites are monitored on strict schedules and the regular submission of updated reports are sufficient for the permits to be renewed again. Standardisation of programmes and procedures is recommended for all operations as this will prevent some areas of not receiving the correct attention. Interaction with and contributions to the local staff and communities appears to be positive with the establishing of medical centres and schools.

21.1.3 Closure Plans

Mine closure plans are not always easy to see in the provided documents, but the plans appear to be well thought out and implemented. As the mining activities are mostly underground, the effect on the environment is limited to the dust and noise generated due to ore transport and the storage of tailings, a large portion of which is used for backfilling mined stopes.

21.1.4 Geotechnical Drill Core Logging

The mines need to continue its practise with respect to core logging. Recommend more detailed geotechnical logging and recording of structures.

21.1.5 Sampling Transportation

Even though no information was provided around this practise, the site inspections proved that core, as well as samples from core, are transported in solid, closed and locked metal containers. Logging, tagging and security of the custody chain for samples are tracked in acQuire database, with unique barcodes and numbers. However it is suggested that the procedures followed need to be documented and recorded better.

21.1.6 Independent Lab Analysis

It is recommended that regular pulp duplicates are submitted an independent laboratory to be analysed as umpire samples.

21.1.7 Bulk Density Data

While bulk density data has been reconciled with production data, independent bulk density analyses should be undertaken at an independent laboratory during the exploration phase to avoid errors.

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References

- 31161 HZL Audit 2021_Report_Finalr

40_Reserve_Schedule.xlsx	2022/06/27 13:34	Microsoft Excel Worksh...	14 KB
Planned_Infra.pptx	2022/06/27 12:36	Microsoft PowerPoint P...	2,800 KB
121_Hydrological_Study_Report.pdf	2022/06/27 12:36	Adobe Acrobat Docum...	6,352 KB
Digital_Projects_SKM.pptx	2022/06/27 12:36	Microsoft PowerPoint P...	10,844 KB
Mine_Meetings_and_Questions_-_V2 - SKM.xlsx	2022/06/27 12:09	Microsoft Excel Worksh...	125 KB
270_FINAL_DARIBA_SK__MINE_CLOSURE_REPORT_202...	2022/06/27 12:09	Adobe Acrobat Docum...	2,130 KB
200_OEE_2021-22.xlsx	2022/06/27 12:09	Microsoft Excel Worksh...	748 KB
130_Mineralogy_Assessment.pdf	2022/06/27 12:09	Adobe Acrobat Docum...	3,124 KB
120_Geotechnical_Report-3.pdf	2022/06/27 12:09	Adobe Acrobat Docum...	2,212 KB
120_Geotechnical_Report-2.pdf	2022/06/27 12:09	Adobe Acrobat Docum...	1,350 KB
120_Geotechnical_Report-1.pdf	2022/06/27 12:09	Adobe Acrobat Docum...	1,937 KB
80_PFS.zip	2022/06/27 12:09	WinZip File	6,571 KB
70_Mining_Plan.pdf	2022/06/27 12:08	Adobe Acrobat Docum...	4,223 KB
80_PFS	2022/06/27 12:21	File folder	

Figure 48: Files & Folders List - HZL Data and Information Pack – SKM

_SKA1_22_SRKCLASS	2022/06/21 10:15	File folder
_SKA2_22_SRKCLASS	2022/06/21 10:15	File folder
_SKA4_22_SRKCLASS	2022/06/21 10:15	File folder
_SKA5_22_SRKCLASS	2022/06/21 10:16	File folder
_SKA6_22_SRKCLASS	2022/06/21 10:16	File folder
_SKA7_22_SRKCLASS	2022/06/21 10:17	File folder
_SKA8_22_SRKCLASS	2022/06/21 10:17	File folder
_SKA11_22_SRKCLASS	2022/06/21 10:17	File folder
_SKA17_22_SRKCLASS	2022/06/21 10:17	File folder
_SKA21_22_SRKCLASS	2022/06/21 10:16	File folder
_SKM_22_SRKCLASS	2022/06/21 10:16	File folder

Figure 49: Data Pack (Folders per Lens) - Resource to Reserve Estimation (DataMine Files)

_combmod_log.txt	2022/04/09 13:29	Text Document	9 KB
DEPA1_22pt.dm	2022/02/01 12:45	DM File	8 KB
DEPA1_22tr.dm	2022/02/01 12:45	DM File	16 KB
dmstusub.dat	2022/04/03 10:16	DAT	0 KB
INF_A1_22_V1pt.dm	2022/04/09 13:27	DM File	8 KB
INF_A1_22_V1tr.dm	2022/04/09 13:27	DM File	28 KB
MEAS_A1_22_V1pt.dm	2022/04/09 13:27	DM File	8 KB
MEAS_A1_22_V1tr.dm	2022/04/09 13:27	DM File	16 KB
SKA1_22.rmproj	2022/04/09 13:31	RMPROJ File	115 KB
SKA1_BM22.dm	2022/01/20 19:32	DM File	14,852 KB
ska1_bm22cl.dm	2022/04/09 13:30	DM File	174,356 KB
ska1_bm22cl_r.csv	2022/04/09 13:30	Microsoft Excel Comma...	2 KB
ska1_bm22cl_r.dm	2022/04/09 13:30	DM File	8 KB
SKA1_CLASS_RR22_v4.mac	2022/04/09 12:38	MAC File	9 KB
STP_PROBA1_22_V1pt.dm	2022/03/09 20:21	DM File	24 KB
STP_PROBA1_22_V1tr.dm	2022/03/09 20:20	DM File	208 KB
STP_PRVDA1_22_V1pt.dm	2022/03/09 20:22	DM File	76 KB
STP_PRVDA1_22_V1tr.dm	2022/03/09 20:21	DM File	828 KB
TongradLog.txt	2022/04/09 13:30	Text Document	78 KB

Figure 50: Data Pack - Resource to Reserve Estimation (DataMine Files) – SKA 1

_combmod_log.txt	2022/04/09 13:33	Text Document	5 KB
A2ORE1M.dm	2022/01/20 14:41	DM File	2,292 KB
a2ore1m_tzone.dm	2022/04/03 10:25	DM File	2,548 KB
a2ore1m_tzone_stat.csv	2022/04/03 10:25	Microsoft Excel Comma...	5 KB
a2ore1m_tzone_stat.dm	2022/04/03 10:25	DM File	12 KB
CLASSIFICATION_SKA2_TZONE.xlsx	2022/04/03 10:26	Microsoft Excel Worksh...	21 KB
DEPA2_22pt.dm	2022/02/01 15:41	DM File	12 KB
DEPA2_22tr.dm	2022/02/01 15:41	DM File	32 KB
dmstulog.dat	2022/04/03 10:22	DAT	26 KB
dmstusub.dat	2022/04/03 10:22	DAT	0 KB
PROBA2_22_V1pt.dm	2022/03/09 20:37	DM File	8 KB
PROBA2_22_V1tr.dm	2022/03/09 20:38	DM File	52 KB
PRVDA2_22_V1pt.dm	2022/03/09 20:39	DM File	24 KB
PRVDA2_22_V1tr.dm	2022/03/09 20:43	DM File	132 KB
SKA2_22.rmproj	2022/04/09 13:33	RMPROJ File	111 KB
ska2_22bmg.dm	2022/04/03 10:25	DM File	4,944 KB
ska2_22bmgc.dm	2022/04/03 10:27	DM File	5,252 KB
ska2_22bmgcl.dm	2022/04/09 13:33	DM File	34,524 KB
ska2_22bmgcl_r.csv	2022/04/09 13:33	Microsoft Excel Comma...	2 KB
ska2_22bmgcl_r.dm	2022/04/09 13:33	DM File	8 KB
ska2_22pt.dm	2022/04/03 10:25	DM File	312 KB
ska2_22tr.dm	2022/04/03 10:25	DM File	1,692 KB
SKA2_CLASS_RR22_v5.mac	2022/04/09 12:41	MAC File	10 KB
SKA2FY22MODF.dm	2022/01/20 15:21	DM File	4,944 KB
SKA2FY22PT.dm	2022/04/03 10:25	DM File	312 KB
SKA2FY22TR.dm	2022/04/03 10:25	DM File	1,692 KB
TongradLog.txt	2022/04/09 13:33	Text Document	77 KB

Figure 51: Data Pack - Resource to Reserve Estimation (DataMine Files) – SKA 2

_combmod_log.txt	2022/04/04 17:39	Text Document	3 KB
_WFCODElog.txt	2022/04/03 10:31	Text Document	3 KB
cholesa4.dm	2020/04/10 14:47	DM File	396 KB
cholesa4_tz.dm	2022/04/03 10:29	DM File	396 KB
cholesa4_tz_stat.csv	2022/04/03 10:29	Microsoft Excel Comma...	2 KB
cholesa4_tz_stat.dm	2022/04/03 10:29	DM File	8 KB
CLASSIFICATION_cholesa4_tz_stat.xlsx	2022/04/04 17:39	Microsoft Excel Worksh...	14 KB
dmstulog.dat	2022/04/04 17:38	DAT	3 KB
dmstusub.dat	2022/04/03 10:29	DAT	0 KB
IND_SKA4pt.dm	2022/04/04 17:38	DM File	8 KB
IND_SKA4tr.dm	2022/04/04 17:38	DM File	80 KB
oremod_a4.dm	2020/04/10 14:48	DM File	14,556 KB
oremod_a4c.dm	2022/04/04 17:38	DM File	19,692 KB
oremod_a4cl.dm	2022/04/04 17:39	DM File	12,352 KB
oremod_a4cl_r.csv	2022/04/04 17:39	Microsoft Excel Comma...	1 KB
oremod_a4cl_r.dm	2022/04/04 17:39	DM File	8 KB
ska4_20Bpt.dm	2022/04/03 10:29	DM File	44 KB
ska4_20Btr.dm	2022/04/03 10:29	DM File	184 KB
SKA4_22.rmproj	2022/04/04 19:57	RMPROJ File	97 KB
SKA4_CLASS_RR22_V2.mac	2022/04/04 17:38	MAC File	5 KB
TongradLog.txt	2022/04/04 17:39	Text Document	73 KB

Figure 52: Data Pack - Resource to Reserve Estimation (DataMine Files) – SKA 4

dmstusub.dat	2022/04/03 10:33	DAT	0 KB
oremod_a5.dm	2020/04/10 14:36	DM File	20 KB
oremod_a5cl.dm	2022/04/03 10:33	DM File	28 KB
oremod_a5cl_r.csv	2022/04/03 10:33	Microsoft Excel Comma...	1 KB
oremod_a5cl_r.dm	2022/04/03 10:33	DM File	8 KB
SKA5_22.rmproj	2022/04/03 10:34	RMPROJ File	107 KB
SKA5_CLASS_RR22_V2.mac	2022/04/02 15:37	MAC File	2 KB
TongradLog.txt	2022/04/03 10:33	Text Document	72 KB

Figure 53: Data Pack - Resource to Reserve Estimation (DataMine Files) – SKA 5

_combmod_log.txt	2022/04/09 14:01	Text Document	13 KB
A6_BMGC.dm	2022/04/02 22:30	DM File	47,696 KB
a6_bmgcl.dm	2022/04/09 14:05	DM File	235,312 KB
a6_bmgcl_r.csv	2022/04/09 14:06	Microsoft Excel Comma...	2 KB
a6_bmgcl_r.dm	2022/04/09 14:06	DM File	8 KB
CCA622pt.dm	2022/02/03 17:03	DM File	8 KB
CCA622tr.dm	2022/02/03 17:03	DM File	32 KB
dmstusub.dat	2022/04/03 10:52	DAT	0 KB
SKA6_22.rmproj	2022/04/09 14:07	RMPROJ File	109 KB
SKA6_CLASS_RR22_v6.mac	2022/04/09 12:43	MAC File	8 KB
STOPESA6_22pt.dm	2022/02/16 14:47	DM File	60 KB
STOPESA6_22tr.dm	2022/02/16 14:47	DM File	348 KB
TongradLog.txt	2022/04/09 14:06	Text Document	77 KB

Figure 54: Data Pack - Resource to Reserve Estimation (DataMine Files) – SKA 6

dmstusub.dat	2022/04/03 10:34	DAT	0 KB
oremod_a7.dm	2021/03/30 10:25	DM File	80 KB
oremod_a7cl.dm	2022/04/03 10:34	DM File	140 KB
oremod_a7cl_r.csv	2022/04/03 10:35	Microsoft Excel Comma...	1 KB
oremod_a7cl_r.dm	2022/04/03 10:35	DM File	8 KB
SKA7_22.rmproj	2022/04/03 10:35	RMPROJ File	107 KB
SKA7_CLASS_RR22_V2.mac	2022/04/02 16:44	MAC File	2 KB
TongradLog.txt	2022/04/03 10:35	Text Document	70 KB

Figure 55: Data Pack - Resource to Reserve Estimation (DataMine Files) – SKA 7

_combmod_log.txt	2022/04/09 13:36	Text Document	4 KB
dmstusub.dat	2022/04/03 10:36	DAT	0 KB
oremoda8.dm	2021/03/30 10:25	DM File	1,400 KB
oremoda8cl.dm	2022/04/09 13:36	DM File	2,980 KB
oremoda8cl_r.csv	2022/04/09 13:36	Microsoft Excel Comma...	1 KB
oremoda8cl_r.dm	2022/04/09 13:36	DM File	8 KB
SKA8_22.rmproj	2022/04/09 13:36	RMPROJ File	109 KB
SKA8_CLASS_RR22_v4.mac	2022/04/09 12:45	MAC File	5 KB
SKA8_DEPL_20pt.dm	2022/04/09 13:35	DM File	12 KB
SKA8_DEPL_20TR.dm	2022/04/09 13:35	DM File	92 KB
SKA8PROBPT.dm	2022/04/09 13:35	DM File	8 KB
SKA8PROBTR.dm	2022/04/09 13:35	DM File	8 KB
TongradLog.txt	2022/04/09 13:36	Text Document	74 KB

Figure 56: Data Pack - Resource to Reserve Estimation (DataMine Files) – SKA 8

_combmod_log.txt	2022/04/09 13:40	Text Document	6 KB
a11_bmg.dm	2022/04/03 10:38	DM File	2,260 KB
a11_bmgc.dm	2022/04/03 10:42	DM File	2,672 KB
a11_bmgcl.dm	2022/04/09 13:42	DM File	124,848 KB
a11_bmgcl_r.csv	2022/04/09 13:42	Microsoft Excel Comma...	1 KB
a11_bmgcl_r.dm	2022/04/09 13:42	DM File	8 KB
CHOLESA11_22.dm	2022/01/20 13:26	DM File	504 KB
cholesa11_22_tz.dm	2022/04/03 10:38	DM File	504 KB
CHOLESA11_22_TZ_22.dm	2022/02/25 17:32	DM File	8 KB
cholesa11_22_tz_s.csv	2022/04/03 10:38	Microsoft Excel Comma...	2 KB
cholesa11_22_tz_s.dm	2022/04/03 10:38	DM File	8 KB
CLASS CODING_TZONE_SKA11.xlsx	2022/04/03 10:40	Microsoft Excel Worksh...	18 KB
dmstulog.dat	2022/04/03 10:38	DAT	6 KB
dmstusub.dat	2022/04/03 10:38	DAT	0 KB
OREMOD_A11.dm	2022/01/20 13:26	DM File	2,260 KB
SKA11_22.rmproj	2022/04/09 13:43	RMPROJ File	109 KB
SKA11_CLASS_RR22_v4.mac	2022/04/09 12:46	MAC File	9 KB
ska11fy22_v1pt.dm	2022/04/03 10:38	DM File	76 KB
ska11fy22_v1tr.dm	2022/04/03 10:38	DM File	400 KB
SKA11FY22pt.dm	2022/04/03 10:38	DM File	76 KB
SKA11FY22tr.dm	2022/04/03 10:38	DM File	400 KB
STPA11_22_V1pt.dm	2022/03/09 20:31	DM File	64 KB
STPA11_22_V1tr.dm	2022/03/09 20:32	DM File	716 KB
TongradLog.txt	2022/04/09 13:42	Text Document	77 KB

Figure 57: Data Pack - Resource to Reserve Estimation (DataMine Files) – SKA 11

a17gmod.dm	2021/03/30 10:25	DM File	360 KB
a17gmodcl.dm	2022/04/03 10:49	DM File	660 KB
a17gmodcl_r.csv	2022/04/03 10:49	Microsoft Excel Comma...	1 KB
a17gmodcl_r.dm	2022/04/03 10:49	DM File	8 KB
dmstusub.dat	2022/04/03 10:49	DAT	0 KB
SKA17_22.rmproj	2022/04/03 10:49	RMPROJ File	107 KB
SKA17_CLASS_RR22_V2.mac	2022/04/02 17:15	MAC File	2 KB
TongradLog.txt	2022/04/03 10:49	Text Document	70 KB

Figure 58: Data Pack - Resource to Reserve Estimation (DataMine Files) – SKA 17

_combmod_log.txt	2022/04/03 10:50	Text Document	4 KB
dmstusub.dat	2022/04/03 10:50	DAT	0 KB
INDA21_22pt.dm	2022/04/03 10:50	DM File	8 KB
INDA21_22tr.dm	2022/04/03 10:50	DM File	16 KB
MEASA21_22pt.dm	2022/04/03 10:50	DM File	8 KB
MEASA21_22tr.dm	2022/04/03 10:50	DM File	16 KB
OREMOD_A21.dm	2022/01/20 14:16	DM File	116 KB
oremod_a21cl.dm	2022/04/03 10:50	DM File	268 KB
oremod_a21cl_r.csv	2022/04/03 10:50	Microsoft Excel Comma...	1 KB
oremod_a21cl_r.dm	2022/04/03 10:50	DM File	8 KB
SKA21_22.rmproj	2022/04/03 10:51	RMPROJ File	111 KB
SKA21_CLASS_RR22_V2.mac	2022/04/02 17:32	MAC File	5 KB
SKA21FY22pt.dm	2022/01/19 12:07	DM File	28 KB
SKA21FY22tr.dm	2022/01/19 12:07	DM File	132 KB
TongradLog.txt	2022/04/03 10:50	Text Document	73 KB

Figure 59: Data Pack - Resource to Reserve Estimation (DataMine Files) – SKA 21

_combmod_log.txt	2022/04/09 10:42	Text Document	225 KB
COMPLEXITY_2A_22pt.dm	2022/02/26 12:53	DM File	16 KB
COMPLEXITY_2A_22tr.dm	2022/02/26 12:53	DM File	64 KB
COMPLEXITY_3A_22pt.dm	2022/02/07 19:56	DM File	28 KB
COMPLEXITY_3A_22tr.dm	2022/02/07 19:56	DM File	112 KB
DEP_SKM_22pt.dm	2022/02/03 16:50	DM File	28 KB
DEP_SKM_22tr.dm	2022/02/03 16:50	DM File	212 KB
dmstusub.dat	2022/04/02 14:12	DAT	0 KB
IND_22_V1pt.dm	2022/04/09 08:20	DM File	8 KB
IND_22_V1tr.dm	2022/04/09 08:19	DM File	28 KB
MEAS_22_V1pt.dm	2022/04/09 08:14	DM File	8 KB
MEAS_22_V1tr.dm	2022/04/09 08:14	DM File	28 KB
PROB_22_V1pt.dm	2022/03/09 20:26	DM File	148 KB
PROB_22_V1tr.dm	2022/03/09 20:26	DM File	1,708 KB
PRVD_22_V1pt.dm	2022/03/09 20:27	DM File	312 KB
PRVD_22_V1tr.dm	2022/03/09 20:29	DM File	3,920 KB
SKM_CLASS_RR22_V6.mac	2022/04/09 07:59	MAC File	12 KB
SKM22.rmproj	2022/04/09 12:30	RMPROJ File	112 KB
SKM22B.dm	2022/01/21 12:43	DM File	107,280 KB
skm22bcl.dm	2022/04/09 12:27	DM File	1,105,396 KB
skm22bcl_r.csv	2022/04/09 12:28	Microsoft Excel Comma...	2 KB
skm22bcl_r.dm	2022/04/09 12:28	DM File	8 KB
t10.dm	2022/04/09 11:37	DM File	3,526,192 KB
TongradLog.txt	2022/04/09 12:28	Text Document	78 KB

Figure 60: Data Pack - Resource to Reserve Estimation (DataMine Files) – SKA Main