



mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

ENVIRONMENTAL IMPACT ASSESSMENT REPORT
And
ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

SUBMITTED FOR ENVIRONMENTAL AUTHORIZATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

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FILE REFERENCE NUMBER SAMRAD: NC30/5/1/1/2/2/10146MR

1. IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining “will not result in unacceptable pollution, ecological degradation or damage to the environment”.

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with uninterpreted information and that it unambiguously represents the interpretation of the applicant.

2. OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objective of the environmental impact assessment process is to, through a consultative process—

- (a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- (b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- (c) identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
- (d) determine the—
 - (i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
 - (ii) degree to which these impacts—
 - (aa) can be reversed;
 - (bb) may cause irreplaceable loss of resources, and
 - (cc) can be avoided, managed or mitigated;
- (e) identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- (f) identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
- (g) identify suitable measures to manage, avoid or mitigate identified impacts; and
- (h) identify residual risks that need to be managed and monitored.

TABLE OF CONTENTS

1	CONTACT PERSON AND CORRESPONDENCE ADDRESS	9
1.1	<i>Details of The EAP Who Prepared The Report</i>	9
1.2	<i>Expertise of the EAP</i>	9
2	DESCRIPTION OF THE PROPERTY	10
2.1	<i>Overview</i>	10
2.2	<i>Locality map</i>	11
3	DESCRIPTION OF THE SCOPE OF THE PROPOSED OVERALL ACTIVITY	12
3.1	<i>Listed and Specified Activities</i>	12
3.2	<i>Description of the Activities to be Undertaken</i>	12
4	POLICY AND LEGISLATIVE CONTEXT	20
4.1	<i>Listed Activities Identified in Terms of NEMA, NEM:WA and NWA</i>	23
4.2	<i>Required Environmental Licences</i>	23
5	NEED AND DESIRABILITY OF THE PROPOSED ACTIVITIES	24
5.1	<i>Need</i>	24
5.2	<i>Desirability</i>	24
6	PERIOD FOR WHICH THE ENVIRONMENTAL AUTHORISATION IS REQUIRED	24
7	MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE INCLUDING A FULL DESCRIPTION OF THE PROCESS FOLLOWED TO REACH THE PROPOSED PREFERRED SITE	25
7.1	<i>Details of all Alternatives Considered</i>	25
7.2	<i>Details of the Public Participation Process Followed</i>	25
8	THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE SITES	56
8.1	<i>Climate</i>	56
8.2	<i>Description of the Current Land Uses</i>	76
8.3	<i>Description of Specific Environmental Features and Infrastructure on the Site</i>	78
8.4	<i>Environmental and Current Land Use Map</i>	79
9	IMPACTS AND RISKS IDENTIFIED INCLUDING THE NATURE, SIGNIFICANCE, CONSEQUENCE, EXTENT, DURATION AND PROBABILITY	79
10	METHODOLOGY USED IN DETERMINING AND RANKING THE NATURE, SIGNIFICANCE, CONSEQUENCES, EXTENT, DURATION AND PROBABILITY OF POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS	79

10.1	Overview	79
10.2	Application of Impact Rating Criteria	80
11	THE POSITIVE AND NEGATIVE IMPACTS THAT THE PROPOSED ACTIVITY AND ALTERNATIVES WILL HAVE ON THE ENVIRONMENT AND THE COMMUNITY THAT MAY BE AFFECTED	82
12	THE POSSIBLE MITIGATION MEASURES THAT COULD BE APPLIED AND THE LEVEL OF RISK	82
13	MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED	83
14	STATEMENT MOTIVATING THE ALTERNATIVE DEVELOPMENT LOCATION WITHIN THE OVERALL SITE	83
15	FULL DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY, ASSESS AND RANK THE IMPACTS AND RISKS THE ACTIVITY WILL IMPOSE ON THE PREFERRED SITE (IN RESPECT OF THE FINAL SITE LAYOUT PLAN) THROUGH THE LIFE OF THE ACTIVITY	83
16	ASSESSMENT OF EACH IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK	83
17	SUMMARY OF SPECIALIST REPORTS	90
17.1	<i>Measures to Avoid, Reverse, Mitigate, or Manage Identified Impacts and to Determine the Extent of the Residual Risks that need to be Managed and Monitored</i>	<i>90</i>
18	ENVIRONMENTAL IMPACT STATEMENT	98
18.1	<i>Summary of the Key Findings of the Environmental Impact Assessment</i>	<i>98</i>
18.2	<i>Final Site Map</i>	<i>98</i>
18.3	<i>Summary of the Positive and Negative Implications and Risks of the Proposed Activity and Identified Alternatives</i>	<i>98</i>
19	PROPOSED IMPACT MANAGEMENT OBJECTIVES AND THE IMPACT MANAGEMENT OUTCOMES FOR INCLUSION IN THE EMPR	99
20	FINAL PROPOSED ALTERNATIVES	101
21	ASPECTS FOR INCLUSION AS CONDITIONS OF AUTHORISATION	101
22	DESCRIPTION OF ANY ASSUMPTIONS, UNCERTAINTIES, AND GAPS IN KNOWLEDGE	101
23	REASONED OPINION AS TO WHETHER THE PROPOSED ACTIVITY SHOULD OR SHOULD NOT BE AUTHORISED	102
23.1	<i>Reasons why the Activity Should be Authorised or Not</i>	<i>102</i>
23.2	<i>Conditions that Must be Included in the Authorisation</i>	<i>102</i>
24	PERIOD FOR WHICH ENVIRONMENTAL AUTHORISATION IS REQUIRED	102

25	UNDERTAKING	102
26	FINANCIAL PROVISION.....	103
26.1	<i>Explain how the Aforesaid Amount was Derived</i>	<i>103</i>
26.2	<i>Confirm that this Amount can be Derived from the Operating Expenditure.....</i>	<i>103</i>
27	DEVIATIONS FROM APPROVED SCOPING REPORT AND PLAN OF STUDY.....	103
27.1	<i>Deviations from the Methodology Used in Determining the Significance of Potential Environmental Impacts and Risks</i>	<i>103</i>
27.2	<i>Motivation for the Deviation.....</i>	<i>103</i>
28	OTHER INFORMATION REQUIRED BY THE COMPETENT AUTHORITY	103
29	DRAFT ENVIRONMENTAL PROGRAMME.....	104
29.1	<i>Details of the EAP.....</i>	<i>104</i>
29.2	<i>Description of the Aspects of the Activity.....</i>	<i>104</i>
30	COMPOSITE MAP	104
31	DESCRIPTION OF IMPACT MANAGEMENT OBJECTIVES INCLUDING MANAGEMENT STATEMENTS.....	104
31.1	<i>Determination of Closure Objectives.....</i>	<i>104</i>
31.2	<i>The Process for Managing any Environmental Damage, Pollution, Pumping and Treatment of Extraneous Water or Ecological Degradation As A Result of Undertaking A Listed Activity</i>	<i>105</i>
31.3	<i>Potential Risk of Acid Mine Drainage.....</i>	<i>105</i>
31.4	<i>Steps Taken to Investigate, Assess, and Evaluate the Impact of Acid Mine drainage.....</i>	<i>105</i>
31.5	<i>Engineering or Mine Design Solutions to be Implemented to Avoid or Remedy Acid Mine dRainage</i>	<i>106</i>
31.6	<i>Measures that will be Put in Place to Remedy Any Residual or Cumulative Impact that May Result from Acid Mine drainage</i>	<i>106</i>
31.7	<i>Volumes and Rates of Water Use Required For the Mining, Trenching or Bulk Sampling Operation</i>	<i>106</i>
31.8	<i>Has a Water Use Licence Been Applied For?</i>	<i>106</i>
31.9	<i>Impacts to be Mitigated in their Respective Phases.....</i>	<i>106</i>
31.10	<i>Impact Management Outcomes</i>	<i>106</i>
31.11	<i>Impact Management Actions.....</i>	<i>107</i>
32	FINANCIAL PROVISION.....	127
32.1	<i>Determination of the Amount of Financial Provision</i>	<i>127</i>
32.2	<i>Undertaking</i>	<i>137</i>
33	REFERENCES	139

LIST OF FIGURES

Figure 3-1: Typical Longhole Open Stope Layout.....	13
Figure 3-2: Typical Drift and Fill Layout.....	15
Figure 3-3: Underground Ventilation Layout.....	16
Figure 3-4: Underground Rock Quality Metrics.....	18
Figure 8-1. Average Annual Wind Direction and Speed for Copperton.....	58
Figure 8-2: Undisturbed Natural Habitat In the Study Area.....	61
Figure 8-3: Dustfall Rates.....	68
Figure 8-4: Day and Night-Time Baseline Noise Survey Results.....	70
Figure 8-5: Geographical Boundary of the SLM.....	72
Figure 8-6: Summary of Employment and Income in SLM.....	75

LIST OF TABLES

Table 2-1: Description of the Properties.....	11
Table 2-2: 21 digit Surveyor-General Code for Each Farm Portion.....	11
Table 4-1: Policy and Legislative Context.....	20
Table 4-2: NEMA Listed Activities.....	23
Table 7-1: Stakeholder Meetings.....	26
Table 7-2: Summary Of Issues Raised By I&APS.....	28
Table 8-1: Mean Monthly and Annual Rainfall and Evaporation.....	56
Table 8-2: Mean Monthly and Annual Temperatures.....	57
Table 8-3: Biodiversity Value of Habitats.....	64
Table 8-4: Key Statistics of Siyathemba Local Municipality.....	73
Table 8-5 Labour Ratios for SLM.....	76
Table 10-1: Criteria for Assessing the Significance of Impacts.....	81
Table 10-2: Significance Rating Matrix.....	82
Table 10-3: Positive/Negative Mitigation Ratings.....	82
Table 16-1: Assessment of Each Identified Potentially Significant Impact and Risk.....	84
Table 17-1: Summary of Specialist Reports.....	91
Table 19-1: Impact Management Objectives and Outcomes.....	100
Table 31-1: Impacts to be Managed in Their Respective Phases.....	108
Table 31-2: Impact Management Outcomes.....	121
Table 31-3: Impact Management Actions.....	123
Table 32-1: Mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon.....	129

LIST OF APPENDICES

Appendix 1: EAP Experience.....	i
Appendix 2: Summary List of Key Policy and Legislative Instruments	ii
Appendix 3: Maps.....	iii
Appendix 4: Record of Registered Land Claims	xviii
Appendix 5: Public Participation Materials.....	xix
Appendix 6: Impact Assessment Matrix	xx
Appendix 7: Specialist Reports.....	xxi
7.1 Heritage and Palaeontology Reports	
7.2 Geohydrological Report	
7.3 Geochemical Report	
7.4 Social Impact Report	
7.5 Blasting Impact Report	
7.6 Conceptual Closure Report	

LIST OF MAPS IN APPENDIX 3

Map 1: Regional Locality Map.....	iv
Map 2: Orion PCM Ore Body	v
Map 3: Surrounding Landowners and Landusers.....	vi
Map 4: Topography	vii
Map 5: Geology.....	viii
Map 6: Soils.....	ix
Map 7: Vegetation.....	x
Map 8: Quarternary Catchments	xi
Map 9: Critical Biodiversity and Ecological Support Areas	xii
Map 10: Protected Areas	xiii
Map 11: PCM in Relation to the Karoo Central AAA	xiv
Map 12: Disturbed Areas.....	xv
Map 13: Current Landuses	xvi
Map 14: Environmental Sensitivity Plan	xvii

LIST OF ACRONYMS AND ABBREVIATIONS

BFS	Bankable Feasibility Study
CBA	Critical Biodiversity Area
CRR	Comment and Response Register
Cu	Copper
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DSR	Draft Scoping Report
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr	Environmental Management Programme
ESA	Ecological Support Area
FSR	Final Scoping Report
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IWULA	Integrated Water Use Licence Application
IWWMP	Integrated Water and Wastewater Management Plan
kl	Kilolitre
ktpa	Kiltons per annum
ktpm	Kiltons per month
l	litre
LHOS	Long Hole Open Stopping
LOM	Life of Mine
m	Metre
mamsl	Metres above mean sea level
mm	Millimetre
MPRDA	Minerals and Petroleum Resources Development Act
MR	Mining Right
MRA	Mining Right Application
MRE	Mineral Resource Estimate
Mtpa	Million tons per annum
NAD	Net Acid Generating
NEMA	National Environmental Management Act
NEM:AQA	National Environmental Management: Air Quality Act
NEM:BA	National Environmental Management: Biodiversity Act
NEM:WA	National Environmental Management: Waste Act
NHRA	National Heritage Resources Act
NWA	National Water Act
p.a.	Per annum
PCM	Prieska Copper Mine
PCML	Prieska Copper Mine Limited

PR	Prospecting Right
PRA	Prospecting Right Application
RWD	Return Water Dam
S&EIR	Scoping and Environmental Impact Reporting
SAHRA	South African Heritage Resource Agency
SARAO	South African Radio Astronomy Observatory
SDF	Spatial Development Framework
SLM	Siyathemba Local Municipality
SLP	Social and Labour Plan
WML	Waste Management Licence
Zn	Zinc

PART A

SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1 CONTACT PERSON AND CORRESPONDENCE ADDRESS

1.1 DETAILS OF THE EAP WHO PREPARED THE REPORT

NAME OF THE PRACTITIONER:	ABS Africa (Pty) Ltd.
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1.2 EXPERTISE OF THE EAP

1.2.1 THE QUALIFICATIONS OF THE EAP

Name: Mr. Paul Furniss

Academic Qualifications:

- Bachelor of Agricultural Science in Animal Science: University of Pretoria, 1998
- Bachelor of Science (Honours) in Wildlife Management: University of Pretoria, 1999
- Master of Science in Environmental Science (Water Resource Management): University of Pretoria, 2000

Professional Registration:

- Pr.Sci.Nat. Professional Natural Scientist (Environmental Science): The South African Council for Natural Scientific Professions, 2007.

Name: Ms. Chané Pretorius

Academic Qualifications:

- Bachelor of Science in Tourism: North West University, 2010
- Bachelor of Science (Honours) in Geography: University of Johannesburg, 2011

1.2.2 SUMMARY OF THE EAPs PAST EXPERIENCE

ABS Africa (Pty) Ltd is a professional environmental advisory company with a focus on the mining environment. The ABS Africa personnel included in the project team structure for the independent environmental assessment have collectively completed more than 100 EIAs across the African continent.

Much of this experience has been gained in undertaking complex and challenging EIAs involving the management of specialist teams, conducting public participation processes, aligning international standards with in-country legislation and interfacing with project engineering teams.

The EAP responsible for this submission has 17 years environmental assessment and management experience in the energy, water, mining and infrastructure sectors.

His project experience includes conducting environmental assessment studies in South Africa, Guinea, Nigeria, Lesotho, Democratic Republic of Congo, Sudan, Namibia, Botswana, Zimbabwe, and Mozambique. Please refer to Appendix 1 for a record of the experience of the EAP.

2 DESCRIPTION OF THE PROPERTY

2.1 OVERVIEW

The historical Prieska Copper Mine (PCM) is situated approximately 3 km south of Copperton and 60 km south-west of the town of Prieska in the Northern Cape Province. The mine falls within the authority of the Siyathemba Local Municipality (Appendix 3, Map 1). The site is accessed via the R357 from Prieska. The mine was owned and operated by Prieska Copper Mine Limited (PCML), a subsidiary of Anglo-Transvaal Consolidated Investment Company Limited (Anglovaal), between 1971 and 1991. The mine operations ceased in 1991 and rehabilitation and closure of the mine was undertaken in accordance with agreements reached with the Department of Mineral and Energy Affairs. A closure certificate was issued by the latter on 19 October 1995. No mining activities have taken place at PCM since 1991.

Orion Minerals (Orion), through its subsidiary company of Vardocube (Pty) Ltd., is the holder of a prospecting right in the Copperton area of the Northern Cape Province. The prospecting right was recently executed, and drilling of the Volcanogenic Massive Sulphide (VMS) Deposit, to confirm the mineral resource estimate for Cu and Zn, has commenced.

The applicant (Vardocube) is applying for a Mining Right for the Prieska Zinc Copper Project (Vardocube Section). The activity being applied for is exclusively for underground mining with no requirement for any surface area disturbance within the proposed mining right area.

The proposed Vardocube mining right area is adjacent to the Repli Trading No. 27 (Pty) Ltd. (Repli) mining right area. Repli is also a subsidiary of Orion and a Mining Right Application (DMR Reference No: NC30/5/1/2/3/2/1/10138 MR) for Repli was submitted in April 2018 and is expected to be finalised by the first quarter of 2019.

The Copperton Deposit extends across the Repli and Vardocube prospecting right areas. Through its subsidiary company Vardocube, Orion therefore intends to access and mine the full extent of the deposit of interest including the Vardocube mining area via the refurbished existing Hutchings Shaft, situated on Portion 25 of the Farm Vogelstruisbult 104, within the proposed Repli mining right area. The Vardocube Section could not be included in the Repli Mining Right Application as the two companies (Vardocube and Repli), have different ownership structures.

A commercial agreement will be entered into between Repli and Vardocube so that relevant infrastructure and facilities established to support the proposed Repli surface and underground mining will also be used for the underground mining of the Vardocube Section of the deposit

The infrastructure and facilities to be established by Repli have been designed with sufficient capacity to accommodate the additional ore and tailings that will be generated from the Vardocube underground mining.

PCM was one of South Africa's first mines to have a decline from surface, using trackless mining methods. Almost all the underground development took place in a competent footwall unit.

PCM was serviced by one main vertical men and rock shaft, four ventilation shafts and the decline. The Hutchings Shaft is an 8.8 m diameter vertical shaft sunk down to approximately 1 km below surface. The decline has a length of approximately 7.1 km.

Approximately 37 km of underground roadways are underground and various pump stations are still in place from the historical dewatering activities.

Underground mining will focus on exploiting what remains of the Deep Sulphide Exploration Target. Ore production will come from stoping areas below the -900m Level. Access to some of these deeper stoping areas was already established as part of the trial mining that was undertaken before mining operations ceased in 1991.

Blasted ore will be hoisted from underground and processed on surface through the Repli process plant and associated infrastructure, situated on Portions 1 and 25 of the Farm Vogelstruisbult 104.

A Scoping and Environmental Impact Reporting (S&EIR) process is being undertaken in support of the Mining Right Application (MRA) and Environmental Authorisation (EA) required for the proposed underground mining activity.

TABLE 2-1: DESCRIPTION OF THE PROPERTIES

FARM NAMES:	Remaining Extent of Portion 1 of the Farm Vogelstruisbult 104
APPLICATION AREA (HA):	6 085.5029 Ha
MAGISTERIAL DISTRICT:	Prieska, Northern Cape
MUNICIPALITIES	Siyathemba Local Municipality Pixley ka Seme District Municipality
DISTANCE AND DIRECTION TO NEAREST TOWNS	Copperton is situated approximately 3 km north of the proposed underground mining area. Prieska is approximately 60 km to the north-east.

TABLE 2-2: 21 DIGIT SURVEYOR-GENERAL CODE FOR EACH FARM PORTION

FARM NAME	PORTION	TITLE DEED	21 DIGIT SURVEY OR GENERAL CODE FOR EACH FARM PORTION
Vogelstruisbult 104	RE/1	T18939/2003	C06000000000010400001

The surface area of the entire property included in the mining right application area measures approximately 6 085 hectares in extent.

2.2 LOCALITY MAP

Please refer to Appendix 3, Map 1.

3 DESCRIPTION OF THE SCOPE OF THE PROPOSED OVERALL ACTIVITY

3.1 LISTED AND SPECIFIED ACTIVITIES

(Please refer to Appendix 3 Map 2 for the outline of the underground extent of the target orebody).

NAME OF ACTIVITY (ALL ACTIVITIES INCLUDING ACTIVITIES NOT LISTED) (E.G. EXCAVATIONS, BLASTING, STOCKPILES, DISCARD DUMPS OR DAMS, LOADING, HAULING AND TRANSPORT, WATER SUPPLY DAMS AND BOREHOLES, ACCOMMODATION, OFFICES, ABLUTION, STORES, WORKSHOPS, PROCESSING PLANT, STORM WATER CONTROL, BERMS, ROADS, PIPELINES, POWER LINES, CONVEYORS, ETC...ETC...ETC.)	AERIAL EXTENT OF THE ACTIVITY HA OR M ²	LISTED ACTIVITY MARK WITH AN X WHERE APPLICABLE OR AFFECTED	APPLICABLE LISTING NOTICE (GNR 544, GNR 545 OR GNR 546)/NOT LISTED
Blasting (underground)	30, 39 (Ha) ¹	X	GNR 984 (17)
Loading, hauling and transport of ore (underground)	30, 39 (Ha) ¹	X	GNR 984 (17)

¹ Approximate surface area extent of the Vardocube Section of the orebody proposed to be mined.

3.2 DESCRIPTION OF THE ACTIVITIES TO BE UNDERTAKEN

3.2.1 MINING METHOD

Historic underground mining successfully extracted 46 Mt of sulphide ore from steep dipping, continuous open stopes, down to a depth of 900 m at a mining rate of 250 ktpm of ore. Excavations that were established to access production areas and transport ore back to the underground crusher are expected to still be in useable condition. This pre-existing network of excavations will provide the initial access and support ventilation for the planned mining until expanded upon.

Underground mining of the Vardocube Section of the ore deposit will be an extension of the same mining method used for the adjacent Repli Section of the ore deposit.

Waste rock will remain underground at designated worked-out stope ends for future use as backfill wherever possible. Access to the underground mine will be via the refurbished existing Hutchings Shaft and rehabilitated decline ramp.

Mine production will be achieved using a combination of two mining methods:

- The continuation of longhole sub-level open stoping (LHOS), supplemented with pastefill and waste rock, where the orebody is steep enough for longhole stoping; and
- The introduction of drift-and-fill, where the orebody dip becomes too flat to allow gravitational flow of ore from the stopes.

3.2.1.1 Long Hole Open Stoping

LHOS will be established by first developing access drifts (typically 4.5 m wide x 4.5 m high) parallel to the strike in the footwall and at a predetermined distance from the reef contact. The access drifts will be developed at typically 20 m vertical intervals to match the designed stope heights. Cross-cuts will then be developed from the footwall access drift, perpendicular to the strike of the ore body to intersect and traverse the ore zone, terminating at the hanging wall contact. Crosscuts will be established along the orebody to service each stoping block.

Ore drill drives will then be developed in the ore zone, along strike of the ore, on the footwall side of the ore zone. The drill drive will be developed to define the full strike length of the orebody.

Each stope block will have a strike length of typically 60 m, with a group of three stopes adjacent to each other and separated from the next group by a 30m-wide rib pillar.

The two end stopes in each group, adjacent to the rib pillars, will be mined out first as primary stopes. Once the primary stopes are mined out and backfilled with cemented rock fill (CRF), pastefill, waste rock or hydraulic fill, the middle or secondary stopes are then to be extracted. The remaining rib pillars will be extracted opportunistically as a tertiary production stage, depending on ground conditions. A typical LHOS layout is illustrated in Figure 3-1.

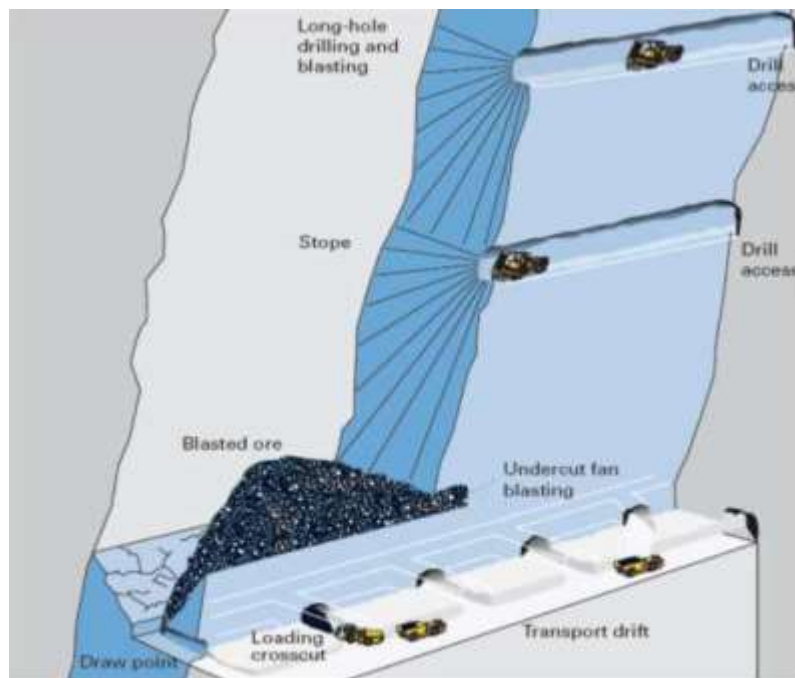
Once a stoping zone is established, the stoping front will retreat up-dip, with the lowest stopes being mined first, backfilled and used as the mucking floor for the adjacent upper stopes.

A typical LHOS stope is commenced by first establishing a raise at one end of the stope to link the lower drill drive to the one vertically above it. The raise is then widened to the width of the ore zone to create the relief slot, by blasting longholes drilled around the raise.

Production blast holes are drilled, either as down-holes or up-holes in rows, with the row interval spaced 1.5 m to 2.0 m along strike (termed the ring burden). Within each row, blast holes are collared in the drill drive and fanned out to cover the ore zone. Spacing of the drill holes at the toe of each hole is kept to below 2.0 m (spacing).

Once the slot is established, rings are fired sequentially into the created void, until the whole stope is blasted.

Remote control LHD units be used to muck the stope. The LHD will muck to reloading bays in the access drives.



Source: Orion Minerals, 2018. Scoping Study Report

FIGURE 3-1: TYPICAL LONGHOLE OPEN STOPE LAYOUT

Once a stope is emptied, the primary stopes will be filled with cemented rock fill, containing a 5 to 7% cement binder. The stopes will be filled via the upper cross-cut and drill drive until tightly filled. Secondary stopes will be mined adjacent to the backfilled primary stopes after sufficient fill cure time is allowed, typically more than 14 days. Secondary stopes are then to be filled with unconsolidated backfill.

Ammonium nitrate and fuel oil (ANFO) is assumed for most production blasting, with bulk emulsion explosives used only when wet conditions are encountered. The powder factors for the primary and secondary stopes have assumed to be 1.5 and 1.2 kg/t of ore, respectively, including the drop raise blasting.

3.2.1.2 Drift and Fill

Where vertical thickness of the ore is not high enough for efficient LHOS, orebody dip too flat or ground conditions inappropriate, then drift-and-fill (D&F) mining will be used.

The drift-and-fill sequence can be described as follows:

- A series of on-strike and on-ore access drives, typically 4.5m wide x 4.5m high, spaced at 60m along-dip intervals and parallel to each other are first established, (these are the equivalent of LHOS level drill drives);
- Primary drift drives are then developed from the access ore drives, in both the up-dip and down dip direction, sub-parallel to the dip direction. The drift drives will be developed within the ore zone and at the upper extent of it. The drift drives will be extended to either breakthrough to the adjacent access ore drive or meet up with a corresponding drift drive from the adjacent access ore drive;
- Primary drift drives are established at intervals that leave sufficient room for secondary and then tertiary drives to be later developed;
- Where ore remains underfoot of the drift drive, the ore is removed by benching the floor; and
- Once benching is completed and the drives emptied, backfilling is done using cement rock fill, as is to be done for LHOS.

A three-stage extraction sequence will be used to ensure that there is always adequate support (either virgin ground, well-cured CRF, paste fill or other selected supplementary support method) adjacent to a drift being extracted and no slender backfill ribs are formed.

Where backfill walls are exposed, (especially primary drifts), cement content will be increased to ensure freestanding backfill. The secondary drifts will require less cement and tertiary only enough cement to prevent liquefaction. A typical D&F layout is illustrated in Figure 3-2.

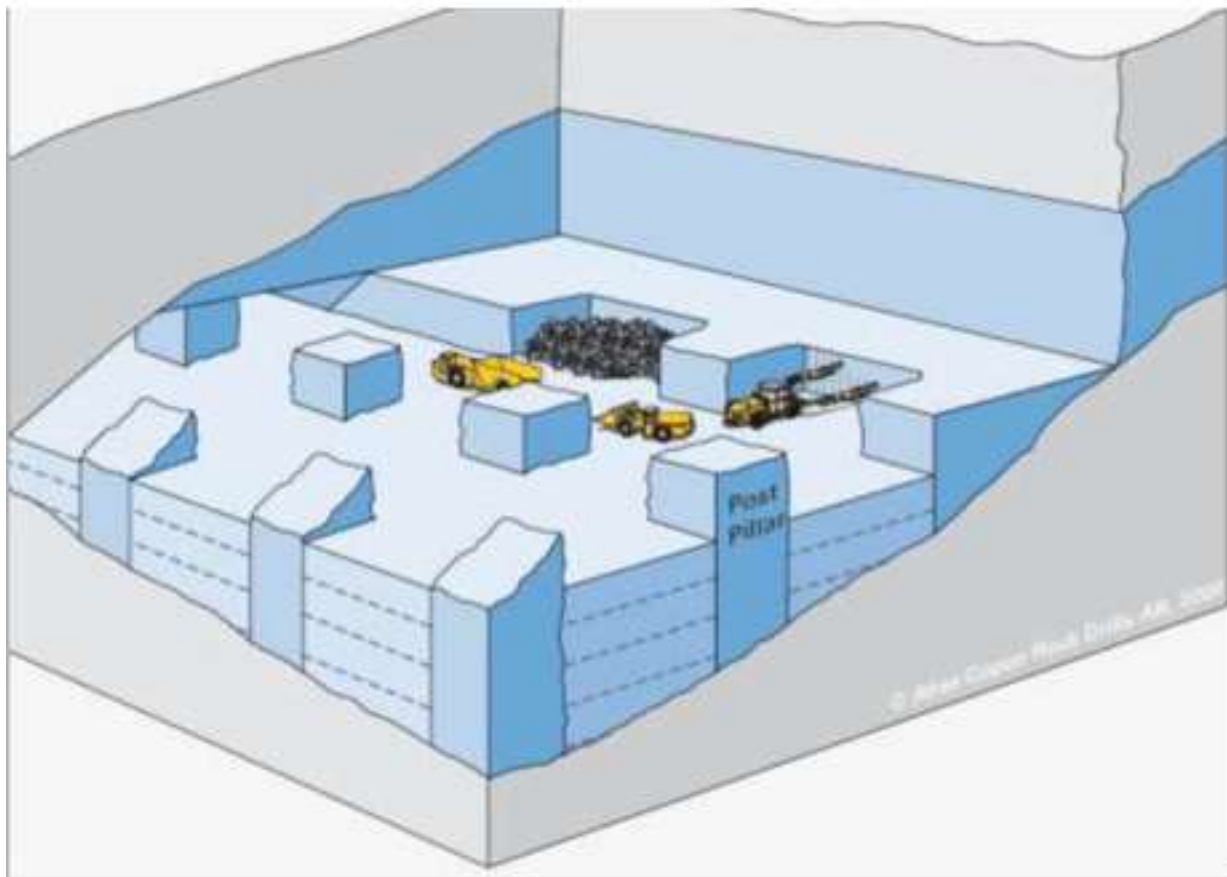


FIGURE 3-2: TYPICAL DRIFT AND FILL LAYOUT

3.2.1.3 Underground Material Handling Systems¹

Mining consumables and materials will be stored on surface (within the Repli mining right area) and transported underground to section buffer stores for distribution to mining areas as required. All the underground material handling systems used for mining of the Repli deposit will also be used for the mining of the Vardocube section.

Blasted rock will be truck hauled from mining areas and tipped into designated truck tips. Electric locos will haul hoppers from the loading points below the orepasses to the existing rail tips feeding the underground crusher station.

Ore will be crushed UG (nominally to minus 150 mm) and hoisted to surface via the Hutchings Shaft.

To minimise electrical energy requirements, limited compressed air will be used for workshops, refuge bays and potential gas (methane) control. Diesel-driven electro-hydraulic drill jumbos and roof bolters will be used. 40t underground trucks (some fitted with ejector buckets) will transport broken rock. LHD's will muck broken rock.

All infrastructure to support the deeps sulphide mining will be positioned underground. Engineering shops and stores will be located at the trackless mining workshop.

¹ Mine Design Criteria, DRA 2018. PCM-DRA2071-ME-DC-001

3.2.1.4 Mine Ventilation

No new or additional mine ventilation shafts are required for the underground mining of the Vardocube Section.

The Hutchings Shaft and Main Decline on the Repli mining right area will be used as the primary intakes. The Boehmka and Beecroft Shafts (also on the Repli mining right area) will be refurbished as up-cast ventilation shafts. New ventilation fans will be erected on the shaft collars. Deepening these shafts will allow sufficient ventilation to reach the new underground workings below the 1024 level. Underground return airways required to transport air to the new up-cast shaft positions will be identified and refurbished.

Refurbishing of required tunnels will include clearing any restrictions that may have developed over time to eliminate pressure losses in the ventilation system.

Additional raise-bore ventilation airways will be installed to allow fresh air to enter the development and production area along strike as the mine develops over time. Moveable fans will be used for ventilation throughout the underground mine and will range in ratings from 22 kW to 50 kW depending on the areas and tunnel length to be ventilated. 22 kW fans will also be utilised to provide ventilation in workshops, offices and pump stations.

Where appropriate the old working areas will be sealed off with ventilation walls and installing mechanical ventilation doors where required. A preliminary ventilation layout for the proposed mine is shown below.

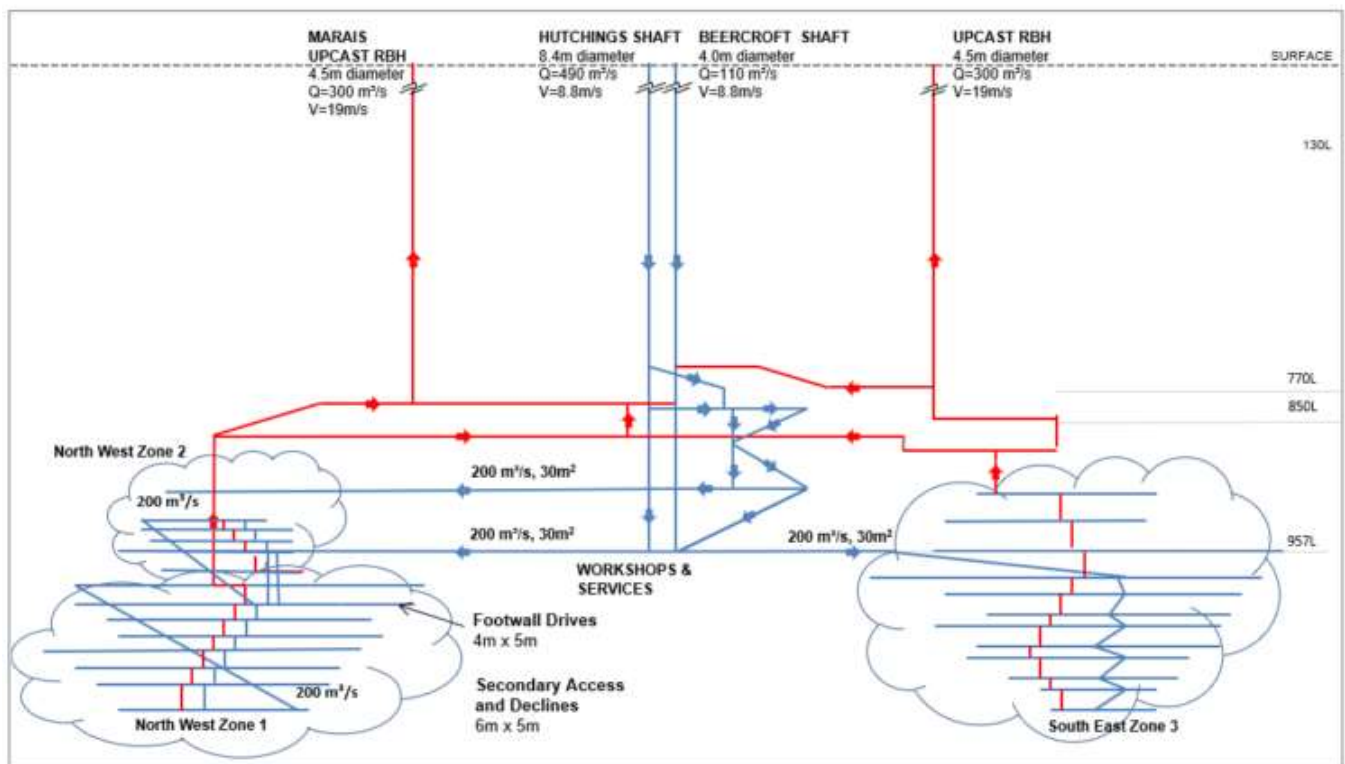


FIGURE 3-3: UNDERGROUND VENTILATION LAYOUT

3.2.1.5 Backfilling

Backfilling for the Vardocube Section will be similar to that undertaken for the adjacent Repli Section.

A combination of paste backfill and waste rock backfill will be used to fill both LHOS and D&F mining stopes. It is estimated that approximately 80% of all mining areas will be backfilled. Once LHOS have been established and access for trucks are available, 40 tonne ejector bucket truck will haul and dump development waste into completed LHOS stopes prior to completion of the paste filling process. Where possible, LHD's will dump waste rock in D&F heading prior to paste fill.

The waste rock will typically be placed un-cemented, followed by the introduction of a free-flowing tailings-cement mix to fill the voids. A full cement backfill will be required in places to create a stable wall.

The paste plant that was constructed for the open pit will be utilised for the underground mining backfill requirements. Tailings from the TSF will be used with cement at various mix ratios depending on the fill and strength requirement.

The backfill delivery system will be based on a dedicated 250 mm HDPE pipeline from surface via one of the existing ventilation shafts to the 310 m level. From this point the pipe-line will be fed down newly installed ventilation raise-bore holes into the Deeps mining section. It is planned to install a piping system within the mining areas to allow two stopes to be filled at any one time.

Water will be used to flush the backfill pipelines between fill cycles. This water will be pumped out of the underground workings and returned to surface for reuse in the Repli Mine backfill plant or process plant.

3.2.1.6 Access²

The rehabilitated and refurbished Hutchings Shaft (within the Repli mining right area) will be used as the main access for men and material. A rock hoist will be used to hoist ore production to surface. Material will be loaded onto rail bound cars and lowered to the main production level (level 957) for distribution to working areas and underground buffer stores.

Trackless Mining Machines (TMMs) will travel from underground workshops to working areas above level 957. New decline ramps (5 m H x 6 m W) will be developed at 9-degree declination to access mining areas below the current infrastructure.

Gathering haulages (5mW x 5mH) will lead from the decline ramps to access the mining blocks. Drift and fill mining development will be a minimum size of 4mW x 4mH to accommodate mining equipment.

3.2.1.7 Dewatering of Underground Workings

Construction Phase Dewatering

No construction phase dewatering of the Vardocube Section is required as the flooded underground workings will be dewatered ahead of the Repli mining activities commencing.

Operational Phase Dewatering

The geohydrological study indicates that the rate of groundwater seepage for underground mining in the area is expected to be very low (indicative average flow of 4.6 l/s), as the rock formations are expected to be unfractured with low permeability and thus not transmitting groundwater.

² Mine Design Criteria, DRA 2018. PCM-DRA2071-ME-DC-001

To ensure safe access for mining of the Vardocube Section, water will continue to be removed from the underground workings and managed as part of the Repli dewatering management system.

3.2.2 GEOTECHNICAL INVESTIGATIONS

Observations from the existing tunnels in the upper levels of the historical mine indicate very competent rock and very little tunnel support was installed. Localised roof-bolting was carried out in isolated areas where small amounts of fracturing was observed. Considering the time from when these tunnels were first opened, the rock conditions are still very competent.

Geotechnical studies carried out on the hanging-wall rocks, footwall rocks and the mineralised zone of the orebody indicate competent rock for all three rock types (Figure 3-4).

RQD (Rock Quality Designation)	Rock quality classification	Q Index rating	Rock quality classification
0 -25%	Very Poor	0.001 - 0.01	Exceptionally Poor
25% - 50%	Poor	0.01 - 0.1	Extremely Poor
50% - 75%	Fair	0.1 - 1.0	Very Poor
75% - 90%	Good	1.0 - 4.0	Poor
90% - 100%	Excellent	4.0 - 10	Fair
		10.0 - 40.0	Good
		40.0 - 100.0	Very Good
		100.0 -400.0	Extremely Good
		400.0 - 1000	Exceptionally Good

RMR (Rock Mass Rating)	Rock quality classification
0-21	Very Poor
21 – 40	Poor
41 – 60	Fair
61 - 80	Good
81 - 100	Excellent

FIGURE 3-4: UNDERGROUND ROCK QUALITY METRICS

Pattern bolting in all new development ends will be carried out. Tunnel dimensions will be 6 x 5 metres for main ramps and footwall tunnels while stope access tunnels will be 4 x 4 metres.

The planned rock support is described below;

- 2 m resin grouted roof-bolts on a 1.5 x 1.5 m pattern for all tunnel development
- Meshing and lacing in addition to the bolting pattern will be installed over the last 10 m of access tunnels intersecting the deposit
- Larger excavations such as the crusher chamber and workshops will require primary roof-bolts as described above with additional 6.5 m cable anchors on a 3 m spacing. 50 mm of shotcrete will then be applied.

3.2.3 MINE INFRASTRUCTURE AND MINE FACILITIES

Mine infrastructure and facilities established as part of the Repli Mining Right Application and which will be used by agreement between the two companies for the processing of the ore from the Vardocube Section includes:

- The refurbishment and refitting of the Hutchings Shaft, ventilation fans, underground workshops, pump stations, electrical substations, dirty and clean water system;
- Establishment of new offices, stores, accommodation, ablution facilities, change-houses, workshops, washbay facilities, fuel storage and dispensing facilities, and refuge chambers;
- Water reticulation, compressed air reticulation, power reticulation, engineering systems, communications network; emergency alarm system, lighting, rock conveying services, and materials handling; and
- Surge silos, a primary underground crusher, shaft ore conveying linking up with a secondary crusher and related process plant facilities on surface to support ore processing.

No dedicated infrastructure or facilities is thus required for the mining of the Vardocube Section.

3.2.3.1 Power

Power will be obtained from the nearby Eskom Cuprum Substation. The Cuprum Substation is supplied by the Kronos Substation nearby which is linked to the national grid via a 400 kV line. The surface and underground power reticulation established by Repli will be used for the electrical power requirements associated with the mining of the Vardocube Section.

3.2.3.2 Explosives Magazine

Explosives required for the blasting of the Vardocube Section will be stored in the same explosives magazine to be utilised by Repli.

3.2.3.3 Water

The underground mining process itself does not require any water use. Water will however be required for flushing of the backfill pipelines between fill cycles and for suppression of dust generated during drilling.

In general, water requirements for processing of the ore at the Repli processing plant is expected to be in the order of 1 m³ per tonne of run-of-mine (ROM) ore processed.

Potable water will be available on site, supplied via the bulk pipeline from Prieska. All water and wastewater infrastructure established by Repli will, by agreement between the two companies, be used for the mining of the Vardocube Section.

An agreement is in place between Repli and the SLM regarding the provision of potable water.

3.2.3.4 Sewage

Chemical toilets will be used for the underground mining. These will be serviced at the required frequency by a contractor.

3.2.3.5 Non-Mineral Waste Management

All solid waste generated underground will be removed to surface and managed through the Repli waste management system.

4 POLICY AND LEGISLATIVE CONTEXT

A non-exhaustive summary list of the various legislation applicable to the proposed development is provided in Appendix 2.

Table 4-1 provides a description of the legislation which has particular importance to the S&EIR process being undertaken for the development.

TABLE 4-1: POLICY AND LEGISLATIVE CONTEXT

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT (A DESCRIPTION OF THE POLICY AND LEGISLATIVE CONTEXT WITHIN WHICH THE DEVELOPMENT IS PROPOSED INCLUDING AN IDENTIFICATION OF ALL LEGISLATION, POLICIES, PLANS, GUIDELINES, SPATIAL TOOLS, MUNICIPAL DEVELOPMENT PLANNING FRAMEWORKS AND INSTRUMENTS THAT ARE APPLICABLE TO THIS ACTIVITY AND ARE TO BE CONSIDERED IN THE ASSESSMENT PROCESS);	REFERENCE WHERE APPLIED
ACTS	
National Environmental Management Act, 1998 (Act No. 107 of 1998)(NEMA)	<p>NEMA provides 18 specific principles relating to Environmental Management. Of key importance are the precautionary principle and the polluter pays principle. The 18 principles of NEMA are to be recognised during the undertaking of the Impact Assessment Process and play a key role during the decision-making process.</p> <p>Section 24 of NEMA requires environmental authorisation to be obtained for certain activities identified in three listing notices, published on 4 December 2014. The procedure for obtaining an environmental authorisation requires either a basic assessment (activities in Listing Notice 1 and 3) or scoping and Environmental Impact Assessment (activities in Listing Notice 2) process to be undertaken to inform the application for authorisation.</p> <p>The proposed underground mining falls within the ambit of listed activities in Listing Notice 2. Since activities in Listing Notice 2 apply to the proposed mining activities, a S&EIR process is being followed. The S&EIR process is being undertaken in compliance with the requirements of NEMA and the EIA Regulations, 2014.</p>
Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA)	<p>The MPRDA regulates the acquisition, use and disposal of mineral and petroleum rights.</p> <p>Vardocube is applying for a mining right in terms of section 22 of the MPRDA.</p>
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA)	<p>The NEM: WA provides for the reform of waste management legislation and repeals or amends the legislation under which waste was previously regulated.</p> <p>Part 4 of the NEM: WA pertains to listed waste management activities. In accordance with section 19(2) of the NEM: WA, the Minister published a schedule of listed waste management activities in Government Notice (GN) 921 of 29 November 2013. These are considered activities that have or are likely to have a detrimental effect on the environment.</p>

	<p>According to regulation 2 of GN 921, no person may commence, undertake, or conduct a listed waste management activity unless a licence is issued in respect of that activity.</p> <p>No Waste Management Licence will be required for the proposed Vardocube MRA as the proposed mining does not involve any listed waste management activities.</p>
<p>Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA)</p>	<p>The objective of the Act is to cover all aspects relating to health and safety of employees and other persons on the mine property. The Act places the responsibility on the mine owner for ensuring that the mine is designed, constructed and equipped in a manner which allows for a safe and healthy working environment.</p> <p>The safety precautions in Section 7 of the MHSA have been incorporated in the environmental sensitivity map.</p>
<p>The National Water Act, 1998 (Act No. 36 of 1998)(NWA)</p>	<p>The National Water Act, 1998 (Act No. 36 of 1998), identifies 11 consumptive and non-consumptive water uses, which must be authorised under a tiered authorisation system, which include Scheduled uses, General Authorisations, or Licenses. In terms of the National Water Act, the following water uses are identified:</p> <ul style="list-style-type: none"> (a) Taking water from a water resource; (b) Storing water; (c) Impeding or diverting the flow of water in a watercourse; (d) Engaging in a stream flow reduction activity contemplated in section 36; (e) Engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1); (f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit; (g) Disposing of waste in a manner which may detrimentally impact on a water resource; (h) Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process; (i) Altering the bed, banks, course or characteristics of a watercourse; (j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and (k) Using water for recreational purposes. <p>This listed activity may be triggered by the dewatering which will be needed to access the orebody. Dewatering is a water use requiring licensing in terms of the National Water Act 36 of 1998.</p>
<p>National Environmental Management: Air Quality Act 2004 (Act No. 39 of 2004)(NEM:AQA)</p>	<p>The main objectives of the National Environmental Management: Air Quality Act 2004 (Act no. 39 of 2004) (NEM: AQA) are to protect the environment by providing reasonable legislative and other measures to:</p> <ul style="list-style-type: none"> ➤ Prevent air pollution; and ➤ Promote conservation and secure ecologically sustainable development. <p>No AEL application has been identified as being necessary for the Vardocube Project.</p>
<p>Hazardous Substances Act (Act No. 15 of 1973)</p>	<p>The objective of the Act is to provide for the control of substances which may cause injury or ill health to or death of human beings due to their toxic, corrosive, irritant, strongly sensitizing or flammable nature or the generation of pressure. In terms of the Act, substances are divided into schedules, based on their relative degree of toxicity and the Act provides for the control of</p>

	<p>importation, manufacture, sale, use, operation, application, modification, disposal and dumping of substances in each schedule.</p> <p>Several chemicals likely to be used in the servicing and maintenance of underground machinery and equipment, such as chemicals typically found in petroleum products, are regulated in terms of this Act. With all appropriate controls in place, the intended use and handling of these chemicals will not conflict with the Act. The EMPr will provide details in this regard.</p>
National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA)	<p>The NHRA describes the importance of heritage in the South African context, and designates the South African Heritage Resource Agency (SAHRA) as guardian of the national estate which may include heritage resources of cultural significance that link to biodiversity, such as places to which oral traditions are attached or which are associated with living heritage, historical settlements, landscapes and natural features of cultural significance, archaeological and paleontological sites, graves and burial grounds, or movable objects associated with living heritage.</p> <p>Section 38 of the Act requires a Heritage Impact Assessment (HIA) to be undertaken for various types of development. If the HIA demonstrates that the development will have an impact on a heritage resource, approval from the South African Heritage Resource Agency, or the relevant provincial heritage authority is needed prior to proceeding with the development.</p> <p>With mining intended to take place at a depth of more than 900 m below natural ground level, no impact to heritage resources is expected. An HIA was completed as part of the environmental authorisation process for the Prieska Zinc Copper Project. This HIA included a palaeontological assessment of a study area incorporating the Vardocube Section. The assessment indicated low to very low palaeontological sensitivity for the area.</p>
Astronomy Geographic Advantage Act, 2007 (Act No. 21 of 2007)	<p>Provides for the protection, preservation and maintenance, in respect of radio frequency interference or interference in any other way, of declared astronomy advantage areas. Three Central Astronomy Advantage Areas have been established to date, namely:</p> <ul style="list-style-type: none"> ➤ The Northern Cape Province, excluding Sol Plaatje Municipality ➤ The Karoo Core AAA ➤ The Karoo Central AAA <p>The proposed mining right area is located within the Northern Cape Province and the Karoo Central AAA. Restrictions may apply with respect to mine-related radio and electrical activities, if these are deemed to interfere with SKA equipment.</p>
GUIDELINES	
Department of Environmental Affairs Guideline Series 7: Public Participation (2012)	<p>The public participation guideline outlines the importance of public participation as well as the minimum legal requirements for the public participation process, the steps to be taken and the guideline for planning a public participation process.</p> <p>The public participation process for this application has incorporated relevant requirements of the guideline.</p>
Department of Environmental Affairs Guideline Series 9: Need and Desirability (2012)	<p>The need and desirability guideline highlights the importance of establishing and assessing the need and desirability for a project. The consideration of need and desirability in the EIA decision making process requires the consideration of the strategic importance of the development alongside the broader societal need and public interests.</p> <p>The need and desirability description for the proposed development has taken cognisance of this guideline.</p>

4.1 LISTED ACTIVITIES IDENTIFIED IN TERMS OF NEMA, NEM:WA AND NWA

TABLE 4-2: NEMA LISTED ACTIVITIES

NEMA LISTED ACTIVITIES		
REGULATION	ACTIVITY NUMBER	SUMMARY DESCRIPTION
GN R.984, 8 December 2014 (as amended on 7 April 2017) Listing Notice 2: Scoping and EIA	2(6)	<p>The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, excluding—</p> <p>(i) activities which are identified and included in Listing Notice 1 of 2014;</p> <p>(ii) activities which are included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies;</p> <p>(iii) the development of facilities or infrastructure for the treatment of effluent, polluted water, wastewater or sewage where such facilities have a daily throughput capacity of 2 000 cubic metres or less; or</p> <p>(iv) where the development is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will not exceed 50 cubic metres per day.</p> <p>This listed activity may be triggered by the dewatering which will be needed to access the orebody. Dewatering is a water use requiring licensing in terms of the National Water Act 36 of 1998.</p>
GN R.984, 8 December 2014 (as amended on 7 April 2017) Listing Notice 2: Scoping and EIA	2(17)	<p>Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including:</p> <p>(a) associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or</p> <p>(b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing.</p> <p>This application for EA is submitted in support of a mining right application for underground mining as per the Mineral and Petroleum Resources Development Act, 28 of 2002.</p>

4.2 REQUIRED ENVIRONMENTAL LICENCES

The proposed mine development requires a Mining Right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act No. 28 of 2002 (MPRDA). In addition to the Mining Right, the proposed activities also require that the applicant obtain an Environmental Authorisation in terms of the National Environmental Management Act 107 of 1998 (NEMA).

Based on initial feedback from discussions with the DWS, it is not anticipated that a Water Use Licence will be required for the mining of the Vardocube Section as dewatering is already included in the Integrated Water Use Licence Application (IWULA) submitted to the DWS by Repli. All underground water required to be removed for safe access to the Vardocube Section will be managed through the Repli dewatering infrastructure.

5 NEED AND DESIRABILITY OF THE PROPOSED ACTIVITIES

5.1 NEED

Recent drilling of the Vardocube Section of the orebody has confirmed that there is valuable zinc and copper metal in the orebody which, through the arrangement with the adjacent Repli operation, can be mined in a cost-effective manner. The market demand for zinc and copper concentrate is strong with a projection for a supply-side constraint for these metals, especially in developed economies. The proposed development is ideally situated to provide for this demand.

In addition to the export market need for zinc and copper concentrate, there is a significant need in South Africa for developments which facilitate economic growth and provide employment opportunities at a local and regional scale. The royalties arising from the mineral extraction, payable to the South African Government in terms of the MPRDA, will provide revenue to the country. The construction and operational phases of the development will furthermore result in employment opportunities and contribute to local economic development through the procurement of goods and services and the implementation of the mine's social development commitments.

5.2 DESIRABILITY

Due to the nature of mineral extraction and processing, underground mining developments do have various physical, social and environmental hazards. These hazards are generally controlled through the application of various engineering design standards and the health, safety and environmental procedures and plans which the operating company implements during the day to day operation of the site.

No significant risks or impacts associated with the proposed underground mining have been identified at this stage. The proposed use of Repli infrastructure and facilities for the mining of the Vardocube Section, including the TSF, WRD, process plant and other surface infrastructure, is beneficial in terms of reducing the potential cumulative impacts from the proposed mining.

Establishment of dedicated infrastructure and facilities for mining and mineral processing of the Vardocube Section would have a significantly greater environmental impact in terms of, among others, resource consumption, emissions to air and water, and loss of natural habitat.

Using the Repli infrastructure and facilities is desirable both in terms of economic feasibility and in reducing potential direct, indirect and cumulative impacts of the proposed mining to the environment. This is consistent with the principles for sustainable development in NEMA. The proposed development has also been found to be consistent with the spatial development planning context applicable to the area. With the appropriate environmental controls in place, the proposed development is also considered to be compatible with surrounding land uses.

Accordingly, it is concluded that there is a need for the project and that undesirable aspects of the development can be satisfactorily mitigated.

6 PERIOD FOR WHICH THE ENVIRONMENTAL AUTHORISATION IS REQUIRED

In terms of the MPRDA, the maximum period a mining right may be issued for is 30 years, with the option to renew for another 30 years. The planned Life of Mine (LOM) for the Prieska Zinc Copper Project based on identified mineral resources and expected extensional exploration targets is estimated at 25 years. The mining of the Vardocube Section will be completed within this 25-year LOM period.

7 MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE INCLUDING A FULL DESCRIPTION OF THE PROCESS FOLLOWED TO REACH THE PROPOSED PREFERRED SITE

7.1 DETAILS OF ALL ALTERNATIVES CONSIDERED

7.1.1 THE PROPERTY ON WHICH OR LOCATION WHERE IT IS PROPOSED TO UNDERTAKE THE ACTIVITY

The location of the proposed underground mining activities in the Vardocube Section are fixed by the orebody and the mineral resources which are being targeted.

7.1.2 THE TYPE OF ACTIVITY TO BE UNDERTAKEN

Underground mining and ore handling is the only activity relevant to this assessment.

7.1.3 THE DESIGN OR LAYOUT OF THE ACTIVITY

The underground mine design is based on safely accessing and optimally mining the orebody.

No site layout alternatives for surface infrastructure has been considered as no surface infrastructure will be established as part of the mining.

7.1.4 THE TECHNOLOGY TO BE USED IN THE ACTIVITY AND THE OPERATIONAL ASPECTS OF THE ACTIVITY

The proposed mining method of LHOS and Drift and Fill methods proposed for underground mining are the only methods deemed suitable for the safe and efficient extraction of the ore.

7.1.5 THE OPTION OF NOT IMPLEMENTING THE ACTIVITY

Should the proposed project not be implemented:

- Underground mining of Vardocube will not proceed;
- The financial and broader socio-economic value associated with the extraction, processing and sale of the minerals will not be realised; and
- The royalties and tax revenue from the underground mining will not accrue to the South African Government.

7.2 DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED

7.2.1 NOTIFICATION

Interested & Affected Parties (I&APs), including landowners, land users and surrounding landowners/land users, have previously been consulted with in terms of the application for a prospecting right and associated environmental authorisation for prospecting on Portion 1 of Vogelstruisbult 104. This consultation process was undertaken in February 2017.

In addition, access agreements have been signed between the Applicant and the surface right owners of Portion 1 of Vogelstruisbult 104. A confidential agreement has also been signed between Orion and a solar PV power plant operator.

Building on this prior and ongoing consultation, the following tasks have been undertaken, providing opportunities for interested and affected parties (I&APs) to participate in the S&EIR Process, including the site selection and alternatives analysis process:

- Pre-application discussion with the competent authority;

- Directly affected landowners and land occupiers were identified and notified of the mining development and the S&EIR Process underway;
- Statutory advertisements (English and Afrikaans) were placed in one regional newspaper and one local newspaper;
- Placement of site notices at various locations within the study area;
- Distribution of a letter to key stakeholders, including an invitation to participate;
- Distribution of the Draft Scoping Report (DSR) for public comment; and
- Meetings with I&APs on request.

All issues raised by I&APs are captured in a Comments and Response Report (CRR). The updated CRR accompanies the corresponding Scoping and EIA Reports.

7.2.2 SCOPING REPORT

As part of project notification, A Draft Scoping Report was made available for public review and comment for a period of 30 days from 27 September 2018 to 29 October 2018. The report was made available as follows:

- By download: <http://www.abs-africa.com/project-documents/>
- By e-mail: prieskapp@abs-africa.com
- Hard copies were made available for review at the following venues:
 - Alkantpan Lodge in Copperton
 - Prieska Municipal Library, Stewart Street, Prieska
 - Orion Minerals Office, Loots Boulevard, Prieska
 - Marydale Municipal Office, Van Wyk Street, Marydale
 - Niekerkshoop Municipal Office, Church Street, Niekerkshoop

Various key stakeholder meetings undertaken as part of the Notification Phase of the Project are summarised in the table below. The minutes to these meetings are included in Appendix 5.

TABLE 7-1: STAKEHOLDER MEETINGS

STAKEHOLDER	DATE
Department of Mineral Resources	31 July 2018
Copperton Wind Farm	26 October 2018

Registered I&APs were notified of the submission of the Final Scoping Report and provided with a copy of the report on request. A copy of the report was also made available through the ABS Africa website.

7.2.3 EIA PHASE

This Draft EIR will be made available for a 30-day comment period. The availability of the draft report will be advertised in a local and regional newspaper and hard copies of the report will be distributed in the same manner as was done for the Draft Scoping Report.

The comments received from registered I&APs on the Draft EIR and EMPr will be included in the Comments and Response Report.

Registered I&APs will be notified in writing of the submission of the Final EIR, and EMPr. A copy of the Final EIR and EMPr will be made available on the ABS Africa website and on request from ABS Africa.

Regulation 24(1) of Government Notice R.982 provides that the DMR must review the Final EIR and EMPr and issue a decision on the EA application within 107 days of submission of the document.

7.2.4 NOTIFICATION OF DECISION

Upon receipt of the decision on the EA, the EIA Project Team will assist the applicant in making the application decisions available to all registered I&APs and notifying them of the appeal procedure to be followed in terms of the National Appeal Regulations [Government Notice No. R.993 promulgated in terms of section 44(1a) and 43(4) of NEMA].

7.2.5 SUMMARY OF ISSUES RAISED BY I&APs

The comments received to date and responses thereto are provided in Table 7-2.

Comments received during the review period for the Draft EIR will be responded to in the Final EIR Report.

TABLE 7-2: SUMMARY OF ISSUES RAISED BY I&APS

INTERESTED AND AFFECTED PARTIES		DATE COMMENTS RECEIVED	ISSUES RAISED	EAPS RESPONSE TO THE ISSUES RAISED
LIST THE NAMES OF PERSONS CONSULTED IN THIS COLUMN; AND MARK WITH AN X WHERE THOSE WHO MUST BE CONSULTED WERE IN FACT CONSULTED				
AFFECTED PARTIES				
Landowner/s (Owners of land included in the Mining Rights Area Boundary and/or owners of land where mine infrastructure is proposed)	X			
Izak Potgieter on behalf of the Request Trust		28 September 2018 via e-mail with attached letter	<p>Letter addressed to Applicant representative (Marcus Birch), copied to ABS Africa:</p> <p>It appears from the information provided by ABS Africa that it is the intention of Vardocube (Pty) Ltd to apply for a mining right covering the entire remainder of Portion 1 of the Farm Vogelstruisbult 104.</p> <p>We urgently seek your confirmation that this is correct together with your advice to what the status of the application for the mining right is.</p> <p>All our client's rights are reserved.</p>	<p>Response from Applicant representative (Marcus Birch), copied to ABS Africa:</p> <p>We confirm that an application for a Mining Right, for the Remaining Extent of Portion 1 of the Farm Vogelstruisbult 104, was lodged by Vardocube (Pty) Ltd. on 27 September 2018. The application has been issued with reference number: NC30/5/1/2/2/10146MR.</p> <p>Although the application that has been lodged by Vardocube is for the Remaining Extent of Portion 1 of the Farm Vogelstruisbult 104, the extent of the mining proposed by Vardocube is limited to the</p>

				<p>underground mining of a relatively small extent of orebody. The orebody of interest is an extension of the orebody proposed to be mined through the adjacent Repli Trading Mining Right Application. Please refer to the attached maps from the Draft Scoping Report, which show the extent of the underground mining proposed to be undertaken as part of the Vardocube application. Please note that there will be no surface impact additional to that covered by the existing Repli MR application.</p> <p>Prior to proceeding with any further or additional mining activities to that currently proposed on the Remaining Extent of Portion 1 of the Farm Vogelstruisbult 104, an amendment would have to be made to the submitted mine works programme and all relevant environmental and other approvals would have to be obtained. The latter would also need to be informed by consultation with interested and affected parties at that time.</p> <p>Kindly note that ABS Africa has been appointed to undertake the required application for Environmental Authorisation and associated EIA Process for the current Vardocube mining right application, including consultation with interested and affected parties. Any issues and comments on the application must please be directed to ABS Africa so that they can be captured and responded to as part of the public participation record for the application.</p>
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Izak Potgieter on behalf of the Request Trust		28 September 2018 via e-mail	As discussed with your Ms Pretorius, the documents are not available under the link provided.	Apologies for the inconvenience. The documents are now available on the ABS Africa website.
Izak Potgieter on behalf of the Request Trust		28 September 2018 via e-mail	<p>E-mail addressed to Applicant representative (Marcus Birch), copied to ABS Africa:</p> <p>Thank you for your response.</p> <p>Please provide a copy of the Letter of Acceptance issued by the Regional Manager: Mineral Regulation (Northern Cape Region) of the Department of Mineral Resources.</p>	<p>Response from Applicant representative (Marcus Birch), copied to ABS Africa:</p> <p>We will furnish a copy of same once this has been received from the RM.</p>
Izak Potgieter on behalf of the Request Trust		12 October 2018 via e-mail	<p>E-mail addressed to Applicant representative (Marcus Birch), copied to ABS Africa:</p> <p>Please advise whether you have received the Letter of Acceptance form the DMR.</p>	<p>Response from Applicant representative (Marcus Birch), copied to ABS Africa:</p> <p>We haven't received this yet. The DMR must issue same within 14 working days of submission date (27th September), which takes us to 17th October.</p> <p>We will forward you the Letter of Acceptance when received. (We did receive acknowledgement of the EA application on 10th October).</p>
Occupiers of the Site (Parties using land within the Mining Rights Area Boundary and/or parties using land where mine infrastructure is proposed)	X			

No comments received.				
Adjacent Landowners (Owners of land immediately adjacent to the Mining Rights Area Boundary and/or owners of land immediately adjacent to where mine infrastructure is proposed, includes the town of Copperton)	X			
No comments received.				
Adjacent Occupiers of Site (Occupiers and users of land immediately adjacent to the Mining Rights Area Boundary and/or occupiers and users of land immediately adjacent to where mine infrastructure is proposed)	X			
No comments received.				
Competent Authorities	X			

Johannes Nematatani DMR		9 October 2018 via e- mail	Please note that the case officer for Vardocube is Mr Machalla Ramabaoea. Machalla Please note the notification letter on the attachment.	This is noted. Could you please confirm Mr Ramabaoea's email address as machalla.ramabaoea@dmr.gov.za
Johannes Nematatani DMR		9 October 2018 via e- mail	That is the correct email address. Machalla please note the emails.	Response noted.
Machalla Ramaboea DMR		10 October 2018 via e- mail	Please find the attached letter for your attention.	DMR acknowledgment letter of application for EA noted and the need to adhere to the timeframes in the EIA Regulations (2014), noted.
Machalla Ramaboea DMR		30 October 2018 via telephone	Comment on the Final Scoping Report will be provided once it has been submitted.	Comment noted.
Johannes Nematatani DMR		30 October 2018 via email	Please kindly remove my email address from the registers of Vardocube and replace with Machalla.Ramaboea@dmr.gov.za	Johannes Nematatani has been removed from the I&AP register.
Machalla Ramaboea DMR		12 November 2018 via email	Have you sent a copy to this department? If not please send one to my attention as soon as possible.	Hard copies of the Final Scoping Report were submitted to your offices on 9 November 2018.
Machalla Ramaboea		29 November 2018 via e- mail	1. The Department has evaluated the submitted SR and Plan of Study for Environmental Impact Assessment and is satisfied that the documents comply with the minimum requirements of Appendix 2(2) of National Environmental Management Act, 1998 (as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations, 2014.	Noted.

			2. The SR is hereby accepted by the Department in terms of regulation 22(a) of the NEMA EIA Regulations, 2014.	Noted.
			3. You may proceed with the environmental impact assessment process in accordance with the tasks contemplated in the Plan of Study for Environmental Impact Assessment as required in terms of the NEMA EIA Regulations, 2014.	Noted.
			4. In addition, the following must be done:	
			a. Ensure that impacts associated with blasting including vibration are addressed extensively	Blasting impacts have been assessed by a specialist. The blasting study report is provided in Appendix 7 of the EIR and includes the impacts of blasting from both the Repli and Vardocube Sections.
			b. Thorough assessment of cumulative negative impacts is required	Cumulative negative impacts have been identified and assessed by the various specialists (social, blasting, and geohydrology). The impacts are described and assessed in Table 19-1.
			c. The Heritage Impact Assessment (HIA) report which was completed during the Environmental Authorisation process of Priska Zinc project must be submitted with the EIR	Please refer to Appendix 7 for the report. Confirmation from the heritage specialists that the report is relevant to the Vardocube Section is also included in Appendix 7.
			d. Determination of the financial provision according to the current (2018) master rate as approved in the guideline for financial provision quantum determination	The financial provision has been determined in accordance with the DMR Master Rate. Please refer to Section 32 of the EIR.

			e. Details of the future land use for the site and infrastructure after decommissioning	The proposed activity is for underground mining only, with no surface area disturbance. The future surface land use is therefore unaffected by the proposed development.
			f. Should mining activities occur within 100m buffer zone of natural water resource or use water from the natural water resource, a Water Use Licence will be required, proof of application for a licence needs to be submitted	No underground mining will take place within 100 m of a water resource.
			g. Possible impacts and effects of the development on the surrounding agricultural and wildlife area must be assessed	The proposed activity is for underground mining only, with no surface area disturbance. No direct impact to agricultural activities or wildlife on the surface of the proposed mining right area is therefore anticipated by the underground mining activities. Indirect impacts to agriculture or wildlife from mine dewatering are also not anticipated as a result of the mining proceeding well below the depth of private boreholes. Please refer to the geohydrology study in Appendix 7 for additional information.
			h. Information on services required on the site, e.g. sewage, refuse removal, water and electricity. Who will supply these services and has an agreement and confirmation of capacity been obtained	Section 3.2 of the EIR details the services that are required and the service providers that are involved. Agreements have been obtained with the relevant service providers.
			5. Please ensure that comments from all relevant stakeholders are submitted to the Department with the Environmental Impact Assessment Report (EIAR). This includes but is not limited to the Provincial Heritage Resources Authority	All comments received to date have been included in Table 7-2 of the EIR. Please refer to Appendix 5 for the proof of correspondence.

			and/or South African Heritage Resources Agency, Provincial Environmental Department, Department of Agriculture, Forestry and Fisheries (DAFF), Department of Water and Sanitation (DWS) and the local municipality. Proof of correspondence with the various stakeholders must be included in the EIAR. Should you be unable to obtain comments, proof of the attempts that were made to obtain comments should be submitted to the Department	
			6. The applicant is hereby reminded to comply with the requirements of regulation 3 of the NEMA EIA Regulations, 2014 with regards to the time period allowed for complying with the requirements of the Regulations	The applicable timeframes have been scheduled and adhered to throughout the process to date.
			7. Please ensure that the EIAR includes the A3 size locality maps of the area and illustrates the exact location of the proposed development. The maps must be of acceptable quality and as a minimum, have the following attributes: <ul style="list-style-type: none"> • Maps relatable to one another • The flood line must be delineated on the topographical map • Co-ordinates • Legible legends • Scale of 1:50000 	Please refer to Appendix 3 of the EIR for the maps.
			8. Further, it must be reiterated that, should an application for Environmental Authorisation be subjected to any permits or authorisations in terms of the provisions of any Specific	No permits or authorisations in terms of SEMAs have been identified as relevant to the proposed underground mining.

			Environmental Management Acts (SEMA), proof of such application will be required	
			9. Kindly note that acceptance of your scoping report application does not grant you a right to commence with the listed activities applied for. Acceptance simply confirms that your application will be processed further and a recommendation on granting or refusal of an environmental authorisation will be forwarded to the Minister or his delegate for consideration, and the decision will be communicated as stipulated in regulation 4(1) of the EIA Regulations.	Noted.
			10. You should also note that commencement with a listed activity without an environmental authorisation contravenes the provisions of section 24F (1) of National Environmental Management Act, 1998 (Act 107 of 1998), as amended (NEMA) and constitutes an offence in terms of section 49A (1) (a) of NEMA.	Noted.
			11. Further note that in terms of regulation 45 of the EIA Regulations; your failure to submit the documents or meet any timeframes prescribed in terms of the said Regulations will result in your application deemed to have lapsed.	The applicable timeframes have been scheduled and adhered to throughout the process to date.
			12. Your attention is brought to Section 24F of the NEMA which stipulates "that no activity may commence prior to an environmental authorisation being granted by the competent authority".	Noted.

Municipal Councillor	X			
Gloria Speelman Siyathemba Local Municipality: Ward 4 Councillor		No comments received.		
Local and District Municipality	X			
H Tsume (Mayor) IWJ Stadhouer (Municipal Manager) J Basson (Infrastructure) Siyathemba Local Municipality		No comments received.		
MT Kibi Pixley ka Seme District Municipality		No comments received.		
Communities	X			
Residents of Copperton were notified through the site and newspaper notices and a hard copy of the Draft Scoping Report was placed at the Alkantpan Lodge in Copperton.				
Department of Land Affairs	X			
Kgotso Moeketsi Provincial Head: NC Department of Agriculture, Land Reform and Rural Development		No comments received.		

Traditional Leaders	N/A			
There is no traditional leadership structure applicable to the Mining Right Application Area.				
Department of Environmental Affairs	X			
Thulani Mthonbeni Dineo Kgosi David Khakhane NC Department of Environmental Affairs and Nature Conservation		No comments received.		
Organs of State with Jurisdiction	X			
Ezekiel Monyamane Transnet SOC Limited		27 October 2018 via email	Kindly send me a copy of the scoping report for my review.	The document can be accessed by following the link as follows: http://www.abs-africa.com/project-documents/
Livhuwani Ndou Transnet SOC Limited		30 October 2018 via e-mail	<p>Please note Transnet comments in respect of your application. It will be highly appreciated if these comments are considered in your project plan:</p> <p>This office has no objection to the proposal in principal. From the information provided (see GIS extract below), only Portion 1 of Vogelstruis-Bult No. 104 may be affected depending on mining/prospecting proximity.</p> <p>We hereby wish to draw your attention to Section 48 (1) of the Minerals and Petroleum Resources Development Act, 2002 which stipulates as follow:</p>	<p>Thank you for your comment.</p> <p>An environmental sensitivity plan for the Project has been compiled and is described in Section 8.4. The plan includes the legislated distances for development in relation to railways. No underground mining is proposed within the legislated distances.</p>

			<p>"48. (1) Subject to section 20 of the National Parks Act, 1976 (Act No. 57 of 1976), and subsection (2), no reconnaissance permission, prospecting right, mining right or mining permit may be issued in respect of—</p> <p>(a) land comprising a residential area;</p> <p>(b) any public road, railway or cemetery;</p> <p>(c) any land being used for public or government purposes or reserved in terms of any other law; or</p> <p>(d) areas identified by the Minister by notice in the Gazette in terms of section 49."</p> <p>Please note that under no circumstances will or do Transnet Limited permit, grant permission or consent to any prospecting or mining activities on its properties. As far as the adjacent properties to the railway line is concerned, your attention is drawn to Regulation 17 (6) (a) of the Mine Health and Safety Act, 1996 which determines that no mining operations may be carried out under or within a horizontal distance of 100 metres from buildings, roads, railways, reserves etcetera.</p>	
Other Competent Authorities Affected	X			
Natasha Higgitt SAHRA		27 September 2018 via e- mail	Thank you for notifying SAHRA of the proposed development. Please note that all development applications are processed via our online portal, the South African Heritage Resources Information System (SAHRIS) found at the following link: http://sahra.org.za/sahris/ . We do not accept	As a follow up to the email below, I noted that your response email was to a different project which is in draft scoping phase (PCM Vardocube section). Please note that the project that was submitted on the SAHRA website was for the Final EIA for the

			<p>emailed, posted, hardcopy, faxed, website links or DropBox links as official submissions.</p> <p>Please create an application on SAHRIS and upload all documents pertaining to the Environmental Authorisation Application Process. As per section 38(8) of the National Heritage Resources Act, Act 25 of 1999 (NHRA), an assessment of heritage resources must form part of the process and the assessment must comply with section 38(3) of the NHRA.</p> <p>Once all documents including all appendices are uploaded to the case application, please ensure that the status of the case is changed from DRAFT to SUBMITTED. Please ensure that all documents produced as part of the EA process are submitted as part of the application and are submitted to SAHRA at the beginning of the Public Review periods. Once all these documents have been uploaded, I will be able to issue an informed comment as per section 38(4) and 38(8) of the NHRA.</p>	<p>Prieksa Copper Mine (Repli application). I have attached the original notification email for reference.</p> <p>Please let me know if there are any difficulties with the Repli submission (status changed as per SAHRA request).</p>
Natasha Higgitt SAHRA		4 October 2018 via e-mail	Please provide the SAHRIS Case IDs for both cases so that I may ensure that everything is correct.	Jaco has created a draft case number for Vardocube - Case number (12995) and will upload the Draft Scoping Report. The Prieska Final EIR has been uploaded to the relevant case number (12764).
Natasha Higgitt SAHRA		2 November 2018 via e-mail with attached letter	The SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit requests that a letter from a qualified archaeologist and palaeontologist stating whether the results of the 2017 HIA are relevant to the current proposed mining right application as part of the EIA phase of the EA Application. The letters must include any additional recommendations where relevant. The draft EIA and	<p>The requested letter will be provided in the Draft EIR, together with the findings of the Phase 1 HIA completed for the Vardocube prospecting right application.</p> <p>Registered I&APs will be notified when the Draft EIR and Appendices are available and a 30 day comment</p>

			<p>appendices must be submitted at the start of the public review period so that an informed comment may be issued. Further comments will be issued upon receipt of the above.</p>	<p>period will be provided, as required by the EIA Regulations (2014).</p>
<p>Natasha Higgitt SAHRA</p>		<p>19 November 2018 via e-mail</p>	<p>As per the SAHRIS Paleo Sensitivity map, the development footprint is located within an area of moderate Paleo Sensitivity and therefore an assessment of palaeontological resources which are located underground is required. Instead of requested an entirely new study, we are requesting a letter the relevance of the previous assessment conducted for a separate application</p>	<p>Is a specialist letter (as requested in the attached document) required given that the mine will not involve any surface disturbance (only underground mining is proposed, with access from the existing mine shaft on the adjacent property) and with the underground mining planned at between 900 m and 1200 m below natural ground level?</p>
<p>Mosala Ntoi Department of Water and Sanitation</p>		<p>29 October 2018 via e-mail with attached letter</p>	<p>The Department of Water and Sanitation hereby acknowledges receipt of the Draft Scoping Report for the proposed mining operations situated on the remaining extent of Portion 1 of the farm Vogelstruisbult No. 104., Prieska Northern Cape. The department takes note of the activity and therefore provides the following comments:</p>	<p>Response noted.</p>
			<p>1. Please note that taking of water from a water resource for the mining operations, including storage, needs to be authorised by this Department.</p>	<p>Based on initial feedback from discussions with the DWS, it is not anticipated that a Water Use Licence will be required for the mining of the Vardocube Section as taking of water / dewatering is already included in the Integrated Water Use Licence Application (IWULA) submitted to the DWS by Repli. All underground water required to be removed for safe access to the Vardocube Section will be managed through the Repli dewatering infrastructure.</p>

			2. Waste needs to be collected and disposed of at registered municipal site, and written agreement should be provided to this Department regarding such agreement.	This is noted. The EMPr will provide control measures for the management of waste.
			3. Any spillage of any hazardous materials including diesel that may occur during storage, excavation and operation must be reported immediately to this Department.	This is noted and will be implemented in the EMPr.
			4. Please note that no development should take place within the 1:100 year flood line.	No surface infrastructure is planned as part of the proposed project.
			5. Stormwater must be managed in such a manner as to disperse runoff and to prevent the concentration of stormwater flow.	No surface infrastructure is planned as part of the proposed project. Stormwater will be managed through the Repli infrastructure.
			6. Any other water use (s), subject to the National Water Act 36 (1998), Section 21, must be adhered to and authorised by this department, if applicable to this application.	Requirement noted.
Other Affected Parties	N/A			
No other affected parties identified to date.				
Interested Parties	X			
George Plaatjies		4 October 2018 via email	Wish to use the opportunity to thank you for the regular updates and information from Orion Mine and Repli Trading. Very much appreciated. JFG HOLDINGS is a local company with it's operations in Prieska and surrounding areas (Siyathemba Municipality). We are +- 60 kilometres from Copperton and has already register on SCNET (Orions' Supplier Database).	Feedback noted.

Fabio Venturi on behalf of the Copperton Wind Farm		16 October 2018 via email	<p>Please kindly register the Copperton Wind Farm (Pty) Ltd as stakeholders for the above-mentioned project.</p> <p>Terramanzi Group will be representing our Client above in this process. Please confirm accordingly.</p>	Mr Jason Cope has been registered for the Copperton Wind Farm. Please let me know if there is anyone else I should add to the database.
Fabio Venturi on behalf of the Copperton Wind Farm		16 October 2018 via email	Thank you kindly – as per below, we will be representing Mr Jason Cope and the Copperton Wind Energy Farm.	Representation noted. Terramanzi Group (Fabio Venturi) is included in the I&AP Register.
Juan Kotze		Letter received 30 October 2018	<p>GWK enjoys the support of and services the needs of approximately 700 farmers in the Greater Prieska area, who are shareholders in GWK, supply us with agricultural products and rely on us for the rendering of various agri-processing and produce-handling services. These comments should be seen in the light of the reciprocal nature of support between us and these shareholders. The interests of our shareholders in the area are ultimately also ours.</p>	Comment noted.
			<p>We are specifically concerned about the effect on groundwater that mining operations may bring— in relation to potential contamination of existing water resources and groundwater levels that may be affected and how that impacts on farming activities and the habitability of an already marginal region. Water is the region’s most valuable resource and requires careful management.</p> <p>However, in principle we welcome the economic boost that successful mining operations may bring to the wider community.</p>	The concern regarding the quality of water in the underground workings and the impact of dewatering on the availability of water is noted. A geohydrological specialist study is being undertaken as part of the EIA.
			We record the following:	Based on initial feedback from discussions with the DWS, it is not anticipated that a Water Use Licence

			<p>1. The proposed mining activities require a water use licence in terms of the National Water Act 36 of 1998 for a number of listed water uses. We wait the Integrated Water Use Licence Application (IWULA) being prepared in parallel with the Scoping & Environmental Impact Report (S&EIR) process and shall comment on these when made available to us. We note your view that the former will most likely not be required by the DWS. We await confirmation of same.</p>	will be required for the mining of the Vardocube Section as taking of water / dewatering is already included in the Integrated Water Use Licence Application (IWULA) submitted to the DWS by Repli. All underground water required to be removed for safe access to the Vardocube Section will be managed through the Repli dewatering infrastructure.
			<p>2. We have encouraged the local Farmers' Union to engage with the future Board of trustees of the rehabilitation fund and potentially take a seat on it, to ensure successful rehabilitation of the affected area and the responsible application of the funds set aside to do so. To this end, kindly advise as to when the Closure Plan as per the requirements of the National Environmental Management Act 107 of 1998 shall be made available for comment, and in particular the associated report describing the associated financial provisions.</p>	Rehabilitation of the mining activities will be addressed as part of the Closure Plan, which will be made available to all I&APs for review and comment accompanying the Draft EIA.
			<p>3. Kindly advise when the Environmental Management Programme (EMPr) will be available for insight and comment.</p>	The draft EMPr will be made available for review and comment with the Draft EIR. All I&APs will be notified when the reports are made available.
			<p>4. We take note that at this stage of the S&EIR process the impact of the project's activities are still being identified. We reserve our rights pending the results of the final report(s).</p>	Comment noted.
Marlise Burger		30 October 2018 Via E-mail	I refer to the abovementioned matters. Please advise who the case officer is dealing with these applications.	Details of the relevant DMR officials for the Repli and Vardocube applications provided by e-mail.

Richard Summers		29 October 2018 Via E-mail with attached letter	<p>1. We act for Copperton Wind Farm (Pty) Ltd, the holder of the environmental authorisation issued on 15 August 2012 for the construction of the Plan 8 Infinite Energy (Pty) Ltd 140 MW Wind Energy Facility near Copperton, Northern Cape (DEA Authorisation Number: 12/12/20/2099) (hereinafter referred to as the "Copperton WEF").</p>	<p>The Copperton Wind Farm has been identified as a stakeholder in both the Repli Project and Vardocube Project. The EAP was informed at the commencement of the Repli Project EA Process that Mr. Jason Cope was the representative for the Copperton Wind Farm. Mr Cope has accordingly been on the I&AP Register since the beginning of the Repli Project and has received all public participation correspondence issued to date in respect of both the Repli Project and the Vardocube Project.</p>
			<p>2. The purpose of this letter is to provide comments in relation to the draft scoping report ("DSR") prepared by ABS Africa (Pty) Ltd in relation to the Prieska Zinc Copper Project Vardocube Section) (hereinafter referred to as the "Vardocube Project") as well as to provide comments in relation to the Final Environmental Impact Assessment Report ("FEIR") in relation to the Prieska Zinc Copper Project (hereinafter referred to as the "Repli Project").</p>	<p>It is noted that the comments have been submitted in respect of two different applications which are at different stages in the application process.</p> <p>The comment period for the Draft EIR for the Repli Project closed on 10 September 2018 and the Final EIR was submitted to the DMR on 17 September 2018.</p> <p>Notwithstanding this, a response has been provided to all comments received.</p> <p>It is also noted that the comments submitted were discussed in the stakeholder meeting held on 26 October 2018, the minutes of which have been included in the Final Scoping Report for the Vardocube Project (this report).</p>
			<p>3. It is important to note that our client has not previously recorded its concerns formally in the context of the Environmental Impact Assessment process for the Repli</p>	<p>The Copperton Wind Farm has been identified as a stakeholder and sensitive receptor in both the Repli Project and Vardocube Project. The EAP was</p>

			<p>Project. The reason for this being that our client was not equipped to provide comment and accordingly appointed us to provide representation when the EAP refused to grant an extension to the commenting period EIA process.</p>	<p>informed at the commencement of the Repli Project EA Process that Mr. Jason Cope was the representative for the Copperton Wind Farm. Mr Cope has accordingly been on the I&AP Register since the beginning of the Repli Project and has received all public participation correspondence issued to date in respect of both the Repli Project and the Vardocube Project.</p> <p>The request for an extension to the comment period was received on the last day of the comment period on the Repli Project Draft EIR. Notification of the comment period on the Repli Project Draft EIR was issued on 6 August 2018. A reminder notification of the commenting period end date was sent on 6 September 2018.</p> <p>In response to the request for an extension, it was indicated that due to the legislated timeframes, it was not possible to extend the comment period. It was suggested that the comments be submitted directly to the DMR for consideration.</p>
			<p>4. At the outset we record that based on a rapid review of the EIA processes for both the Vardocube and Repli Projects, there is a critical lack of information relating to certain project-related impacts referred to herein. There is no valid basis therefore to suggest that the generic mitigation measures identified in the DSR and FEIR will be a failsafe mechanism for protecting the operational success and viability of the Copperton EF. More specifically, there is insufficient information in the EIA processes to guarantee that anticipated impacts</p>	<p>It is understood that this comment relates to the alleged lack of information regarding the aspects specifically dealt with in the letter submitted, namely blasting, dust, traffic and geotechnical considerations.</p> <p>The impacts were identified, assessed and mitigation proposed, as required by the EIA Regulations (2014). Specialist studies in each of these aspects have been undertaken and the findings included in the EIR for</p>

			<p>associated with the Prieska Zinc Copper Project will be avoided and/or mitigated.</p>	<p>the Repli Project. To the extent that they are applicable, the information will also be included in the Draft EIR for the Vardocube Project.</p> <p>There is thus no critical lack of information with respect to these impacts. Furthermore, the mitigation measures that have been proposed by the specialists are specific to the project activities assessed.</p> <p>More detailed replies are provided in response to each of the specific comments on these aspects.</p>
			<p>5. As will be evident from the submission below, there is a legal obligation on the competent authority (the Department of Mineral Resources (“DMR”) in terms of the National Environmental Management Act 10 of 1998 to have regard to all potential adverse environmental and socio-economic impacts. In the absence of relevant information regarding all such impacts, the EIA processes are deficient.</p>	<p>Relevant information on the aspects of blasting, dust, traffic and geotechnical considerations have been provided in the EIA processes.</p>
			<p>Blasting</p> <p>6. The Copperton WEF is a significant investment in renewable energy technology which stands to be impacted by the proposed mine operations associated with the Prieska Zinc Copper Project.</p> <p>7. The sustainable and long-term operation of the turbines and infrastructure (both above-ground and below-ground) is critical to the viability of the Copperton WEF. The turbines and infrastructure are potentially susceptible to even low levels of vibration impacts.</p>	<p>The EIR for the Repli Project included a blasting impact evaluation study, compiled by a technical specialist. Potentially sensitive receptors to blasting impacts were identified within a 10 km radius of the proposed mining area. Copperton Wind Farm was specifically identified as a receptor, situated approximately 6.2 km from the nearest proposed mining area.</p>

			<p>8. The FEIR in relation to the Repli Project and the DSR in relation to the Vardocube Project do not address the identification, evaluation and assessment of adverse impacts associated with blasting and related activities. Given the size of the combined mining area, more detailed information is required to illustrate that the avoidance and control of off-site impacts that result from blasting, including but not limited to impacts associated with ground vibrations, airblast (including noise and concussion) and flyrock will be appropriately addressed. These concerns relate to all aspects of the proposed mining projects and include prospecting, mining, quarrying and construction activities.</p>	<p>The study included an assessment of the impact of vibration on existing and proposed structures surrounding the proposed mining area. The likely peak vibration amplitude, referred to as Peak Particle Velocity (PPV), was calculated separately for the opencast and underground mining. The study indicated that the predicted PPV as a function of distance from blasting is 0.1 PPV and 0.0 PPV for the open-pit and underground blasting respectively at a 3.5 km distance from blasting.</p> <p>With the calculated PPV results for the surface and underground being effectively zero (0) at 3.5 km from the blasting source, it can be concluded that there will be no vibration effects at 6.2 km from the source where the Copperton Wind Farm is located.</p> <p>Please refer to the blasting impact evaluation study for further details.</p> <p>Impacts associated with blasting and related activities have been identified, evaluated and assessed.</p> <p>The EIR for the Repli Project included a blasting impact evaluation study, compiled by a technical specialist. Potentially sensitive receptors to blasting impacts were identified within a 10 km radius of the proposed mining area. Copperton Wind Farm was specifically identified as a receptor, situated approximately 6.2 km from the nearest proposed mining area.</p>
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				<p>The study assessed several blasting-related impacts, including impacts from vibration, airblast, flyrock, dust and fumes, and water pollution.</p> <p>Please refer specifically to Table 3 and Figures 1 and 2 in the blasting impact evaluation study (Appendix 10 of the Repli Project EIR).</p> <p>The blasting impact evaluation study will be included in the Vardocube Project Draft EIR.</p>
			<p>9. The relevant reports (the DSR and the FEIR) do not contain the necessary information which (1) identifies the causes of ground vibrations and airblast in relation to the Prieska Zinc Copper Project and/or (2) the precise measures and management practices required to be followed in order to control and minimise the adverse effects on the Copperton WEF.</p>	<p>The blasting impact evaluation study was included in the Repli Project EIR and it will also be included in the Vardocube Project EIR.</p> <p>Copperton Wind Farm was specifically identified as a receptor in the study and the possible impact to the facility was reported on. Please refer to Table 2 and 4 of the blasting impact evaluation study.</p> <p>Please refer to Section 7 and 8 of the blasting impact evaluation study for the mine-related causes of ground vibration and airblast.</p> <p>Section 10 of the blasting impact evaluation study provides the mitigation measures recommended by the specialist, including the implementation of a monitoring programme.</p>
			<p>10. In the very least, we anticipate that appropriately qualified technical analysis and input is required in order to accurately predict ground vibrations as they propagate away from the blast sites. Particle motions and velocities will be required to be appropriately quantified and</p>	<p>The EIR for the Repli Project included a blasting impact evaluation study, compiled by a technical specialist.</p>

			<p>reported as part of the EIA processes. In addition to the ground vibrations, the EIA processes will be required to measure airblast and any elevated airblast levels associated with the Prieska Zinc Copper Project as well as the potential impacts associated therewith for the Copperton WEF.</p>	<p>The study included an assessment of the impact of ground vibration on existing and proposed structures surrounding the proposed mining area. The likely peak vibration amplitude, referred to as Peak Particle Velocity (PPV), was calculated separately for the opencast and underground mining and the results compared against the relevant international standard.</p> <p>Measurement of airblast would require an actual blasting event which is not possible at present as blasting may only commence once all statutory approvals have been obtained. The airblast impact has been predicatively assessed by the technical specialist in terms of its likelihood and probability and mitigation measures have been proposed.</p> <p>Please refer to Sections 9 (Risk Assessment) and 10 (Mitigation Measures) of the blasting impact evaluation study.</p>
			<p>11. The potential cumulative effect of both ground vibrations and airblast for the turbines and infrastructure of the Copperton WEF will require careful evaluation, consideration and assessment in order for the abovementioned EIA processes to satisfy the reporting requirements of the EIA Regulations and in turn for the Department's decision-making functions to withstand scrutiny in terms of inter alia section 2 and 24 of the National Environmental Management Act.</p>	<p>Please refer to the comment above. The potential impacts from blast-induced ground vibration and airblast have been assessed and mitigation measures proposed.</p>
			<p>Dust Effects</p>	<p>Comment noted.</p>

			<p>12. The viability and sustainable operation of a wind energy facility is dependent on amongst other things rotor design and the high performance of the turbines. Several of the most critical factors required for the effective operation of wind energy facilities are to avoid the degradation of performance of wind turbine rotors and associated stalling which can be severely aggravated by dust impacts and dust accumulation on blade surface areas.</p>	
			<p>13. The Copperton WEF has been designed according to certain predicted loads and operational criteria which did not foresee or predict the potentially significant dust emissions from mine-related activities on the adjacent properties. For this reason, it is important for the impact assessment processes undertaken in connection with both the Repli and Vardocube Projects to identify, consider and evaluate the dust effects on the performance of the wind turbines associated with the Copperton WEF.</p>	<p>An air quality specialist study was undertaken as part of the EIA Process for the Repli Project and a copy of the report was included in Appendix 10 of the EIR. Section 3.1 of the report identifies the Copperton Wind Farm as an Air Quality Sensitive Receptor (AQSR) in proximity to the proposed mining activities. Among others, the study assessed the impact of dustfall, in terms of the relevant legislated standards, on all AQSRs, including the Copperton WEF.</p> <p>The report indicates that the simulated dustfall rates outside of the Repli Project mining right area are low and well within the legislated dust control standards. In addition, the isopleth plots based on the simulated dustfall deposition rates indicate that the impact area is in a south-south-easterly direction from the mine with an impact area extending up to approximately 2.5 km from the mining activities. The Copperton Wind Farm is situated north-west of the mining activities and at a distance of 6 km away. The conservative dustfall simulations indicate that there is therefore an extremely low likelihood of any dustfall deposition impact on the Copperton WEF.</p>

				Please refer to Section 4.3 of the air quality specialist study for details in this regard.
			14. The elevated dust levels associated with mining operations associated with the Prieska Zinc Copper Project are a very real and valid concern insofar as they might impact the viability of Copperton WEF. Further and detailed information and assessment is required in this regard. The applicants are invited to contact the Copperton WEF developer in order to obtain more detailed technical information and design related aspects of the wind turbine airfoils in order to supplement its specialist studies in relation to these Projects.	Comment and invitation to obtain further information are noted. Based on the findings of the air quality specialist study, no additional information is deemed to be necessary for the air quality specialist study as the study does not identify any potential dustfall impacts to the Copperton Wind Farm.
			<p>Traffic Related Impacts</p> <p>15. Construction in relation to the Copperton WEF is currently underway. The construction periods is anticipated to continue for a period of 36 months. Given the nature of the Repli and Vardocube Projects associated with the Prieska Zinc Copper Project, it is anticipated that traffic related impacts associated with the mine may impact on road infrastructure and give rise to certain indirect impacts, including significant increase in dust emissions due to increased vehicular traffic and use of heavy-duty vehicles.</p>	<p>A traffic impact specialist study was undertaken as part of the EIA Process for the Repli Project and a copy of the report was included in Appendix 10 of the EIR. The study considered the potential impact of mine-related traffic on road infrastructure and relevant traffic engineering criteria, including road safety.</p> <p>Emissions from vehicular traffic during the construction phase and operational phase of the proposed mining activity, including dust entrainment, were included in the emissions inventory of the air quality specialist study. Please refer to Section 4.1 of the air quality specialist study report.</p> <p>It is recognised that the delivery of large equipment during the construction phase of the Copperton Wind Farm may coincide with mine vehicle traffic or the delivery of equipment during the construction</p>

				<p>phase of the Repli Project. This is, however, a temporary impact which can be managed through the implementation of an effective communication plan between the two developments.</p>
			<p>16. In order to ensure that the traffic related aspects and impacts of the proposed mines and mining operations do not impact adversely on Copperton WEF, further detailed information is required regarding:</p> <ul style="list-style-type: none"> • The road networks in and around Copperton that are to be used by the mine and in connection with mining operations; • The anticipated volumes of traffic generated by the mine during both construction and operational phases; and • The nature and number of abnormal loads that might impact on other road users in the area. 	<p>These aspects have been considered. Please refer to the traffic impact assessment undertaken for the Repli Project EIR (Appendix 10).</p> <p>As discussed in the stakeholder meeting of 26 October 2018, sharing of transport plans between the mine, Copperton Wind Farm and other major road users, particularly for the scheduling of the delivery of abnormal loads during the construction phase, is recommended as a measure to minimise traffic disruption.</p>
			<p>17. In addition, further and detailed information is required regarding proposed dust suppression and other mitigation measures to control and abate any adverse impacts associated with traffic and road usage.</p>	<p>Detailed mitigation for the control of dust has been provided in the Repli Project EIR. In particular, please refer to Section 6 of the air quality specialist study report.</p>
			<p>Geotechnical considerations</p> <p>18. The DSR and FEIR should identify and specifically address any plan or mitigation measure required in order to address the geotechnical risks associated with the Repli and Vardocube Projects and its potential impacts on surrounding land uses such as the Copperton WEF. To the extent that the specialist studies undertaken to date have not expressly considered project-level impacts on specific land uses and specific land users the findings are of limited value due to their generic application (and reliance upon assumption rather than specific project-related impacts).</p>	<p>All relevant geotechnical considerations have been considered as part of the mine engineering design. Section 3.2.7.1 of the Repli Project EIR and Section 3.2.2 of the Vardocube Project Scoping Report provide a summary of the geotechnical conditions associated with the mine.</p> <p>The engineering design work has indicated that mining-induced seismicity is a function of high stress levels and a geologically disturbed and brittle rock mass. From the testwork conducted, the rock</p>

				<p>quality conditions are deemed to be good. Please refer to Figure 3-6 in the Repli Project EIR for these details.</p> <p>It is also significant that historical mining to a depth of approximately 900 m was successfully undertaken in the past without any reports of mining-induced seismic activity. The planned backfilling of voids continuous with the underground mining is also expected to reduce the possibility of any mine-induced seismic events.</p> <p>Mine-induced seismicity is a foremost concern in terms of the mine design to ensure safe operations. Notably, the geotechnical engineers have not deemed it necessary for the mine design to include for seismic events because of among others, the low natural seismic intensity of the area, high strength rock mass and relatively low induced stress levels which characterise the mine. Based on this, no geotechnical risk is expected for the Copperton Wind Farm.</p>
			<p>19. We submit that a limited or inadequate consideration of geotechnical conditions at the impact assessment stage may lead to consequences which potentially impact on other land uses and/or land users in close proximity to the site. Such failures could include: slope failure, uncontrolled falls of ground, uncontrolled subsidence, rock bursts and other seismic events.</p>	<p>Please refer to the comment above.</p>
			<p>20. A more detailed understanding of geotechnical considerations and site conditions is required before the EIA processes can be said to contribute meaningfully to</p>	<p>Please refer to the comment above.</p>

			<p>understanding the potential impacts associated with projects of this scale and nature.</p>	
			<p>Conclusion</p> <p>21. There is a serious potential for the proposed Prieska Zinc Copper Project to impact adversely on the operational sustainability and viability of the Copperton WEF. It is this type of situation that the Court in the Fuel Retailers case sought to avoid, remarking that a legitimate object of the EIA process is to identify and predict the actual or potential impact on socio-economic conditions. The Fuel Retailers case is particularly relevant as the Court held that the impact of a proposed development on the feasibility of other developments is required to be carefully assessed during the EIA process.</p>	<p>The Copperton Wind Farm has been identified as a stakeholder and sensitive receptor in both the Repli Project and Vardocube Project.</p> <p>The studies completed have not identified a serious potential for any adverse impact to the Copperton Wind Farm from the proposed activities at the Prieska Zinc Copper Mine.</p>
			<p>22. The reports for the Repli and Vardocube Projects do not currently identify and predict the actual or potential environmental and socio-economic impacts associated with the Prieska Zinc Copper Project.</p>	<p>The potential impacts related to the Repli Project, including those of blasting, dust, traffic and geotechnical considerations, have been identified and assessed and mitigation has been proposed, as required by the EIA Regulations (2014). Specialist studies have been undertaken and the findings included in the EIR for the Repli Project. Impact identification and assessment for the Vardocube Project is ongoing and the findings will be included in the Draft EIR. Registered I&APs will be notified of the availability of the Draft EIR and the associated public comment period.</p>

8 THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE SITES

The proposed activity is an underground mine with no surface development or disturbance. Notwithstanding this, a summary description of the attributes associated with both the surface and underground environment is provided as underground mining can still have indirect impacts to the surface environment by, for example, altering the hydrology of wetland systems, where there is a hydrological link between these systems and groundwater.

The baseline specialist studies undertaken as part of the S&EIR Process for the adjacent Repli MRA and associated application for EA, included parts of Portion 1 of Vogelstruisbult 104. Summary descriptions of the findings of these specialist studies, as relevant to the Vardocube Section, are therefore included in the sections below.

8.1 CLIMATE

PCM is situated in the BWh (mild desert climate) of the Köppen Climate Classification System. Climatic conditions are characterised by warm to hot summers, high evaporation and dry warm winters, a mean annual rainfall of 198 mm and a large degree of variability in the monthly rainfall. Potential evaporation is extremely high. The temperatures are highest in January and coldest month in July.

8.1.1 MEAN ANNUAL RAINFALL

Preliminary investigation of the site hydrological characteristics by Peens & Associates (2017) indicate a Mean Annual Rainfall of 198 mm for the site. Rainfall is strongly seasonal with approximately 60% of the yearly rainfall falling in the summer months (October to January) (Table 8-1).

8.1.2 MEAN ANNUAL EVAPORATION

Regional evaporation data obtained from gauging stations operated by the Department of Water and Sanitation (DWS) was used by Peens & Associates (2017) to calculate a Mean Annual Evaporation (MAE) of 2714 mm for the area (Table 8-1).

TABLE 8-1: MEAN MONTHLY AND ANNUAL RAINFALL AND EVAPORATION

MONTH	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
RAINFALL													
MM	26.6	31.2	41.0	23.3	9.3	4.8	5.2	5.5	5.2	12.2	15.3	18.8	198
%	13.4	15.7	20.7	11.8	4.7	2.4	2.6	2.8	2.6	6.1	7.7	9.5	100
EVAPORATION													
MM	283	336	380	373	295	241	158	109	82	100	146	211	2 714
%	10.4	12.4	14.0	13.7	10.9	8.9	5.8	4.0	3.0	3.7	5.4	7.8	100

Source: Peens & Associates (2017)

8.1.3 TEMPERATURE

High maximum and very low minimum temperatures characterise the environment. The temperatures are highest in January with an average around 26.9°C. July is the coldest month with 9.8°C on average.

TABLE 8-2: MEAN MONTHLY AND ANNUAL TEMPERATURES

MONTH	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ANNUAL
RAINFALL													
MIN	12.1	15	17.8	19.2	18.5	16	11.3	5.9	1.5	1	3.7	7.5	10.8
MAX	29.2	31.3	34.1	34.6	33.8	31	26.8	22.3	18.8	18.6	21.7	25.2	27.3
AVE	20.6	23.1	25.9	26.9	26.1	23.5	19	14.1	10.1	9.8	12.7	16.3	

Source: South African Weather Service (Prieska Weather Station)

8.1.4 WIND SPEED AND DIRECTION

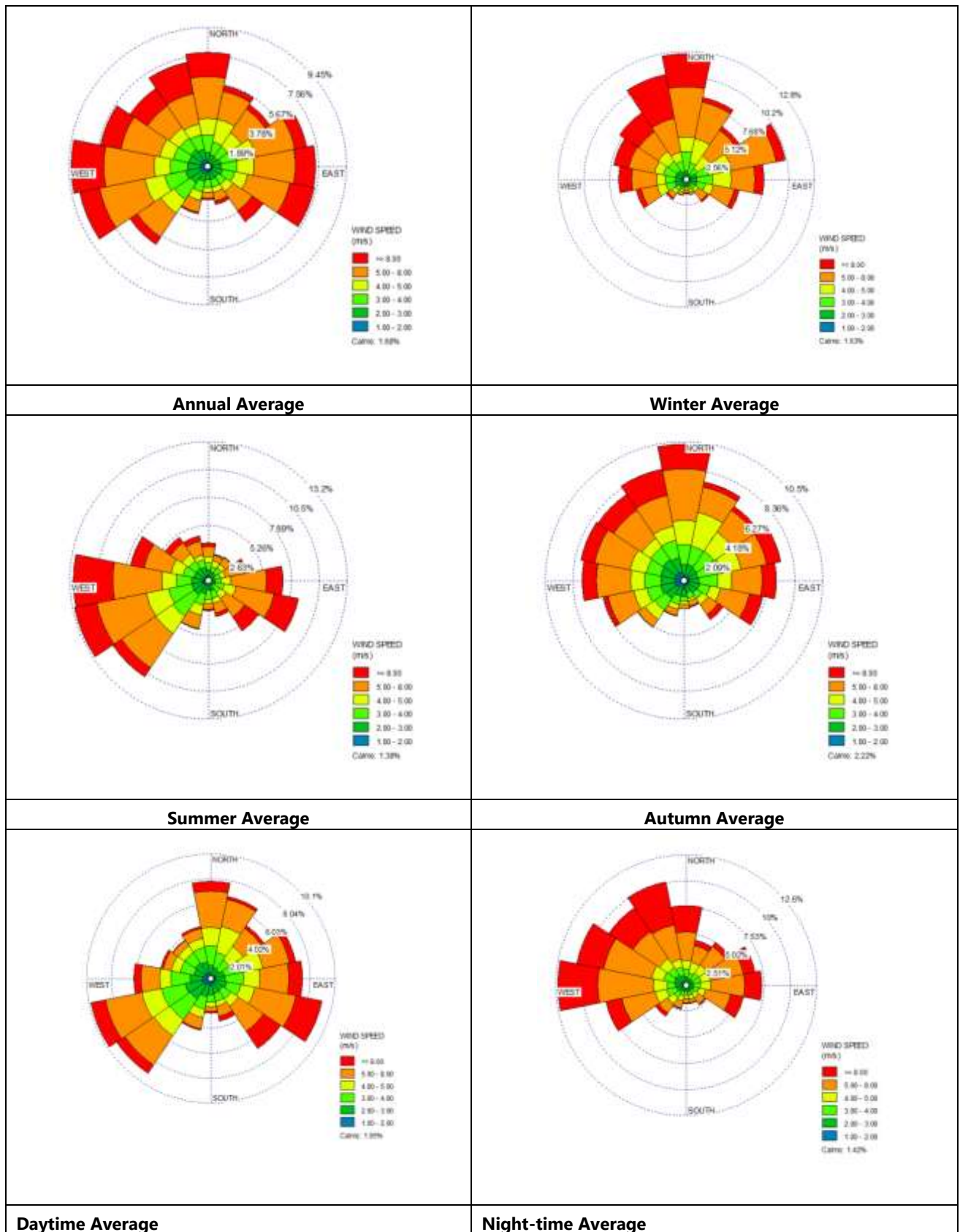
Dominant wind directions and wind speed across the site are presented in Figure 8-1. Seasonal and daytime/night-time variation in wind speeds and direction are also shown.

Wind roses comprise 16 spokes, which represent the directions from which the wind blew during a specific period. The colours used in the wind roses reflect the distinct categories of wind speeds; for example, yellow representing winds in between 1.5 and 2 m/s. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. The frequency with which calms occurred, i.e. periods during which the wind speed was below 1 m/s are also indicated.

Annual average wind direction is dominant from the west and west-west-south. Winds from the north, east and east-east-south are also frequent. Wind is a characteristic of the region, with calm conditions (wind speed less than 1m/s) only being present for 1.58% of the time.

There is a distinct seasonal variation between summer and winter wind direction with predominant winds in winter being from the north and north-north-west. In summer, the predominant wind direction is from the west and west-west-south with south-easterly winds also important. Autumn and spring wind direction is similar to that of winter and summer respectively.

Daytime average wind direction is from the south-west and south-east whereas night-time wind direction is predominantly from a westerly direction. Wind speeds are stronger during night-time compared with daytime conditions.



Source: MM5 Data (2014-2016)

FIGURE 8-1. AVERAGE ANNUAL WIND DIRECTION AND SPEED FOR COPPERTON

8.1.5 TOPOGRAPHY

The area is flat with no significant natural physiographic features present in the area (Appendix 3, Map 4). The terrain type can be described as slightly irregular plains. Elevation across the site varies from approximately 1100 mamsl (metres above mean sea level) in the east to approximately 1080 mamsl in the west.

8.1.6 GEOLOGY

The Prieska Orebody is hosted by highly deformed metamorphic rocks of the Copperton Formation of the Areachap Group, which forms part of the Namaqualand Metamorphic Province.

The copper-zinc orebody forms part of a varied sequence of chemical sediments located at the contact between streaky to banded quartz-feldspar-hornblende gneisses and a sequence of varied banded mafic gneisses and amphibolites. Outcrops in the MRA area are sparse and most of the area is covered by thin sand and scree cover and up to 5m thick calcrete. In the southern corner of the MRA surface area tillite, mudstone and shale of the younger Dwyka Formation unconformably overly the rocks of the Copperton Formation.

Regional geology is shown in Appendix 3, Map 5.

8.1.7 RADIOACTIVITY

Laboratory assay data from rock samples removed during the Repli prospecting drilling programme showed some variation in the concentration of total Uranium (U) and Thorium (Th). The average concentration of total U and total Th in the rock samples was however below the 0.5 Bq/g regulatory limit at which material is considered to be radioactive.

A screening investigation on the U-238, U-234, U-235 and Th-232 radionuclide isotopes in the Repli tailings testwork was undertaken to determine if the concentrations of these isotopes may be enriched during mineral processing and thus result in radioactivity levels in the tailings exceeding the 0.5 Bq/g or 500 Bq.kg⁻¹ (nuclide specific) regulatory limit. The results indicated that all the nuclides were significantly below the exemption level of 500 Bq.kg⁻¹ (radionuclide specific). This means that the material associated with the samples was not considered as radioactive material per se.

Since the rock material from the Vardocube section is from the same orebody as that proposed to be mined by Repli, no difference in the total concentration of Uranium (U) and Thorium (Th) is expected.

8.1.8 SOILS AND AGRICULTURAL LAND CAPABILITY

A baseline soils and agricultural land capability survey has been undertaken for the area by Eco Soil (2017). A summary of the findings of this survey are presented below.

Red/yellow apedal, freely drained soils with a high base status characterise the largest part of the MRA surface area (Appendix 3, Map 6). The Ah93 soil group occupies a large percentage of land in the south of the site. The soils are shallow (less than 450 mm deep) and of low agricultural potential and have rock, weathered rock or calcrete as underlying material. Clay contents are generally less than 15 % and the soils may therefore be susceptible to wind erosion.

There is no peat or soils with a high potential agricultural value within the MRA surface area. The area can be classed in land capability class III: Soils not suitable for arable agriculture, but suitable for grazing.

Land use of the areas surrounding the PCM site is restricted to low intensity grazing. The natural grazing capacity of the site is approximately 35-40 hectares per large stock unit. The combination of low rainfall, high potential evaporation, high maximum and low minimum temperatures, as well as low potential shallow soils limits agricultural activities.

8.1.9 TERRESTRIAL ECOLOGY

A baseline terrestrial ecology survey has been undertaken for the area by Ecorex Consulting Ecologists (2017). This study area included a significant portion of the proposed Vardocube Mining Right Area. A summary of the findings of this survey are presented below.

8.1.9.1 *Regional Context - National Vegetation Types*

The study area is situated within the Nama-Karoo Biome. The flora of the Nama-Karoo is not as diverse and rich as the adjacent Succulent Karoo and does not contain any centres of plant endemism. Three geographically distinct bioregions are present within this biome, namely the Bushmanland, Upper Karoo and Lower Karoo. The study area is situated within the Bushmanland Bioregion at the junction of two national vegetation types, namely Bushmanland Arid Grassland (NKb3) and Bushmanland Basin Shrubland (NKb6). (Appendix 3, Map 7).

Bushmanland Arid Grassland has a conservation status of Least Threatened although only small areas are officially conserved in Augrabies National Park and Goegap Nature Reserve. Bushmanland Basin Shrubland is not represented in any official conservation areas, but shows no sign of serious habitat transformation and has a conservation status of Least Threatened.

8.1.9.2 *Local Context - Vegetation Assemblages*

A large proportion of the study area still comprises Natural Habitat that appears to be relatively undisturbed and is particularly well represented in the eastern half of the study area. This vegetation varies from open grassland to relatively dense shrubland and is likely to be representative of Bushmanland Basin Shrubland, with elements of Bushmanland Arid Grassland present. This is the vegetation assemblage in which plant species of conservation concern are most likely to be found and is the habitat that is most likely to support populations of fauna species of conservation concern.

Three broad-scale vegetation communities have been identified within the study area, based primarily on analysis of high-resolution satellite imagery.




These are as follows:

- Modified Habitat.
- Undisturbed Natural Habitat; and
- Disturbed Natural Habitat.

All the areas that have been cleared of natural habitat, such as buildings and historical mining facilities, are classified as Modified Habitat.

Undisturbed Natural Habitat was classified into three distinct vegetation communities or assemblages. These are described in Figure 8-2.

FIGURE 8-2: UNDISTURBED NATURAL HABITAT IN THE STUDY AREA

VEGETATION COMMUNITY	DESCRIPTION	PHOTOGRAPH
<p><i>Aizoaceae</i> dwarf shrubland on calcrete plains</p>	<p>This vegetation community is found on plains throughout the project area, specifically where calcrete is prominent on the soil surface. It is the vegetation community that is most representative of Bushmanland Basin Shrubland in the project area. <i>Aizoaceae</i> dwarf shrubland differs from <i>Rhigozum</i> dwarf shrubland in having noticeably higher diversity of dwarf shrubs and much lower proportional grass cover.</p>	
<p><i>Rhigozum trichotomum</i> dwarf shrubland on sandy plains</p>	<p><i>Rhigozum</i> dwarf shrubland is found on the deeper, red to reddish brown sands in the project area, usually with little or no evidence of calcrete on the soil surface. While this vegetation community is still representative of Bushmanland Basin Shrubland, it contains elements of Bushmanland Arid Grassland as well, particularly the relative abundance of grass cover.</p>	
<p>Pans</p>	<p>Several circular to sub-circular ephemeral pans are found in the eastern half of the study area, as well as a few adjacent to the north-eastern boundary. None of the pans held any water during fieldwork and comprised either bare soil or heavily grazed seasonal grassland. Species richness appears to be low, but could not be assessed because of the lack of visible above-ground foliage. Most of the plant species present are likely to be habitat specialists adapted to the extremes of flooding and extended drought, justifying an elevated conservation importance for this vegetation assemblage.</p>	

Disturbed Natural Habitat refers to areas of Natural Habitat that have not been transformed by construction of infrastructure such as roads, buildings or tailings storage facilities, but have been degraded through human activity such as movement of heavy machinery or dumping of building rubble.

Alien invasive plant thickets were mapped within the Degraded Natural Habitat mapping unit. These thickets are found most often in areas that have previously been degraded or transformed, as well as around edges of pans or livestock watering points. The invasive alien tree species *Prosopis glandulosa* is the dominant, while the closely related *Prosopis velutina* is present in small numbers. Species representative of the original Natural Habitat state are usually present, particularly *Rhigozum trichotomum*, which is an indigenous invader of disturbed habitats.

This degraded Natural Habitat still contains a seedbank of the original flora and some original plant cover and has a significantly higher potential for restoration than Modified Habitat does. Most of the areas of degraded Natural Habitat are situated adjacent to Modified Habitat.

8.1.9.3 Species of Conservation Concern

The vast majority of the plant species occurring in the general vicinity of the study area are currently classified as either Least Concern (661 spp) or Not Evaluated (66 spp).

One species, *Listia minima*, is classified as Data Deficient (Taxonomically Problematic) and cannot be assessed until its taxonomy is resolved (Victor, 2006). The following three species of conservation concern have been confirmed to occur in the QDS:

- *Hoodia officinalis* subsp. *officinalis*,
- *Phyllobolus amabilis*, and
- *Aloidendron dichotomum* (Quiver Tree).

None of these species were located during fieldwork.

8.1.9.4 Endemic Plant Species

The Copperton study area is situated at the southern boundary of the Griqualand West Centre of Plant Endemism as defined by Frisby (2016). Five of the 26 endemic or near-endemic GWCE species have been confirmed to occur in the general vicinity of the study area, namely *Calobota cuspidosa* (Fabaceae), *Justicia thymifolia* (Acanthaceae), *Phyllobolus amabilis* (Aizoaceae), *Putterlickia saxatilis* (Celastraceae) and *Searsia tridactyla* (Anacardiaceae).

Dedicated searches for these and other GWCE species were conducted in the project area during summer fieldwork but none were located. However, many species were in vegetative state, some without even having leaves present, and it is possible that GWCE endemics may have been overlooked.

8.1.9.5 Protected Plant Species

Eleven of the plant species confirmed to occur in the project area during fieldwork are protected. One species is protected under Schedule 1 of the Northern Cape Nature Conservation Act (No. 9 of 2009), namely *Hoodia gordonii*, while nine species are protected under Schedule 2 of the same act. A single species, *Boscia albitrunca*, is protected under the National Forest Act (No. 84 of 1998).

8.1.9.6 Alien Invasive Plant Species

Two tree species are of particular concern and are classified as Category 3 invasive species in the Northern Cape under the National Environmental Management: Biodiversity Act (No.10 of 2004): Alien and Invasive Species Regulations, 2014: Honey Mesquite (*Prosopis glandulosa*) and Velvet Mesquite (*P. velutina*). *Prosopis glandulosa* is relatively common in the project area and has invaded degraded areas in the vicinity of the mine and at most of the pans and livestock watering points. *Prosopis velutina* is less common and potentially a lower threat than *P. glandulosa*.

8.1.10 FAUNA

8.1.10.1 Mammals

Numerous small mammal species are endemic to the Namib-Karoo Biome, of which the following have been confirmed to occur within the general vicinity of the study area (Friedman & Daly, 2004): Western Rock Sengi (*Elephantulus rufescens*), Round-eared Elephant Shrew (*Macroscelides proboscideus*), Spectacled Dormouse (*Graphiurus ocellatus*), Pygmy Rock Mouse (*Petromyscus collinus*), Brukkaros Pygmy Rock Mouse (*P. monticularis*), Bush Vlei Rat (*Otomys unisulcatus*), Brants's Whistling Rat (*Parotomys brantsii*) and Littledale's Whistling Rat (*P. littledalei*).

Two Vulnerable and five Near Threatened mammal species have been recorded in QDSs in the vicinity of the study area according to distribution maps in Friedman & Daly (2004), three of which have a moderate likelihood

of occurring because of the presence of suitable habitat, and one of which was confirmed to occur. A carcass of a sub-adult Brown Hyaena (*Parahyaena brunnea*), which is classified as Near Threatened, was recovered from within the study area. This species has large home ranges and is unlikely to be confined to the project area, although it could be resident. No threatened mammals are likely to be present within the project area.

8.1.10.2 Birds

Twenty-three species are listed by Barnes (1998) as being endemic to the Namib-Karoo biome i.e. not occurring outside of the biome, of which 15 species (65%) have been recorded within the general vicinity of the study area during the current Southern African Bird Atlas Project (SABAP2).

While only four of these species were located in the project area during fieldwork, it is likely that species such as Karoo Long-billed Lark *Certhilauda subcoronata*, Sickie-winged Chat *Cercomela sinuata* and Tractrac Chat *C. tractrac* also occur. A number of near-endemics such as Rufous-eared Warbler *Malcorus pectoralis*, Namaqua Sandgrouse *Pterocles namaqua* and White-throated Canary *Crithagra albogularis* were also observed during fieldwork. Two species that are endemic to the Kalahari-Highveld biome have also been recorded in the same area, both of which were confirmed to occur during fieldwork

The study area is also situated in a designated secondary Endemic Bird Area, namely the Karoo EBA (s047) (Barnes et al., 2001). There are no Important Bird Areas within the vicinity of the study area, the closest being the Platberg-Karoo Conservancy IBA (ZA037), approximately 130 km to the east (Barnes, 1998).

The quarter-degree grids 2922 CD and 3022 AB, in which the study area falls, currently have a combined list of 158 bird species recorded during the ongoing second Southern African Bird Atlas Project (SABAP2), a total probably approaching true species diversity. However, the small size of the study area, homogenous structure of vegetation, high degree of transformation and the lack of waterbodies make it unlikely that more than 40-50 species occur within the study area.

Six Endangered (EN), five Vulnerable (VU) and five Near Threatened (NT) species have been recorded from the general vicinity of the project area during SABAP2. One of the Endangered species, Ludwig's Bustard *Neotis ludwigii*, was located during fieldwork in shrubland east of Copperton within the study area and is possibly resident in very low numbers. Two Near Threatened species were also located in the project area during fieldwork. Pairs and small groups of Double-banded Courser *Rhinoptilus africanus* and several family groups of Karoo Korhaan *Eupodotis vigorsii* were seen and heard in shrubland. Karoo Korhaan is likely to be a breeding resident in the project area, while Double-banded Courser is more likely to be an irregular breeding visitor. Jenkins (2011) reported regularly active nests of Martial Eagle *Polemaetus bellicosus*, which is classified as Endangered, within 11 km south of the study area (on tower 512 of the HydraKronos 400 kV line), and within 22 km to the south-west (on tower 392 of the AriesKronos 400 kV line). Thus it is likely that this species regularly forages over the study area.

Two Vulnerable species have a moderate likelihood of occurring in the project area, based on assessment of habitat present in the project area and likelihood of occurring in proximity to disturbance, namely Lanner Falcon *Falco biarmicus* and Red Lark *Calendulauda burra*. Limited nesting habitat is present for Lanner Falcon, but it has fairly large foraging home ranges and is potentially a non-breeding visitor. Red Lark is a habitat specialist that prefers shrublands or grasslands on deep, sandy soils and is a potentially resident species in this habitat in the project area. One Near Threatened species has a moderate likelihood of occurring in the project area based on the above criteria, namely Sclater's Lark *Spizocorys sclateri*.

8.1.10.3 Herpetofauna (Reptiles and Amphibians)

The desktop study initially revealed that a total of 48 reptile species could be expected to occur within and surrounding the study area of which three species are endemic and three are considered as near-endemic (Bates et al., 2014). Only seven (15%) of these species were previously observed within the QDS of the study area (ReptileMap, 2017). Refinement of the list of expected species, based on the species and habitats observed within

the study area during the field survey, decreased the number of expected reptile species to 31 (probability of occurrence either medium or high). This is mostly due to the lack of extensive rocky or ridge habitats excluding strongly rupicolous species (e.g. *Karusasaurus polyzonus*), while the lack of large tracts of sandy soils and the complete absence of Camelthorn trees (*Vachellia erioloba*) excluded fossorial (e.g. *Acontias lineatus*) and arboreal (e.g. *Chamaeleo dilepis*) species respectively.

Reptile activity levels were very low during fieldwork, presumably due to very dry veld conditions, low humidity, cold temperatures and strong winds brought about by two consecutive cold fronts. A total of 15 reptile species (76 individuals) were observed during the survey. No species of conservation concern were observed.

For amphibians, an initial eleven species were expected to occur within and surrounding the study area of which only one species is considered endemic (Du Preez & Carruthers, 2009). A single species has been observed within the QDS of the study area (FrogMap, 2017). Refinement of the list of expected species, based on the species and habitats observed within the study area during the field survey, decreased the number of expected amphibian species to nine (probability of occurrence either medium or high). No amphibian species were observed in the project area during fieldwork. Additional fieldwork after the ephemeral pans had received some rain would have resulted in a few species being located, but fieldwork timing did not correspond with good rains.

No herpetofauna species currently designated as species of conservation concern have been observed within the focal QDS of the study area (2922CD) or the surrounding 8 QDS's. However, a single species that potentially occurs in the area is of concern and requires discussion. FrogMAP (2017) lists the Giant Bullfrog (*Pyxicephalus adspersus*) as Near Threatened (NT), while Du Preez & Carruthers (2009) list it as Vulnerable (VU) and NEMBA (2004) lists it as Protected. This species breeds in shallow temporary pans which are present within the study area and surroundings, and consequently have elevated biodiversity value. It has been classified as NT as a result of loss of its breeding habitat to urbanisation and agricultural use, as well as being particularly susceptible to collisions with vehicles on roads and is often targeted as a food source by people.

A recent observation of a skink specimen initially identified as a Thin-tailed Legless Skink (*Acontias gracilicauda*) near Postmasburg is believed to represent an undescribed species (W. Conradie [PEM] *pers. comm.*). No suitable habitat for this species was observed within the study area and it is therefore not expected to be influenced by the proposed development.

8.1.11 PRELIMINARY BIODIVERSITY VALUE ASSESSMENT

The Biodiversity Value (BV) of each habitat (modified and natural), determined qualitatively by integrating the Conservation Importance (CI) and Functional Importance (FI) of each community, is indicated in Table 8-3.

TABLE 8-3: BIODIVERSITY VALUE OF HABITATS

VEGETATION ASSEMBLAGES	CONSERVATION IMPORTANCE	FUNCTIONAL IMPORTANCE	BIODIVERSITY VALUE
PANS	High	High	High
NATURAL HABITAT (UNDISTURBED)	Moderate	Moderate	Moderate
NATURAL HABITAT (DEGRADED)	Moderate	Low	Low
MODIFIED HABITAT	Very Low	Very Low	Very Low

The Pan vegetation community was assessed as having High BV on account of high CI score on the basis of a potential for supporting species of conservation concern as well as a high proportion of habitat specialists, and a high FI score. Both *Aizoaceae* dwarf shrubland and *Rhigozum trichotomum* dwarf shrubland were rated as having Moderate BV as a result of moderate CI and FI values.

The Pans and both shrubland vegetation communities represent the untransformed natural habitat in the project area and are key habitats in which negative impacts need to be avoided and in which no infrastructure should be placed wherever possible. The ecologically compromised state of degraded Natural Habitat has resulted in a Low BV, although it is a habitat that still has some of the original vegetation cover and has a higher potential for restoration than Modified Habitat, which has a Very Low BV.

8.1.12 SURFACE WATER

The study area falls within the Orange (D) Primary catchment, the D5 Secondary catchment and the Lower Orange DWS water management area. It falls within the D54D quaternary catchment. The watershed associated with the survey area drains toward the Basterput se Leegte River within the adjacent catchment, which drains northwards into the Hartbees River, which then confluences with the Orange River near the town of Kakamas.

The quaternary sub-catchment's underlying geology consists of tillite, undifferentiated assemblage of compacted sedimentary extrusive and intrusive rocks as well as principally arenaceous strata. The underlying geology is covered with moderate to deep sandy soils with a medium erodibility index and an estimated annual sediment yield of 10 000 tons per annum. The entire catchment area falls with an endoreic area, which is classified as a catchment area that does not contribute to mean annual runoff. Hence, this catchment only produces runoff during major storms.

Several non-perennial rivers traverse the surface area. (Appendix 3, Map 8). Drainage across the site is generally from east to west.

Prior to its diversion, the historic alignment of one of the non-perennial rivers passed through the area now occupied by the historical mine surface infrastructure and sinkholes on the adjacent Portion 25 and 26 of Vogelstruisbult 104. The non-perennial river is not named; however, it is a tributary of the Hartbeest River, which discharges into the Lower Orange River. This watercourse has an effective catchment area of 259 km² and is currently diverted to the north and south of the historical mine surface infrastructure and sinkholes. The diversion consists of an earth channel with a berm on the lower ground side of the channel.

The proposed underground mine will not have an impact on any surface water resources in the area.

8.1.13 SURFACE WATER ECOSYSTEMS

A surface water ecosystems study has been undertaken for the area by Enviross (2018). This study area included a significant portion of the proposed Vardocube Mining Right Area. This study indicated that the region has an arid climate and therefore persistent surface water ecosystems are rare. Poorly-developed watercourses are commonplace, but defined channels are rare due to the generally low volumes of rainfall events. Most watercourses are barely perceptible and convey small volumes of water only during rainfall events, with no permanent aquatic habitat noted throughout the survey site. Watercourses are therefore thought to be limited to stormwater drainage toward more developed watercourses located further downstream of the site.

Few wetland features were observed within the area, which was expected because of the arid climate. A single naturally-occurring wetland unit that supports a surface water ecosystem was identified. The wetland / pan is within 100 m of the proposed main access road to the Repli mine. This is an existing road.

No surface water ecosystems are expected to be impacted by the proposed underground mining of the Vardocube Section.

8.1.14 GROUNDWATER

A groundwater specialist study was undertaken by ILEH (2018) for the adjacent Repli section. This study was updated to include the planned mining of the Vardocube Section. A copy of the updated report is provided in Appendix 7.

From a geohydrological perspective three aquifers are present. The upper 15 m of the geological succession comprises unconsolidated sand, calcrete and clay, which is expected to be dry except after a rainfall event. The unconsolidated sediments are underlain by a fractured gneiss aquifer, which is estimated to be approximately 100 m thick. Groundwater is associated with fractures and faults. The fieldwork data suggests the transmissivity of the gneiss varies between 0,2 and 32 m²/d. The matrix of this aquifer is expected to have a low transmissivity, probably around 0,2 m²/d or lower. The average depth to groundwater in this aquifer is 18 m, but it is dewatered locally around the historical PCM underground workings. This aquifer is regionally important, as it is used for private groundwater abstraction.

A lower fractured rock aquifer is present at depths greater than 100 m. There is currently no information available to characterise this aquifer. The monitoring boreholes drilled during the current project extended to depths of between 80 and 150 m below surface and target the upper fractured rock aquifer discussed above. Literature-based aquifer characteristics were therefore used to assess impacts associated with the deep fractured rock aquifer.

A hydrocensus was completed in order to identify and characterise private groundwater use in the vicinity of the PCM operations. A total of 32 boreholes were located. These boreholes are drilled to an average depth of 40 m. Half of the boreholes identified were dry or not in use. Groundwater is solely used for stock watering and none of the boreholes identified during the hydrocensus are used for potable supply. A borehole on the farm Vogelstruisbult, situated east of the PCM mining area is reported to have a high yield, but on average the yields of boreholes identified are low.

A total of 12 groundwater monitoring boreholes were drilled around the proposed project as well as around the historical TSF. One borehole was drilled to a depth of 150 m at the historical TSF. The remainder of the boreholes were drilled to 80 m below surface. The depth to groundwater in these boreholes varies between 6 m and 35 m below surface, with an average depth of 20 m. Regionally, groundwater flows in a south-westerly direction at a gradient of 1:125. Groundwater flow patterns indicate a lowering in groundwater levels around the historical PCM mine and a mound in groundwater levels around the historical TSF.

The sparse intersection of water-bearing features in the boreholes drilled suggests that the aquifers have been dewatered to a large extent in the immediate vicinity of the mine. The information also confirms that groundwater occurrence is erratic in this arid environment.

Aquifer tests were completed on the five boreholes that intersected groundwater. The results indicate that two boreholes had yields of 4,5 l/s (150 000 lph) and 1,9 l/s (82000 lph). The yields of the remainder of the boreholes are low, on average 0,06 l/s (2500 lph). The results of the aquifer tests were also used to calculate the transmissivity and storage coefficients for the boreholes. These parameters describe the aquifer conditions intersected in each borehole. Higher transmissivity and storage coefficient values are associated with stronger aquifers.

The results indicate that the fractured rock aquifers present are heterogeneous with transmissivities varying between 0,2 and 6,2 m²/d.

The average calculated storage coefficient from the tests is $1,16 \times 10^{-3}$. These values are typical of the rock formations intersected.

The outcome of the chemical analysis of the groundwater samples taken from the hydrocensus boreholes indicate that regionally, groundwater is saline with elevated total dissolved solids, chloride and in some instances sulphate concentrations.

The groundwater in private boreholes has also been contaminated with nitrates that are most probably associated with agricultural activities. Elevated selenium and uranium levels are typical for the region, but may result in chronic health risks if ingested over prolonged periods of time.

Groundwater quality in the mining area is characterised by increased sulphate and manganese concentrations. The most significant impact on groundwater quality at the PCM operations is associated with the historical TSF. Sulphate concentrations in this area exceed 2500 mg/l in two of the monitoring boreholes.

The potential sources to groundwater contamination identified from the available dataset includes the following:

- The historical TSF on Portion 0 of the Farm Slimes Dam 154. Groundwater monitoring information indicates that this facility is already impacting on groundwater quality;
- The proposed new TSF. It is noted that the new TSF will be lined, thus reducing the impact on groundwater quality associated with the facility significantly;
- The underground workings; and
- The effluent dam, which will contain poor quality water pumped to surface from the underground workings. This dam will also be lined, thus significantly reducing the risk of groundwater contamination.

Contamination from these sources may reach the aquifers vertically through the unsaturated soil horizon and the weathered aquifer from surface sources of contamination like the historical TSF. Once the potential contamination reaches the fractured rock aquifer, the preferential flow paths would be the faults and fractures present. Groundwater will also flow through the rock matrix, but at much lower rates compared to the preferential pathways.

The receptors to groundwater contamination include the following:

- Existing private groundwater users; and
- Non-perennial streams near the mining area. It is however noted that these streams are dry and this impact is therefore not anticipated to be of significance.

8.1.15 AIR QUALITY

There are no ambient air quality monitoring stations near PCM. The ambient air quality in the area is however expected to be within the acceptable range of all the pollutants specified in the National Ambient Air Quality Standards, Government Notice 1210, promulgated in terms of the National Environmental Management: Air Quality Act 39 of 2004. This is attributed to the remoteness of the site and the absence of any significant atmospheric emission sources in the region.

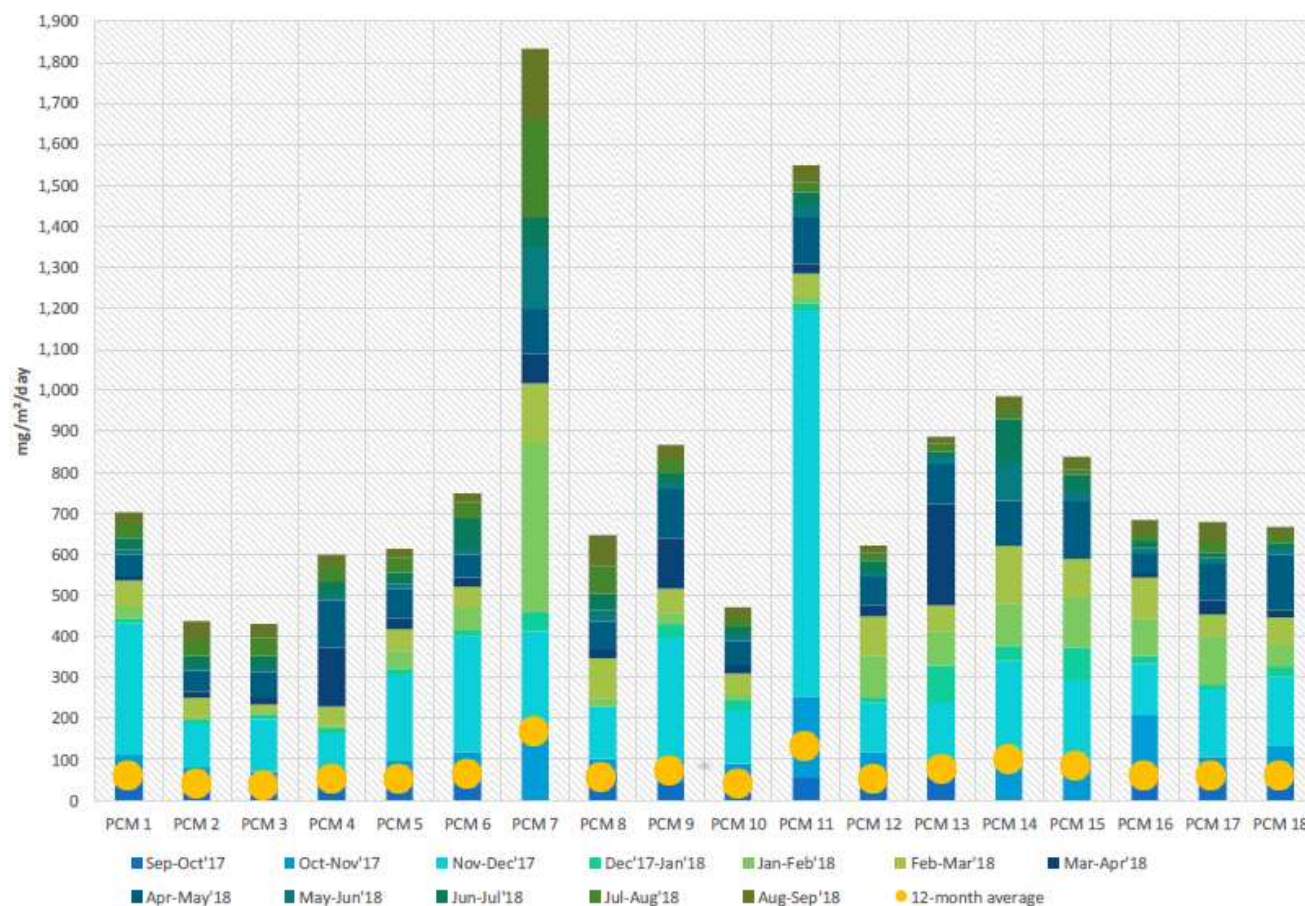
Existing sources of emissions to the local airshed are expected to be from the following activities:

- Dust entrainment from vehicles using unsurfaced roads and tracks;
- Burning of biomass;
- Windblown dust and particulate emissions from exposed areas, including historical mining structures such as the TSF and WRD; and
- Alkantpan activities.

A dustfall network has been established to develop a pre-mining record of dustfall. The network comprises of 18 dust buckets, positioned in relation to prevailing wind direction, planned prospecting and mining activities and site-specific conditions.

Acceptable dustfall rates in terms of the National Dust Control Regulations, 2013 Government Notice 827, promulgated in terms of the National Environmental Management: Air Quality Act 39 of 2004 for residential areas is less than 600 mg/m²/day and for non-residential areas less than 1200 mg/m²/day.

Results from 12 months of monitoring (September 2017 – September 2018) indicate that the pre-mining dustfall levels are very low (Figure 8-3).



Source: Airshed Planning Professionals (2018)

FIGURE 8-3: DUSTFALL RATES

Dustfall rates increased from the Sep/Oct 2017 sampling period to Nov/Dec 2017 sampling period but decreased drastically between the Nov/Dec 2017 and Dec 2017/Jan 2018 sampling period. This may be attributed to the decline in on-site activities over the holidays, also resulting in less traffic on the roads. There was a slight increase in the dustfall rates for the period Jan/Feb 2018 and again in Feb/Mar 2018, with a slight decrease again in Mar/Apr 2018. The Apr/May 2018 results show a slight increase again, but with a lower maximum dustfall rate and a higher minimum dustfall rate than the previous sampling period. For the period May/Jun 2018 the dustfall rates decreased to similar levels recorded during Dec 2017/Jan 2018. Dustfall rates were slightly higher than the previous periods during Jun/Jul 2018, Jul/Aug 2018 and again during Aug/Sep 2018, but low compared to the other months. Sep/Oct 2018 had similar dustfall rates to Jun/Jul 2018

8.1.16 ENVIRONMENTAL NOISE

A baseline environmental noise survey has been undertaken for the area by Airshed Planning Professionals (2017).

A summary of the findings of this survey are presented below. It is expected that the surface mining and associated activities undertaken by Repli will be the most significant contribution to noise in the area and that the proposed underground mining of the Vardocube Section will not have any significant additional impact on noise sensitive receptors.

8.1.16.1 Baseline Noise Survey Results

The baseline noise survey results for daytime and night-time are presented in Figure 8-4.

The following can be noted with respect to the daytime noise measurement results:

- Measurements indicate day-time ambient noise levels that are comparatively quiet but influenced by occasional noisy incidents such as vehicle pass-bys;
- On-site drilling (prospecting) activities were clearly audible at on-site survey sites (Site 1, Site 3, and Site 4);
- The measured noise levels are considered typical of rural and suburban areas according to SANS 10103;
- Recorded on-site LAeq's ranged between 31.5 dBA and 48.3 dBA and are therefore in compliance with IFC guidelines for industrial receptors (70 dBA) and residential, institutional and educational receptors (55 dBA);
- At Copperton, LAeq, LAeq, and LA90 of 47.4 dBA, 43.8 dBA, and 24.5 dBA were recorded respectively. Levels correspond to what is typically expected in rural areas and are currently compliant with the IFC guideline for residential, institutional and educational receptors (55 dBA); and
- At the Nelspoortjie farmstead entrance, next to the R357, LAeq, LAeq, and LA90 of 66.5 dBA, 61.3 dBA, and 19.4 dBA were recorded respectively. The large difference in recorded LAeq, LAeq, and LA90 is attributed to vehicle pass-bys. Levels correspond to what is typically expected in urban areas with main roads and are currently not compliant with the IFC guideline for residential, institutional and educational receptors (55 dBA).

The following can be noted with respect to the night-time noise measurement results:

- Measurements indicate night-time ambient noise levels that are quiet but influenced by occasional noisy incidents such as vehicle pass-bys;
- On-site drilling (prospecting) activities were audible at all survey sites;
- On-site LAeq's ranged between 38.4 dBA and 42 dBA which is considered typical of rural and suburban areas according to SANS 10103;
- Recorded on-site LAeq's ranged between 30.3 dBA and 41 dBA and are therefore in compliance with IFC guidelines for industrial receptors (70 dBA) and residential, institutional and educational receptors (45 dBA); and
- At Copperton, LAeq, LAeq, and LA90 of 36.3 dBA, 31.8 dBA, and 28.7 dBA were recorded respectively. Levels were very low and comparable to what is typically expected in rural areas. They are currently also compliant with the night-time IFC guideline for residential, institutional and educational receptors (45 dBA).

- At the Nelspoortjie entrance, next to the R357, LAeq, LAeq, and LA90 of 38.4 dBA, 27.6 dBA, and 19.4 dBA were recorded respectively. Levels correspond to what is typically expected in rural areas and are compliant with the night-time IFC guideline for residential, institutional and educational receptors (55 dBA).

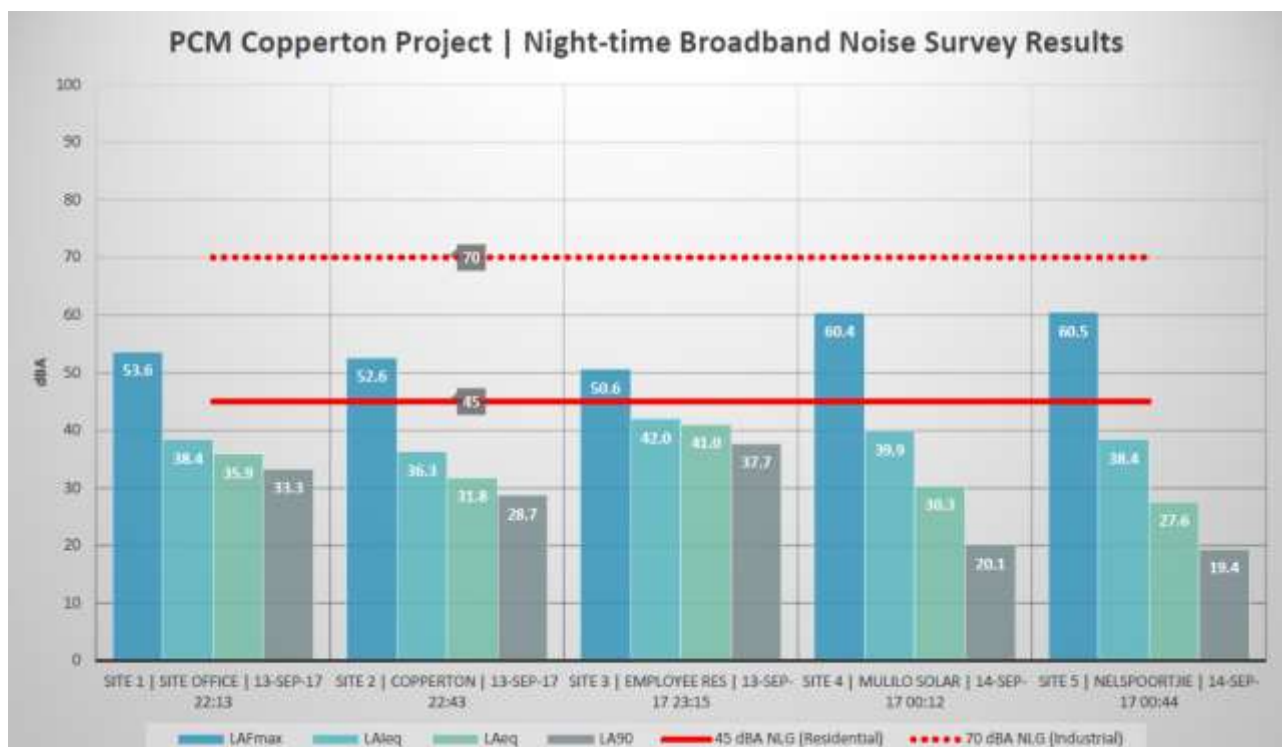
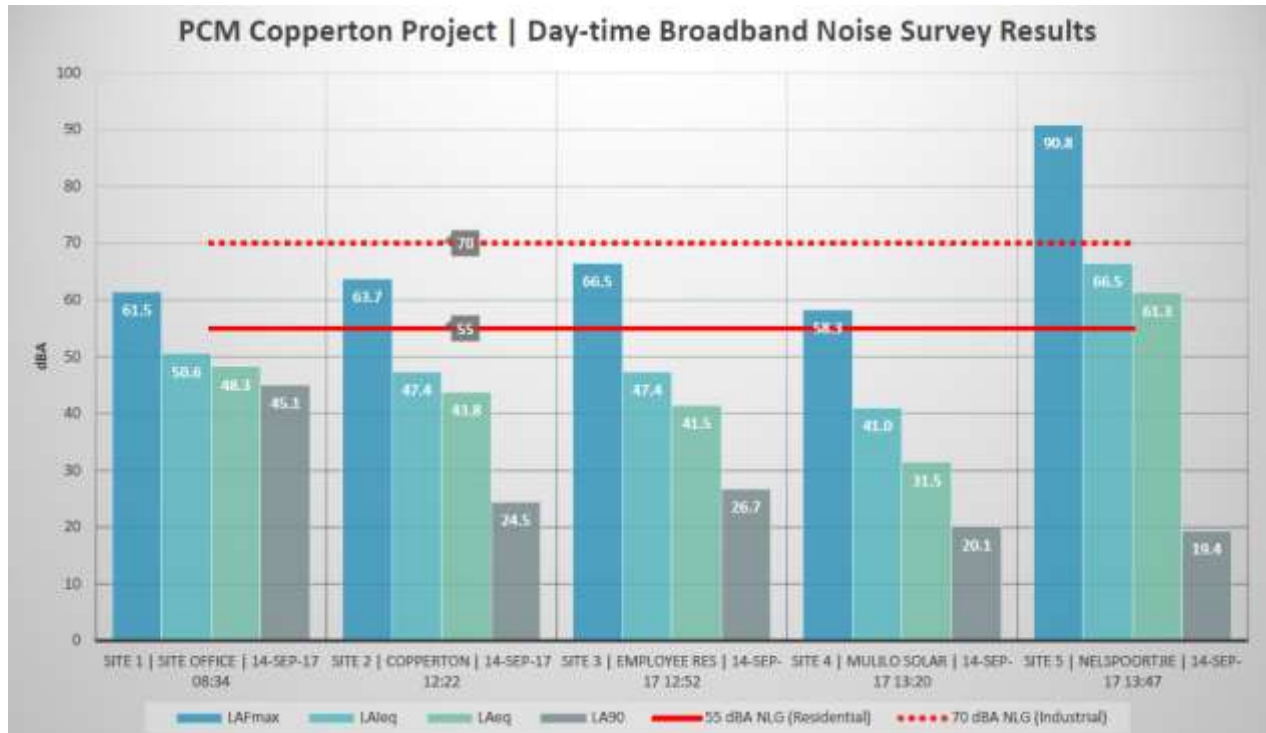


FIGURE 8-4: DAY AND NIGHT-TIME BASELINE NOISE SURVEY RESULTS

8.1.17 HERITAGE

A baseline heritage and paleontological survey was undertaken for the area by Heritage Contracts and Archaeological Consulting (2017). The heritage and paleontological specialists have confirmed that the findings of the survey are applicable to the Vardocube Section. Please refer to Appendix 7 for this confirmation.

8.1.17.1 Literature Review

Beaumont *et al.* (1995: 240) observed that “thousands of square kilometres of Bushmanland are covered by a low density lithic scatter”. These artefacts are generally very well weathered and mostly pertain to the Early Stone Age (ESA) and Middle Stone Age (MSA). Occasional Late Stone Age (LSA) artefacts are also noted. What is noteworthy of the Northern Cape archaeological record is the presence of pans which frequently display associated archaeological material.

Of interest, is the work of Kiberd (2001, 2005, 2006) who excavated Bundu Pan, some 25 km to 30 km northwest of Copperton. The site yielded ESA, MSA and LSA horizons and the artefacts were accompanied by warthog and equid teeth to name a few (Beaumont *et al.* 1995).

Orton (2011) noted that to the northwest, west and southwest of Copperton sites have been investigated by Beaumont and colleagues (1995), Smith (1995) and Parsons (2003, 2004, 2007, 2008) yielding LSA deposits. Work on these sites led to a distinction between hunter-gatherer and herder sites, based on stone artefact assemblages (Beaumont *et al.* 1995). All these Later Stone Age sites have very few, if any, organic items on them. The only organic material found on sites like these is fragments of ostrich eggshell probably belonging to broken water containers. Such flasks have been widely recorded across the Northern Cape (Morris 1994).

8.1.17.2 Archaeology

Based on research conducted in the area ESA, MSA and LSA scatters as well as sites can be expected in the larger study area. Due to the development of the study area that would have impacted on surface indicators of heritage sites no significant archaeological sites or finds are expected. Impacts to heritage resources will occur primarily during the construction phase and no impacts are expected during the operation and decommissioning phase.

8.1.17.3 Historical Period Finds

Historical finds include middens, structural remains and cultural landscape. Due to the large scale, mining related development of the study area and surrounds from 1972 it is assumed that structures are younger than 60 years and not protected by the NHRA. Impacts to heritage resources will occur primarily during the construction phase and no impacts are expected during the operation and decommissioning phase.

8.1.17.4 Burials and Cemeteries

Graves and informal cemeteries can be expected anywhere on the landscape and studies in the surrounding areas recorded informal graves and unmarked graves. The graveyard in Copperton will not be affected in anyway by the proposed development.

8.1.17.5 Palaeontology

A Heritage Impact Assessment (HIA) was completed as part of the environmental authorisation process for the adjacent Prieska Zinc Copper Project Repli Section. This HIA included a palaeontological assessment of a study area incorporating the Vardocube Section. The assessment indicated low to very low palaeontological sensitivity for the area.

8.1.18 SOCIO-ECONOMIC ENVIRONMENT³

8.1.18.1 Siyathemba Local Municipality

The proposed Vardocube mining right area is located within Ward 4 of the Siyathemba Local Municipality (SLM), which is managed by the Pixley Ka Seme District Municipality, within the Northern Cape Province of South Africa. The towns of Brakbos, Brulpoort, Draghoender, Koegas, Marydale, Niekerkshoop, Prieska, Shamley's Farm, Uitvlug, and Westerberg fall within the boundaries of the SLM (Figure 8-5).

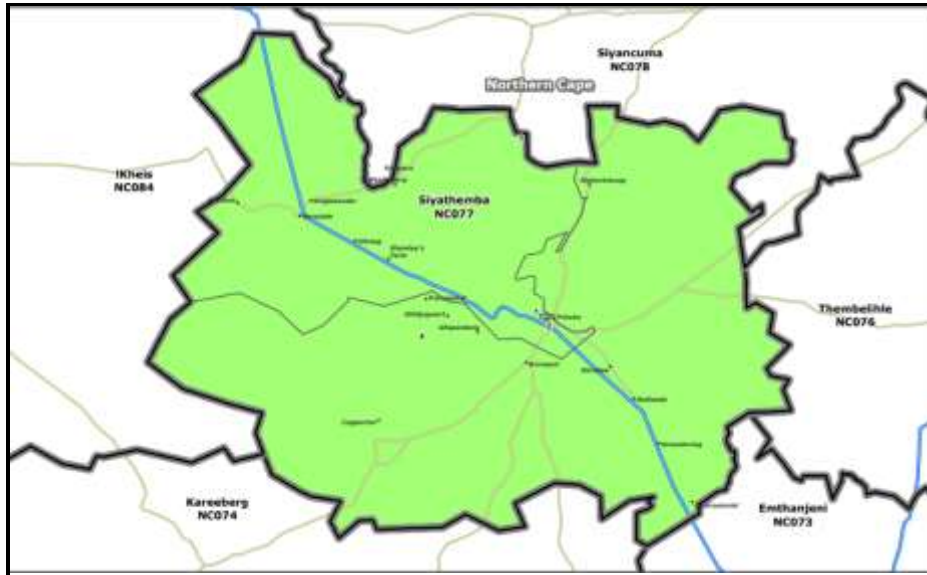


FIGURE 8-5: GEOGRAPHICAL BOUNDARY OF THE SLM

SLM was established in 2001 and is a category B municipality. It is located within the central easterly parts of the Northern Cape Province along the Orange River. It is approximately 220 km away from the nearest business center of Kimberley. The surface area of the municipality is approximately 8 200 km², accounting for 8% of the total district surface area and approximately 3% of the provincial area. A summary of the key statistics of the municipality is provided in Table 8-4.

8.1.18.2 Spatial and Regional Development Planning

The SLM Spatial Development Framework (SDF) was compiled in 2006 and, according to the SLM IDP (2017-2018), is no longer used for guiding for development planning in the municipality. No development planning guidelines or objectives have therefore been defined for Copperton or the proposed MRA surface area.

Similarly, no local or regional development plans for the Copperton area have been proposed.

8.1.18.3 Population

There are approximately 22 000 people residing in the municipality. This represents approximately 1.9% of the total population in the Northern Cape. The population of Siyathemba contracted by 0.4% on average per annum between 2000 and 2010. The decline of the Siyathemba population was mainly driven by lower fertility rates.

The death rate (the number of deaths per 1,000 people in a year) increased from 11.2 deaths per 1,000 people in 1995 to 11.6 during 2010.

³ There is a general lack of recent published demographic and other socio-economic data for the SLM. Except where noted, the information in this section has been summarised from Statistics South Africa Census Data (2011) and the SLM Local Economic Development Strategy (2012)

This is significantly lower than the death rates recorded over the same period for the Northern Cape and South Africa. The reason for the lower death rate in the study area was mainly the result of lower HIV/AIDS prevalence rates when compared with South African averages.

The most dominant population group in the SLM are Coloured individuals, who represent more than 75% of the total population in the municipal area. Black African and White population groups comprise around 12% and 8% of the population respectively. The dominant languages in the SLM are Xhosa and Afrikaans. Afrikaans is the most widely spoken language (78%).

TABLE 8-4: KEY STATISTICS OF SIYATHEMBA LOCAL MUNICIPALITY

KEY STATISTICS	NUMERICAL VALUE
Total population	21,591
Young (0-14)	30,8%
Working age	63,2%
Elderly (65+)	6%
Dependency Ratio	58,2%
Gender Ratio	99,3%
Growth Rate	1.57% (2001 - 2011)
Population density	1 person/km ²
Unemployment rate	24.3%
Youth unemployment rate	30.2%
No schooling aged 20+	11.5%
Higher education aged 20+	5.3%
Matric aged 20+	18%
Number of Households	5.831%
Number of Agricultural Households	1.334%
Average Household size (person)	3.6
Female headed households	36.1%
Formal dwellings	88.6%
Housing owned/paying off	54.3%
Flush toilet connected to sewerage	64.9%
Weekly refuse removal	73.9%
Piped water inside dwelling	43.1%
Electricity for lighting	86.2%

Source: Statistics South Africa (2011)

8.1.18.4 Educational Facilities and Education

There is a total of 10 schools (3 combined, 6 primary and 1 secondary) within the SLM (SLM IDP 2017-2018).

4.2% of the municipal population has not attended any type of a schooling system, while 48.5% have primary school education. A little over 1700 individuals (4%) have graduated from a University / Technikon.

In Siyathemba, around 14% of adults have a matric certificate compared to 24.7% in the Northern Cape. The percentage of the population with a tertiary education in Siyathemba (5.1%) is also lower than that for the Northern Cape (7.3%).

8.1.18.5 Access to Water, Sewage and Solid Waste Services

SLM is the Water Services Authority (WSA) and Water Services Provider (WSP) for the 3 towns within their area of authority. Piped water is accessed by about 98% of the SLM population and about 90% of the municipal population have access to flush toilets⁴.

Siyathemba has three water supply schemes. For the Copperton and surrounding areas, water is provided from the Water Treatment Works in Prieska. Water abstraction is from the Orange River. Waterborne sanitation is only available in the urban areas of Prieska.

About 75% of the population have access to a weekly refuse collection service⁵. There is an existing licensed waste disposal site in Prieska. This facility is a G:C:B⁻ licensed facility and can only accept general waste. According to the SLM IDP (2017-2018), the site has a remaining airspace of 20 years. SLM has indicated that the site is not well managed at present due to financial and personnel constraints⁶. A new incinerator is proposed to be installed at the facility, the timing of which is unclear.

8.1.18.6 Housing

Within the Pixley Ka Seme District Municipality, 87.2% of households live in formal units, while 12.8% are found in informal housing units.

A variety of residential components are available within the municipal boundaries. More than 81% of household dwellings found in Siyathemba can be classified as houses or brick structures on separate stands. The average for the Northern Cape is 77.4%. Some 8.6% of local dwellings can be described as shacks.

The average household size in the larger Pixley Ka Seme District Municipality is about 3.7, female headed households is about 36.90%, formal dwellings at 86.30% and the housing owned is at 52.00%.

8.1.18.7 Public Safety and Security

There are three police stations within the SLM, situated in Marydale, Niekerkshoop, and Prieska respectively. There is no municipal fire-fighting capability in the SLM and no disaster manager plan for the municipality.

8.1.18.8 Community Health and Health Facilities

There is a total of 4 health facilities within the SLM, namely Niekerkshoop Clinic, E'Thembeni Clinic, Marydale PHCC, and Prieska Clinic.

The 2010 HIV/AIDS prevalence rate of the Siyathemba population was 6%. This is lower than the prevalence rates in the Northern Cape (8%) and South Africa (13%). However, since 2000, the number of people living with HIV/AIDS in the Siyathemba municipal area more than doubled from about 400 to just over 1,200 people in 2010. The prevalence rate is expanding faster in Siyathemba (at 11% p.a.) when compared with South Africa (at 6% on average p.a. since 2000).

SLM manages 3 cemeteries in Prieska, and 2 cemeteries in Niekerkshoop and Marydale. Expansion of the cemeteries in each of these towns is planned.

8.1.18.9 Electricity and Energy

Around 86% of household dwellings found in Siyathemba have access to electricity. This indicator is on par with the provincial average.

⁴ SLM Water Services Development Plan, 2017

⁵ SLM IDP (2017-2018)

Between 2006 and 2011, there was a general increase in the use of electricity as a primary source of energy. This is due to local electrical infrastructure improvements across the province (SLM IDP, 2016).

As shown in the graph below, the majority of the population have access to electricity, which is used primarily for cooking, heating and lighting. The proportion of households within the municipality that use electricity for lighting has increased from 57% in 1996 to approximately 84% in 2011.

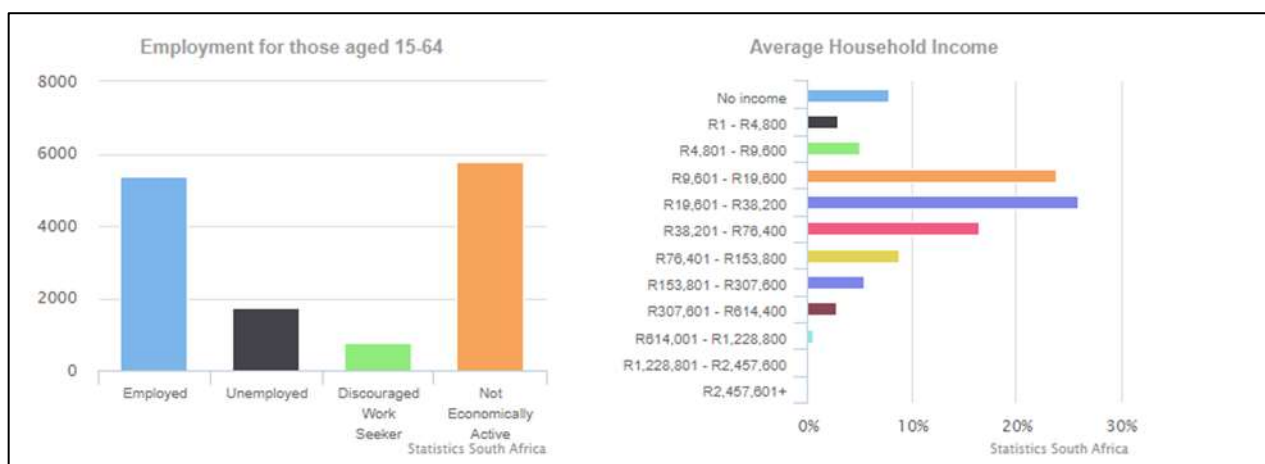
Although relatively expensive, paraffin and gas are used for cooking and heating in some places. Households using electricity as a source of energy for cooking increased from 48% in 1993 to 74% in 2011.

8.1.18.10 Employment⁶

Between 2001 and 2011, there has been a decrease in the number of people employed and a concomitant increase in the number of unemployed people across the Pixley Ka Seme District Municipality.

For Siyathemba, 5 787 individuals remain as being economically inactive, while 5 370 are employed. The unemployment rate in SLM in 2011 was 24.3%.

The average household income is approximately R9 000 – R19 500. Obtaining any form of income generating employment within the municipality has become increasingly difficult in recent years. This is attributed to the lack of education, resulting in the uneducated experiencing the highest incidences of poverty.



Source: Statistics South Africa (2011)

FIGURE 8-6: SUMMARY OF EMPLOYMENT AND INCOME IN SLM

8.1.18.11 Labour

The labour participation rate across the Pixley Ka Seme District Municipality is 50%. The labour dependency ratio for Siyathemba is estimated at 2 (An additional two persons are supported by every person in the labour force).

Other significant labour ratio statistics for SLM are provided in Table 8-5.

⁶ SLM IDP (2017-2018)

TABLE 8-5 LABOUR RATIOS FOR SLM

LABOUR PARTICIPATION RATE	LABOUR DEPENDENCY RATIO	LABOUR YOUTH DEPENDENCY RATIO	LABOUR AGED DEPENDENCY RATIO
48	2	0.4	84

Source: SLM IDP (2017-2018)

8.1.18.12 Economy

The SLM Local Economic Development (LED) Vision is “Ensuring long term economic sustainability through local value addition and social upliftment, as well as integrated community development. We strive towards an economy owned by local people.”

The regional and local economy is poorly diversified with a reliance on, in the case of SLM, the government and agriculture sectors. The mining and manufacturing sectors provide very few of the employment opportunities in the SLM.

The mining sector is identified within the SLM IDP (2017-2018) as a sector with development potential.

The following can be noted with respect to the economy of the SLM and the potential economic influence of the proposed mine development:

- SLM is a small economy. Larger rural municipalities in South Africa have a Gross Geographic Product (GGP) of between R5bn and R10bn. By contrast, SLM has an estimated GGP of R 1.3 bn. A GGP is simply the sum of all salaries and wages, depreciation and operating profits in an economy. This means the new mine, with 450 employees, could add an annual GGP of R216 million per annum, or 16,6% of GGP to the local economy. This is significantly high. Another perspective is that the average salaries and wages in mining is R120 000 per annum and hence 450 new employees in the SLM has a purchasing power of R54 million per annum;
- The small economy in SML is a result of two factors, one the lack of rainfall that results in less than productive land (thus demand for land is low), and two, as a result, its low population. In addition, there is no innovation in the local economy;
- Furthermore, the average income per capita in SLM is half of that of the average income in South Africa, which furthermore reduces the economic quality of life of the SLM population because they have less disposable income, in a remote area where the prices of goods are more than the average South Africa prices due to high transport costs;
- The quality of social services is rated much higher by the SLM population than the average South African because the demand for services is much less locally; and
- The lack of adequate employment opportunities is the most significant concern for the SLM population. There are almost 14 000 people in the workforce in Siyathemba and just over 4 000 formal jobs. Thus two-thirds of the working population does not have formal jobs.

8.2 DESCRIPTION OF THE CURRENT LAND USES

Current land uses within the proposed MRA surface area are as follows:

- Grazing of livestock;
- An operating 20 MW solar power plant and a proposed solar PV power plant are within the proposed MRA surface area boundary;
- Windmills and related agricultural infrastructure;
- Two existing quarry operations;

- The Alkantpan landing strip;
- Road to Copperton and Alkantpan from the R357; and
- Disused rail siding.

Land uses on immediately adjacent properties include the following:

- Alkantpan Test Range;
- Various infrastructure associated with the historical PCM;
- Registered servitude between the historical mineral processing area and the historical TSF
- Grazing of livestock;
- Residential town of Copperton;
- The proposed Copperton Wind Farm and Garob Wind Farm border the proposed MRA surface area boundary in the east. The nearest wind turbines are approximately 6 km from the proposed mining area;
- Several proposed solar PV projects are situated towards the south and south-east of the proposed MRA surface area boundary;
- Historical PCM TSF;
- Eskom Cuprum Substation; and
- Windmills and related agricultural infrastructure.

8.2.1 EXISTING SURFACE LAND USES

Copperton is situated to the north of the proposed Vardocube underground mining operation. The town is still in use, though only 40 of the original 300 houses now remain. The full extent of the town is excluded from the proposed Vardocube mining right area. Similarly, Portions 5 and 6 of the Farm Vogelstruisbult 104, are excluded from the MRA. The Eskom Cuprum Substation is located on these properties.

An operating 20 MW solar power plant is situated towards the middle of the MRA surface area boundary. Other existing infrastructure within the MRA surface area includes partially intact stormwater diversion berms constructed by PCML in the 1970s, the access road to Copperton and PCM from the R357, a disused rail spur and several mine houses used, at present, by contractors involved with the prospecting activities.

The remainder of the MRA surface area is largely undisturbed scrubland used for grazing of small livestock.

There is no registered land claim applicable to Portion 1 of Vogelstruisbult 104.

8.2.2 SURROUNDING LAND USES

Surrounding landowners and land users comprise of the historical PCM, private landowners and the Alkantpan Test Range (to the west). Several proposed renewable energy (wind and solar) projects are situated towards the east and south of the proposed MRA surface area boundary. (Appendix 3, Map 3).

Most of the buildings and related infrastructure associated with the historical PCM were demolished when the mine closed in 1991. The western section of the Repli MRA surface area is characterised by remnants of the demolished infrastructure remaining from the historical mining between 1971 and 1991. Remaining surface infrastructure includes the Hutching Shaft column, crusher bins, flotation dams and a concentrate drying slab.

The historical tailings storage facility containing the residues from the historical mining borders the proposed Vardocube MRA surface area in the south-west.

8.3 DESCRIPTION OF SPECIFIC ENVIRONMENTAL FEATURES AND INFRASTRUCTURE ON THE SITE

8.3.1 SURFACE WATER FEATURES AND WETLANDS

Several non-perennial rivers traverse the proposed Vardocube Mining Right Application (MRA) surface area.

In addition to the non-perennial rivers, there are several wetlands (endorheic pans) present within the proposed Vardocube MRA surface area. With no surface infrastructure applicable to the proposed underground mining and with mining anticipated to occur at a depth of more than 900 m below natural ground level, no impact to wetlands/pans is expected. The location of all watercourses and the applicable buffers, namely 100 m for non-perennial rivers and 500 m for wetlands (pans), are shown in the environmental sensitivity plan in Appendix 3.

8.3.2 PROTECTED AREAS

There are no protected areas in close proximity (within 10 km) of the MRA surface area boundary. The nearest protected area is the Witsand Provincial Nature Reserve, located approximately 150 km to the north of the MRA surface area boundary (Appendix 3, Map 12).

8.3.3 CRITICAL BIODIVERSITY AREA AND ECOLOGICAL SUPPORT AREA

The Northern Cape spatial biodiversity plan identifies a Critical Biodiversity Area (CBA) across a portion of the MRA. This CBA follows the pre-diversion alignment of a non-perennial watercourse which was diverted as part of the historical mining activities undertaken by PCM.

The wetlands/pans scattered across the proposed MRA surface area are designated as Ecological Support Areas (ESA).

With all mining to be underground and no surface infrastructure to be established, no impact to CBA or ESA features are expected.

8.3.4 DECLARED KAROO CENTRAL ASTRONOMY ADVANTAGE AREA

8.3.4.1 *Background*

The proposed Vardocube mining area is situated within two declared Astronomy Advantage Areas (AAA), namely as follows:

- The Northern Cape Province; and
- The Karoo Central AAA.

Specifically, the Vardocube mining area is located within Advantage Area 3 of the Karoo Central AAA (Appendix 3 Map 13).

The AAAs are established in terms of the Astronomy Geographic Advantage Act 21 of 2007. The purpose of establishing the AAAs is to protect the radio astronomy work associated with the Square Kilometre Array (SKA) Project in Carnarvon. The cosmic rays which the SKA radio telescopes receive and interpret are extremely faint and are thus sensitive to interference from other radio devices as well as electromagnetic interference from electrical equipment. The radio interference protection philosophy associated with the AAAs is as follows⁷:

- Maximise the radio frequency spectrum available for the SKA so that the scientific work is not significantly compromised;
- Minimise the impact on local people and residual radio interference, and facilitate access to alternative radio communications;

⁷ http://www.ska.ac.za/wp-content/uploads/2016/07/ska_sa_gaa_eng.pdf

- Restrictions on sources of radio frequency interference, for where there are no alternative options, will be highest close to the SKA Virtual Centre (or core) but decrease with distance.

Engagement with the Department of Science and Technology (DST) and the South African Radio Astronomy Observatory (SARAO) as part of Orion's Repli MRA to ensure that the mine activities will not have an impact on the SKA is ongoing.

8.4 ENVIRONMENTAL AND CURRENT LAND USE MAP

The following dominant current land use categories are recognised:

- Agriculture – grazing;
- Residential;
- Historical mining and related infrastructure; and
- Power infrastructure.

The environmental and current land use map is provided in (Appendix 3, Map 15).

9 IMPACTS AND RISKS IDENTIFIED INCLUDING THE NATURE, SIGNIFICANCE, CONSEQUENCE, EXTENT, DURATION AND PROBABILITY

The impacts and risks identified for the proposed mine development are summarised in Table 16-1. The impact matrix is provided in Appendix 6.

10 METHODOLOGY USED IN DETERMINING AND RANKING THE NATURE, SIGNIFICANCE, CONSEQUENCES, EXTENT, DURATION AND PROBABILITY OF POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS

10.1 OVERVIEW

The impact assessment methodology comprised of a risk-based impact matrix in which the outcomes, impacts and residual risk of the project activities was determined as follows:

- Step 1: Identify and describe the impact in terms of its nature (negative or positive) and type (direct or indirect);
- Step 2: Assess the impact severity (including reversibility and the potential for irreplaceable loss of resources), impact duration and impact spatial scale (extent);
- Step 3: Assign an impact consequence rating;
- Step 4: Assess the impact probability;
- Step 5: Assign the impact significance rating;
- Step 6: Identify measures and controls by which the impact can be avoided, managed or mitigated; and
- Step: Repeat the impact assessment on the assumption that the mitigation measures are applied and assign the residual impact (post mitigation) significance rating.

The purpose of the impact assessment was not to identify every possible risk and impact which the proposed project activities may have on the receiving social environment. Rather, the assessment was focused on identifying and assessing the most material impacts, commensurate with the nature of the project activity and the characteristics of the receiving social environment.

All impacts were assessed in the following phases:

- Construction;
- Operation; and
- Decommissioning and Closure.

10.2 APPLICATION OF IMPACT RATING CRITERIA

The various impact rating criteria used and how they were applied are described in the section that follows.

The first phase of impact assessment is the identification of the various project activities which may impact upon the identified environmental categories.

The identification of significant project activities is supported by the identification of the various receiving environmental receptors and resources. These receptors and resources allow for an understanding of the impact pathways and assessment of the sensitivity of the receiving environment to change.

The significance of the impact is then assessed by rating each variable numerically, according to defined criteria as provided in Table 10-1. The purpose of the significance rating of the identified impacts is to develop a clear understanding of the influences and processes associated with each impact.

The severity, spatial scope and duration of the impact together comprise the consequence of the impact; and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact and can obtain a maximum value of 10.

The values for likelihood and consequence of the impact are then read from a significance rating matrix as shown in Table 10-1 and Table 10-2.

The model outcome of the impacts is then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in instances of uncertainty or lack of information by increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations the model outcomes are adjusted. Arguments and descriptions for such adjustments, as well as arguments for each specific impact assessments are presented in the text and encapsulated in the assessment summary table linked to each impact discussion.

TABLE 10-1: CRITERIA FOR ASSESSING THE SIGNIFICANCE OF IMPACTS

SEVERITY OF IMPACT	RATING
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful	5
SPATIAL SCOPE OF IMPACT	RATING
Activity specific	1
Area specific	2
Whole project site / local area	3
Regional	4
National/International	5
DURATION OF IMPACT	RATING
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post closure / permanent	5
FREQUENCY OF ACTIVITY / DURATION OF ASPECT	RATING
Annually or less / low	1
6 monthly / temporary	2
Monthly / infrequent	3
Weekly / life of operation / regularly / likely	4
Daily / permanent / high	5
FREQUENCY OF IMPACT	RATING
Almost never / almost impossible	1
Very seldom / highly unlikely	2
Infrequent / unlikely / seldom	3
Often / regularly / likely / possible	4
Daily / highly likely / definitely	5

CONSEQUENCE

LIKELIHOOD

Activity: a distinct process or task undertaken by an organisation for which a responsibility can be assigned.

Environmental aspect: an element of an organisation’s activities, products or services which can interact with the environment.

Environmental impacts: consequences of these aspects on environmental resources or receptors.

Receptors: comprise, but are not limited to people or man-made structures.

Resources: include components of the biophysical environment.

Frequency of activity: refers to how often the proposed activity will take place.

Frequency of impact: refers to the frequency with which a stressor will impact on the receptor.

Severity: refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.

Spatial scope: refers to the geographical scale of the impact.

Duration: refers to the length of time over which the stressor will cause a change in the resource or receptor.

TABLE 10-2: SIGNIFICANCE RATING MATRIX

		CONSEQUENCE (SEVERITY + SPATIAL SCOPE + DURATION)													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
LIKELIHOOD (FREQUENCY OF ACTIVITY + FREQUENCY OF IMPACT)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

TABLE 10-3: POSITIVE/NEGATIVE MITIGATION RATINGS

COLOUR CODE	SIGNIFICANCE RATING	VALUE	NEGATIVE IMPACT MANAGEMENT RECOMMENDATION	POSITIVE IMPACT MANAGEMENT RECOMMENDATION
	Very High	126-150	Improve current management	Maintain current management
	High	101-125	Improve current management	Maintain current management
	Medium-High	76-100	Improve current management	Maintain current management
	Low-Medium	51-75	Maintain current management	Improve current management
	Low	26-50	Maintain current management	Improve current management
	Very Low	1-25	Maintain current management	Improve current management

11 THE POSITIVE AND NEGATIVE IMPACTS THAT THE PROPOSED ACTIVITY AND ALTERNATIVES WILL HAVE ON THE ENVIRONMENT AND THE COMMUNITY THAT MAY BE AFFECTED

The positive and negative impacts are presented in the stipulated format in Table 16.1.

12 THE POSSIBLE MITIGATION MEASURES THAT COULD BE APPLIED AND THE LEVEL OF RISK

The mitigation hierarchy is being applied throughout the S&EIR Process.

The mitigation hierarchy is an approach to mitigation planning and can be summarised into the following steps:

- Avoidance;
- Minimisation;
- Restoration; and

➤ Offsets.

The findings and recommendations of the specialist studies will be used to develop the environmental and operational controls which will be more focused on impact minimisation and restoration (as part of mine rehabilitation and closure).

13 MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED

No alternative sites have been considered as the site is defined by the presence of a mineable resource. In addition, the target orebody is an extension of the orebody proposed to be mined by Orion's subsidiary Repli from the adjacent Portion 25 of Vogelstruisbult 104.

Vardocube will make use of the mine infrastructure established by Repli rather than establishing its own mine infrastructure. By sharing the mine infrastructure, Orion will therefore be optimising its capital expenditure and reducing the cumulative impact of its mining activities.

14 STATEMENT MOTIVATING THE ALTERNATIVE DEVELOPMENT LOCATION WITHIN THE OVERALL SITE

The project site has been selected based on the presence of a mineable resource. The project plan and site layout has been based on limiting the project area footprint, avoiding sterilisation of resources and avoiding sensitive areas, where possible, from an environmental and social perspective, while still considering engineering feasibility and financial considerations.

15 FULL DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY, ASSESS AND RANK THE IMPACTS AND RISKS THE ACTIVITY WILL IMPOSE ON THE PREFERRED SITE (IN RESPECT OF THE FINAL SITE LAYOUT PLAN) THROUGH THE LIFE OF THE ACTIVITY

The impact assessment methodology is described in Section 10 of this report.

16 ASSESSMENT OF EACH IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK

The assessment is presented in the required format in Table 16.1. The impact matrix is provided in Appendix 6.

TABLE 16-1: ASSESSMENT OF EACH IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK

ACTIVITY whether listed or not listed. (E.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc...etc...etc.)	POTENTIAL IMPACT (e.g. dust, noise, drainage surface disturbance, fly rock, surface water contamination, groundwater contamination, air pollution etc....etc...)	ASPECTS AFFECTED	PHASE In which impact is anticipated	SIGNIFICANCE if not mitigated	MITIGATION TYPE⁸ (modify, remedy, control, or stop) through (e.g. noise control measures, storm-water control, dust control, rehabilitation, design measures, blasting controls, avoidance, relocation, alternative activity etc. etc) E.g. Modify through alternative method. Control through noise control Control through management and monitoring through rehabilitation	SIGNIFICANCE if mitigated
Summary of Socio-Economic Impacts and Risks						
All activities involving employment and procurement of goods and services	The mine development will create several hundred direct employment opportunities in the construction and operational phase respectively. Many more indirect employment opportunities will also be created. Implementation of the commitment to maximise local employment wherever practicable will increase the significance of this positive impact	Socio-Economic Environment	All Phases	Medium-High '+'	Enhance through implementation of the SLPs	High '+'

⁸ Please refer to the EMPr for details of the mitigation measures

All activities involving employment and procurement of goods and services	Procurement of local goods and services by the mine, employees and contractors will stimulate local business and create opportunities for entrepreneurship.	Socio-Economic Environment	All Phases	Medium-High '+'	Enhance through implementation of the SLPs	Medium-High '+'
Training and development	Implementation of the HRD programme, as described in the two SLPs is expected to result in skills transfer, career progression, re-skilling and improved levels of literacy in the community as a whole.	Socio-Economic Environment	All Phases	Medium-High '+'		High '+'
Community infrastructure development	The development of housing and direct and indirect mine investment in new/upgraded community infrastructure such as roads and potable water will have a positive impact for residents in Prieska and Copperton.	Socio-Economic Environment	Construction and Operation	Low-Medium '+'		Medium-High '+'
All activities involving employment and procurement of goods and services	The procurement of goods and services by the mine, employees and contractors will result in an increased demand for various goods and services in Copperton and Prieska. This may result in conditions of hyperinflation. The impact is expected to be temporary as market forces respond and the gap between supply and demand narrows.	Socio-Economic Environment	All Phases	Low-Medium '-'	Control through planning	Low-Medium '-'

<p>All activities involving employment and procurement of goods and services</p>	<p>An influx of people seeking employment can be expected during the construction phase especially. This will be amplified by the potential overlap in the construction phase with two wind energy developments. This will place additional demand on municipal services in Prieska and Copperton such as public safety, health care, water, sanitation, and housing. The impact can be mitigated through cooperative planning with the SLM.</p>	<p>Socio-Economic Environment</p>	<p>All Phases</p>	<p>Low-Medium '-'</p>	<p>Control through planning. See detailed mitigation measures</p>	<p>Low-Medium '-'</p>
<p>All activities involving employment and procurement of goods and services</p>	<p>Disruption of social patterns within the Prieska and Copperton communities may occur, especially during the construction phase because of the influx of job seekers for the mine and wind energy developments. This may be amplified if there is tension between locals and foreign nationals and/or racial or cultural differences. Human health impacts from diseases like HIV/AIDS can also occur as a result of a change in social dynamics. The impact can be mitigated through the housing strategy cooperative planning with the SLM and community leaders</p>	<p>Socio-Economic Environment</p>	<p>All Phases</p>	<p>Medium-High '-'</p>	<p>Control through planning. See detailed mitigation measures</p>	<p>Low - Medium '-'</p>

All mine-related activities	Minor, major and fatal injuries from potential mine health and safety incidents. There are multiple health and safety risks associated with underground mining, ore processing and movement of man and materials. In addition, the mine will store and handle various hazardous substances including explosives. Implementation of a comprehensive health and safety management programme and adherence to legislation governing mine health and safety requirements will mitigate this impact	Socio-Economic Environment	All Phases	High '-'	Control through planning design and operational controls	Low - Medium '-'
All mine-related activities	Increased levels of crime may be experienced in the area as a result of the influx of people seeking employment. Contact crimes may result in injuries and in severe cases, fatalities	Socio-Economic Environment	All Phases	Medium-High'-'	Control through planning, design and operational controls	Low - Medium '-'
All mine-related activities	The mining will generate royalties in accordance with the MPRDA, payable to the national government. Furthermore, the development of the site and connection to municipal services will result in the payment of rates and taxes to the SLM	Socio-Economic Environment	Construction and Operational	Low-Medium '+'	No mitigation identified	Low-Medium '+'
All mine-related activities	Decommissioning and closure of the mine will have a negative impact on those employed, the families they support and the	Socio-Economic Environment	Decommissioning and Closure	Medium-High'-'	Control through planning and implementation of the SLPs. See detailed mitigation measures	Low - Medium '-'

	businesses which provide services to the mine. The impact of closure can be mitigated through the implementation of the measures in the SLP, including regular, consultative review of closure strategies and the portable skills / re-skilling programme					
Summary of Groundwater Impacts and Risks						
Mine dewatering	Lowering of groundwater levels in private boreholes, thus affecting the performance of the boreholes that fall within the dewatering cone	Groundwater	Operational	Medium-High ^{'-'}	Monitor through groundwater monitoring programme Replace boreholes affected by dewatering	Low - Medium ^{'-'}
Underground mining	Contamination of groundwater in private boreholes, making the groundwater unfit for use	Groundwater	Operational	Medium-High ^{'-'}	Control through design and operational controls Monitor through groundwater monitoring programme	Low - Medium ^{'-'}
Underground mining	Contamination of groundwater in private boreholes, making the groundwater unfit for use	Groundwater	Closure and Decommissioning	Low ^{'-'}	Control through design and operational controls Monitor through groundwater monitoring programme	Very Low ^{'-'}
Summary of Air Quality Impacts and Risks						
All mining activities which generate particulate emissions (underground)	Elevated PM10 and PM2.5 Concentrations	Air quality	Operational	Low - Medium ^{'-'}	Control through design and operational controls	Low ^{'-'}
Mining, Material Handling and Transportation (underground)	Elevated dust fall levels	Air quality	Operational	Low - Medium ^{'-'}	Control through design and operational controls	Low ^{'-'}

Summary of Blasting Impacts and Risks						
Blasting (underground)	Blast-induced ground vibration damage to buildings closer than 500 m from blasting	Structural damage	Operational	Low - Medium '-'	Waste rock and ore will be drilled and blasted as part of the mining operations. Vibration levels experienced at surface are expected to be well below the levels at which structural damage could occur. Avoid / minimise through design and operational controls	Low - Medium '-'
Blasting (underground)	Blast-induced ground vibration damage to buildings farther than 500 m from blasting	Structural damage	Operational	Low '-'	Avoid / minimise through design and operational controls	Low '-'
Summary of Heritage Impacts and Risks						
Underground mining	Disturbance/Loss of Significant Archaeological or Cultural Heritage Sites/Remains	Archaeology, palaeontology, and cultural heritage	All phases	Low '-'	Maintain / monitor through implementation of chance-find procedure	Very Low '-'
Summary of Impacts to MeerKAT/SKA Observatory						
Operating of mine equipment and machinery, including communication devices (underground)	EM and RF interference within the declared Karoo Central AAA and the impact this may have on the operation of the MeerKAT/SKA Observatory	EM and RF Interference	All phases	High '-'	Avoid / minimise through design and operational controls	Low '-'

17 SUMMARY OF SPECIALIST REPORTS

The environmental baseline, findings and recommendations of the specialist studies undertaken as part of the Repli S&EIR Process, which have relevance to the mining of the Vardocube Section, have been incorporated into this EIR and EMPr.

In addition, the EIR has been informed by the following additional specialist studies:

- Groundwater model and impact assessment report to assess the additional mining area and the possible effects on groundwater quality and quantity in the study area;
- Geochemical characterisation study comprising of a static leach analysis on selected drill core samples from the Vardocube Section to confirm the expectation that the ore and waste rock material will not incur any additional geochemical risk to that assessed for Repli;
- Confirmation from specialists that the heritage and paleontological survey results from the Repli studies are applicable to the Vardocube Section;
- Blasting impact evaluation study update to include an assessment of impacts from the blasting of the Vardocube Section; and
- Updated social impact assessment based on the Vardocube Social and Labour Plan (SLP).

The findings of the specialist studies are summarised in Table 17-1. Copies of the individual specialist study reports are provided in Appendix 7.

17.1 MEASURES TO AVOID, REVERSE, MITIGATE, OR MANAGE IDENTIFIED IMPACTS AND TO DETERMINE THE EXTENT OF THE RESIDUAL RISKS THAT NEED TO BE MANAGED AND MONITORED

The preliminary identification of impacts and associated mitigation measures are presented in Table 16-1.

TABLE 17-1: SUMMARY OF SPECIALIST REPORTS

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (MARK WITH AN X WHERE APPLICABLE)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Groundwater	<p>Seepage</p> <p>In order to gain access to the flooded historical underground workings, mine dewatering will be undertaken prior to the commencement of underground mining. Model simulations suggest that groundwater seepage associated with mining of the Vardocube resource may vary between 0,3 and 23 l/s, but would most probably be around an average of 4,6 l/s.</p> <p>Dewatering</p> <p>The cone of depression in the upper fractured rock aquifer as a result of cumulative mine dewatering by Repli and Vardocube is expected to be fault controlled. The drawdown cone may therefore extend up to 1200 m from the underground mining area in a southeasterly direction. West and east of the mining area, the cone of depression is not expected to extend further than 600 m from the mining area. Two private boreholes are located close to the edge of the simulated cone of depression. It is possible that the impact of mine dewatering could affect these boreholes during mining and it would therefore be prudent to include these in the monitoring programme to ensure that adverse impacts are picked up early. It is estimated that groundwater levels may take up to 100 years to recover after mine dewatering ceases at closure. It is furthermore unlikely that groundwater levels would fully recover, based on the current level of flooding and the low permeabilities of the rock formations intersected.</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>Section 9</p> <p>Section 11</p> <p>Section 12</p> <p>Section 16</p> <p>Section 17</p> <p>Section 19</p> <p>Section 21</p> <p>Section 23</p> <p>Section 29 Part B-EMP</p>

	<p>Impact on Groundwater Quality</p> <p>Simulations indicate that the most significant impact on groundwater during the operational phase of mining by Repli and Vardocube is associated with the historical TSF.</p> <p>In the long-term, simulations show that if the new TSF is lined and the liner remains intact, that no groundwater contamination is anticipated from this area. Groundwater contamination associated with the historical underground workings are also not expected to migrate significantly post closure, as groundwater levels will remain reversed towards the mine as groundwater levels rebound after mine closure. No private boreholes fall within the delineated long-term zone of influence on groundwater quality associated with the new TSF and the Repli and Vardocube mining areas.</p> <p>The impact of the historical TSF will most probably result in the most significant long-term impacts. The fault present underneath the facility is expected to act as a preferential flow path to groundwater. The sulphate plume may migrate up to 1km along the fault from the facility in the long-term. Contamination may also migrate up gradient of the historical TSF in a southeasterly direction along this fault due to the mound in groundwater that forms as a result of recharge from the facility. No private boreholes fall in the zone of influence, but it is possible that two boreholes (BH10 and 116BH9) may be impacted on, as these boreholes may fall on the fault structure mapped in this area.</p> <p>Risk of Decant</p> <p>The available dataset suggests that groundwater levels will most probably not recover to surface in the long-term and decant from the mining area is therefore not expected.</p> <p>Groundwater Monitoring Programme</p> <ul style="list-style-type: none"> ☞ Implement a management plan aimed at reducing and/or eliminating adverse impacts on the receptors identified. These include existing private groundwater users. ☞ Track and record the progress of implementation of all groundwater management measures. 		
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	<ul style="list-style-type: none"> ➤ Implement sufficient monitoring procedures to measure the effectiveness of groundwater management measures in both mine monitoring and private boreholes located within the delineated zones of influence. ➤ Analyse the information obtained from all monitoring programmes against compliance targets to establish trends. ➤ Should the trends indicate adverse impacts on groundwater levels and/or quality, implement suitable measures within the shortest possible time to remediate and/or eliminate such adverse impacts identified. 		
Geochemical Characterisation	<p>Results</p> <ul style="list-style-type: none"> ➤ Seven of the nine samples tested can be classified as non-acid generating (NAG), based on their acid generating and neutralising capacity. Two samples (PPG and PT) can be classified as potentially acid forming, although the potential for acid generation is relatively low (34 and 22 kg H₂SO₄/t respectively, based on NAG data). ➤ The magnitude of the acid generating potential predicted from the NAG test was higher than that calculated from the acid-base accounting. This is most likely due to the relatively low reactivity of the silicate minerals, which account for much of the acid neutralising capacity. ➤ The acid neutralising capacity of most of the non-acid forming samples, with the exception of PEG, is of similar magnitude to the acid generating potential of the PPG and PT material, suggesting co-disposal may be an option. ➤ The whole rock analysis showed that all samples contained at least two elements (copper and barium) at concentrations in excess of the TCT0 limit. ➤ None of the samples contained any elements at concentrations in excess of the TCT1 limits, so all the material tested falls can be considered between TCT0 and TCT1. 	<p style="text-align: center;">X X X X X X X X X</p>	<p>Section 9 Section 11 Section 12 Section 16 Section 17 Section 19 Section 21 Section 23 Section 29 Part B-EMP</p>

	<ul style="list-style-type: none"> ➤ Reagent water leach tests were performed and the leachate from all samples contained vanadium concentrations that exceeded the LCT0 limit. In addition, the leachate from the PT sample contained boron at a concentration in excess of the LCT0 limit. For all other elements the concentrations in the leachate were below the LCT0 limit for all samples. ➤ An acidified water leach test, using sulphuric acid, was performed as two of the samples could be classified as potentially acid forming. The results showed that the calcium and magnesium concentrations in the leachate were substantially higher than for the corresponding reagent water leach. The PT and SMG samples yielded manganese concentrations in the leachate that exceeded the LCT0 limit. ➤ All nine samples tested exceeded the TCT0 limit in and least two parameters and the LCT0. ➤ limit in at least one, but no samples exceeded either a TCT1 or LCT1 limit. Therefore, all samples can be classified as Type 3 waste, according to the National Norms and Standards for Assessment of Waste for Landfill Disposal, under the National Environmental Management: Waste Act of 2008. <p>The results are consistent with the geochemical characterisation testwork undertaken for Repli. Accordingly, no additional engineering design or other controls are required for the management of ore, waste rock, tailings material or groundwater.</p>		
Heritage and Palaeontology	<p>Prof Marion Bamford (2018) indicated that the Rossouw (2017) study remains valid for the project area and that additionally a Fossil Chance Find Protocol should be added to the EMPr together with photographs of examples of fossils that have been found in the Dwyka Group near Douglas to assist the geologist, environmental officer or other responsible person.</p> <p>The Van der Walt (2018) study for the proposed Prieska Copper Mine remains valid for the study area. Several Middle Stone Age artefacts were found scattered over the area in varying densities (background</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>Section 9</p> <p>Section 11</p> <p>Section 12</p> <p>Section 16</p> <p>Section 17</p> <p>Section 19</p> <p>Section 21</p> <p>Section 23</p>

	<p>scatter) and is of low heritage significance. No structures older than 60 years occur in the study area and no graves were recorded. Stone Age sites were recorded in the area and are indicated in relation to the project area in Figure 4. No impact on any heritage resources is expected due to the underground mining methods employed by the proposed project.</p> <p>From a heritage perspective due to the disturbed character of the site and the fact that the proposed activities will include exclusively underground mining (900 m below the surface) with no surface infrastructure it is recommended that the project can continue.</p>	X	Section 29 Part B-EMP
Blasting and Vibration	<p>Blasting will occur from a depth of about 900 m. Therefore, receptor distances are calculated from the vertical and horizontal component distances.</p> <p>To achieve low negative impact significance, vibration (Peak Particle Velocity) at any privately-owned structure must be maintained below 5 mm/s. From the calculated vibration amplitudes, it is unlikely that any privately-owned structures surrounding the mine will be negatively impacted by blasting vibration.</p> <p>The underground blasting for the Vardocube Section will not generate any significant risk to surface receptors.</p>	X X X X X X X X	Section 9 Section 11 Section 12 Section 16 Section 17 Section 19 Section 21 Section 23 Section 29 Part B-EMP
Social and socio-economic	<p>Several impacts on the social environment have been assessed by the relevant technical specialists. Of most importance in this regard in terms of the underground mining of the Vardocube Section are the potential impacts noted with respect to dewatering of the mine on several boreholes nearest the mine site which are currently used for livestock watering, and the possible contamination of boreholes downgradient of the historical TSF.</p> <p>Regular review of the mitigation measures recommended for these impacts, informed by the required monitoring to be undertaken, should be undertaken to ensure that these impacts are managed over the LOM.</p>	X X X X X X X X	Section 9 Section 11 Section 12 Section 16 Section 17 Section 19 Section 21 Section 23 Section 29 Part B-EMP

	<p>The Applicant has compiled a Social and Labour Plan (SLP) in accordance with the requirements of the Minerals and Petroleum Resources Development Act 28 of 2002 and the relevant Mining Charter.</p> <p>The SLP addresses the Applicant’s plans for ensuring that it achieves commercial success whilst also developing its employees and community for the better and in compliance with transformation targets as stipulated in the applicable Mining Charter.</p> <p>The Copperton Wind Farm commenced with construction in the last quarter of 2018 and the Garob Wind Farm is scheduled to commence with construction in April 2019.</p> <p>The construction phase of these two developments may overlap with the construction phase of Repli and Vardocube and this will have a cumulative impact on social aspects for the region.</p> <p>The assessment of social impacts and associated mitigation measures has been assessed cumulatively for the Repli and Vardocube Mining Right Areas.</p> <p>The proposed development has the potential to create significant employment and economic development opportunities for local communities during the construction and operational phases of the Project</p> <p>The mine social and labour plan has provided costed plans for optimising local employment, skills development and a commitment to implementing seven local economic development projects, identified in collaboration with the SLM.</p> <p>Several negative social impacts have been identified. These impacts have been assessed to be reversible and can be satisfactorily mitigated.</p> <p>The renewable energy developments and the proposed Repli and Vardocube mining activities are likely to have a significant cumulative regional impact on the socio-economic environment, with a substantial inflow of people and resources into a local economy which is currently small and poorly diversified. The establishment of a committee between developers, government and</p>		
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	<p>the local community is recommended to ensure that the regional opportunities created by these developments can be optimised and the potential synergistic benefits realised.</p> <p>Provided that the mitigation measures in this report and the measures in the mine social and labour plan are implemented, it is the opinion of the specialist that the authorisation may be granted.</p> <p>Compliance with the mitigation measures in this report should be included as conditions of the environmental authorisation.</p>		
<p>Closure</p>	<p>The conceptual rehabilitation and closure plan and associated estimate of closure costs for the Repli and Vardocube application areas have been undertaken to ensure that the conceptual completion criteria are achieved.</p> <p>The estimated costs of rehabilitation and closure have been structured so as to distinguish between concurrent rehabilitation of the mine and the works required during the decommissioning phase, closure and post closure phase. It is assumed that the rehabilitation of the mine will be carried out in conjunction with the operation of the mine and related activities by the staff employed on the mine.</p> <p>The rates used in the estimates of costs have been sourced from rates for similar works carried out on other projects and are similar to those used in the estimates of capital expenditure on the Project.</p> <p>A commercial agreement has been entered into between Repli and Vardocube so that relevant infrastructure and facilities established to support the proposed Repli surface and underground mining will also be used for the underground mining of the Vardocube Section of the deposit. The current agreement is that Vardocube will contribute to the quantum on a pro-rata basis using the Mineral Resource Estimate of the entire Prieska Zinc Copper Project., which is around 18% of the total Mineral Resource Estimate for selected infrastructure that is shared, such as the TSF, shaft etc.</p>	<p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p> <p>X</p>	<p>Section 9</p> <p>Section 11</p> <p>Section 12</p> <p>Section 16</p> <p>Section 17</p> <p>Section 19</p> <p>Section 21</p> <p>Section 23</p> <p>Section 29 Part B-EMP</p>

18 ENVIRONMENTAL IMPACT STATEMENT

18.1 SUMMARY OF THE KEY FINDINGS OF THE ENVIRONMENTAL IMPACT ASSESSMENT

Key findings of the impact assessment for the proposed mine development are as follows:

- Sufficient and appropriate information on the proposed development and the receiving environment was available for conducting the impact assessment;
- With mitigation measures applied, the proposed development is compatible with surrounding land uses;
- The proposed development has the potential to create significant employment and economic development opportunities for local communities during the construction and operational phases of the project;
- The mine social and labour plan has provided costed plans for optimising local employment, skills development and a commitment to implementing two local economic development projects, identified in collaboration with the SLM; and
- Several negative impacts have been identified. These impacts have been assessed to be reversible and can be satisfactorily mitigated.

18.2 FINAL SITE MAP

The final site map, showing the position of the mineral resources is provided in Appendix 3, Map 2. No surface infrastructure will be required as part of the proposed mine.

18.3 SUMMARY OF THE POSITIVE AND NEGATIVE IMPLICATIONS AND RISKS OF THE PROPOSED ACTIVITY AND IDENTIFIED ALTERNATIVES

A summary of the positive and negative impacts and risks associated with the proposed development are provided below:

18.3.1 POSITIVE IMPACTS

Several positive socio-economic impacts have been identified:

- The development will create direct employment opportunities in the construction and operational phase respectively. Many more indirect employment opportunities will also be created. Implementation of the commitment to maximise local employment wherever practicable will increase the significance of this positive impact;
- Procurement of local goods and services by the mine, employees and contractors will stimulate local business and create opportunities for entrepreneurship;
- Implementation of the HRD programme, as described in the two SLPs is expected to result in skills transfer, career progression, re-skilling and improved levels of literacy in the community as a whole;
- The development of housing and direct and indirect mine investment in new/upgraded community infrastructure such as roads and potable water will have a positive impact for residents in Prieska and Copperton; and
- The mining will generate royalties in accordance with the MPRDA, payable to the national government. Furthermore, the development of the site and connection to municipal services will result in the payment of rates and taxes to the SLM.

Opportunities to maximise the benefits of the positive impacts should be identified throughout the LOM, ideally in collaboration with other project developments, such as the solar and wind energy developers.

18.3.2 **NEGATIVE IMPACTS**

The potentially negative impacts of the development which were assessed to be of most importance⁹ were as follows:

18.3.2.1 **Socio-Economic**

- The procurement of goods and services by the mine, employees and contractors will result in an increased demand for various goods and services in Copperton and Prieska. This may result in conditions of temporary hyperinflation, particularly during the construction phase where there may be an overlap in construction activities with renewable energy developments in the region;
- An influx of people seeking employment can be expected. This will place additional demand on municipal services in Prieska and Copperton such as public safety, health care, water, sanitation, and housing;
- Minor, major and fatal injuries from potential mine health and safety incidents;
- Increased levels of crime may be experienced in the area as a result of the influx of people seeking employment;
- Minor, major and fatal injuries to community members from health and safety incidents like vehicle collisions, fire and other incidents; and
- Decommissioning and closure of the mine will have a negative impact on those employed, the families they support and the businesses which provide services to the mine.

18.3.2.2 **Groundwater and Geochemical Characterisation**

- Lowering of groundwater levels in private boreholes, thus affecting the performance of the boreholes that fall within the dewatering cone; and
- Contamination of groundwater in private boreholes, making the groundwater unfit for use.

18.3.2.3 **Air Quality**

- Elevated PM10 and PM2.5 Concentrations over the LOM (underground mining); and
- Elevated dust fall levels over the LOM (underground mining).

18.3.2.4 **EM and RF Interference**

- EM and RF interference from mine equipment and machinery and the impact this may have on the MeerKAT/SKA Observatory.

The negative impacts were assessed to have an acceptable residual risk after mitigation measures were implemented.

In conclusion, the impact assessment has indicated that the potential negative impacts can be avoided or reduced to acceptable levels through implementation of the management measures in the EMPr.

19 **PROPOSED IMPACT MANAGEMENT OBJECTIVES AND THE IMPACT MANAGEMENT OUTCOMES FOR INCLUSION IN THE EMPr**

The key objectives of an EMPr are to set out the management and monitoring measures required to both minimise any potentially adverse environmental impacts and enhance the environmental benefits of the Project, and to ensure that responsibilities and appropriate resources are efficiently allocated to implement the plan.

⁹ Impacts with a Low-Medium, Medium-High, and High post-mitigation impact significance rating

The aspects which are considered to be of most importance to the development, including the respective management objectives and outcomes for the impacts associated with these aspects are provided in Table 19-1.

The management objectives and outcomes will be achieved through the implementation of the management actions in the EMPr.

TABLE 19-1: IMPACT MANAGEMENT OBJECTIVES AND OUTCOMES

ASPECT	MANAGEMENT OBJECTIVE	MANAGEMENT OUTCOME
Soil	<ul style="list-style-type: none"> ➤ Manage suitable onsite soil resources for rehabilitation activities. ➤ Prevent the contamination of soil resources. ➤ Managed response to the clean-up of accidental spillages and leaks. 	<ul style="list-style-type: none"> ➤ Soil resources protected from contamination. ➤ Accidental leaks and spillages responded to rapidly and all contamination remediated in accordance with legal requirements.
Air	<ul style="list-style-type: none"> ➤ Control and minimise particulate and dust emissions. 	<ul style="list-style-type: none"> ➤ Air emissions from the development managed in accordance with legal requirements.
Groundwater	<ul style="list-style-type: none"> ➤ Surrounding land users unaffected by dewatering and other mine activities. ➤ Prevent the contamination of groundwater resources. ➤ Managed response to the clean-up of accidental spillages and leaks. ➤ Monitor groundwater to ensure that any changes in groundwater quality and quantity are identified and investigated 	<ul style="list-style-type: none"> ➤ Good stakeholder relations with community members. ➤ Groundwater resources protected from contamination. ➤ Accidental leaks and spillages responded to rapidly and all contamination remediated in accordance with legal requirements.
Health and Safety	<ul style="list-style-type: none"> ➤ Prevent criminal activities onsite. ➤ Prevent occupational and community health and safety incidents. 	<ul style="list-style-type: none"> ➤ Secure and safe site.
Noise	<ul style="list-style-type: none"> ➤ Prevent noise impacts from development activities at sensitive noise receptors. ➤ Complaints which are received are properly investigated and responded to appropriately. 	<ul style="list-style-type: none"> ➤ Good stakeholder relations with community members and authorities.
Heritage	<ul style="list-style-type: none"> ➤ Protection of heritage resources. 	<ul style="list-style-type: none"> ➤ No heritage resources damaged or destroyed during construction activities.
Socio-Economic	<ul style="list-style-type: none"> ➤ Influx is managed in a planned and peaceful manner. ➤ Support for the development by the local community is enhanced. ➤ Maximise the local economic development potential of the development. 	<ul style="list-style-type: none"> ➤ Community conflict avoided. ➤ Employment from community. ➤ Local procurement. ➤ Good stakeholder relations with community members and authorities.
EM and RF Interference with the MeerKAT/SKA Observatory	<ul style="list-style-type: none"> ➤ EM and RF interference from mine equipment and machinery minimised to 	<ul style="list-style-type: none"> ➤ Relevant permits required in terms of the Astronomy Geographic Advantage Act, 2007 are issued to the mine.

	<p>the extent that there is compliance with the applicable protection levels.</p>	<ul style="list-style-type: none"> ➤ Mine activities proceed over the LOM without impacting on the MeerKAT/SKA Observatory. ➤ Good stakeholder relations between the mine and SARAO.
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20 FINAL PROPOSED ALTERNATIVES

No additional alternatives to those identified and assessed through the impact assessment process are proposed for the mine development.

21 ASPECTS FOR INCLUSION AS CONDITIONS OF AUTHORISATION

The following conditions should be included in the authorisation:

- The Applicant must continue to reassess the risks and impacts of the development throughout its operational life. Should any change in the risk and impact profile of the development be determined, additional management controls and mitigation measures must be implemented and the EMPr amended to reflect these changes;
- The EMPr, including all management and monitoring measures must be implemented;
- An emergency preparedness and response plan must be developed by the Applicant for the site;

22 DESCRIPTION OF ANY ASSUMPTIONS, UNCERTAINTIES, AND GAPS IN KNOWLEDGE

Advisory on Business and Sustainability Africa (Pty) Ltd. (ABS Africa) has prepared this report specifically for Vardocube (Pty) Ltd. The contents of this report:

- Are based on the legal requirements for undertaking an Environmental Impact Assessment, as defined in the National Environmental Management Act, 1998 (Act No. 107 of 1998) and the scope of services as defined within the contractual undertakings between Vardocube and ABS Africa;
- Are specific to the intended development at the proposed site. The report shall not be used nor relied upon neither by any other party nor for any other purpose without the written consent of ABS Africa. ABS Africa accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report; and
- Reflect the best judgement of ABS Africa in light of the information available at the time of preparation. The analyses contained in this report has been developed from information provided by Vardocube and other parties. This information is not within the control of ABS Africa and ABS Africa has not audited such information and makes no representations as to the validity or accuracy thereof.

In addition, it is noted that:

- The assessment has been based on the project description provided by the Applicant. Changes to this project description may influence the assessment and the mitigation measures in the EMPr;
- It has been assumed that the respective specialists have ensured that the relevant quality control standards were applied with respect to sample collection, preparation and laboratory testing protocols, including equipment calibration; and
- The post-mitigation impact is based on the understanding that the Applicant will establish the financial and administrative framework necessary for the complete implementation of the mitigation measures outlined in the EMPr over the Life of Mine (LOM).

23 REASONED OPINION AS TO WHETHER THE PROPOSED ACTIVITY SHOULD OR SHOULD NOT BE AUTHORISED

23.1 REASONS WHY THE ACTIVITY SHOULD BE AUTHORISED OR NOT

The need and desirability for the Project has been established and although several negative impacts have been identified, none of these impacts are deemed to be significant to the extent that the development cannot be regarded as consistent with the principles for sustainable development, as described in the National Environmental Management Act 107 of 1998.

Accordingly, based on the findings of the impact assessment, and with the understanding that the mitigation measures will be implemented, and the conditions of the environmental authorisation enforced by the relevant authorities, the EAP is of the opinion that an environmental authorisation for the development may be granted.

23.2 CONDITIONS THAT MUST BE INCLUDED IN THE AUTHORISATION

23.2.1 SPECIFIC CONDITIONS TO BE INCLUDED INTO THE COMPILATION AND APPROVAL OF EMPR

The following specific conditions, relevant to the EMPr are to be included:

- The Applicant must continue to reassess the risks and impacts of the development throughout its operational life. Should any change in the risk and impact profile of the development be determined, additional management controls and mitigation measures must be implemented and the EMPr amended to reflect these changes;
- Any engineering and operational control measures stipulated by SARAO as necessary in terms of the SKA Project, are to be included as conditions of the authorisation;
- The EMPr, including all management and monitoring measures must be implemented; and
- An emergency preparedness and response plan must be developed by the Applicant for the site.

23.2.2 REHABILITATION REQUIREMENTS

The rehabilitation requirements are conceptually described in the Closure Plan, attached in Appendix 7.

24 PERIOD FOR WHICH ENVIRONMENTAL AUTHORISATION IS REQUIRED

In terms of the MPRDA, the maximum period a mining right may be issued for is 30 years, with the option to renew for another 30 years.

The planned Life of Mine (LOM) for the Prieska Zinc Copper Project based on identified mineral resources and expected extensional exploration targets is estimated at 25 years.

25 UNDERTAKING

It is hereby confirmed that the financial provisioning requirements described in the Closure Plan are applicable to the Environmental Impact Report and EMPr.

26 FINANCIAL PROVISION

26.1 EXPLAIN HOW THE AFORESAID AMOUNT WAS DERIVED

The closure plan for rehabilitation and the resulting cost estimate has been developed according to the MPRDA, NEMA and associated Regulations, and guidelines of the Department of Mineral Resources (“DMR”). The environmental risks associated with the project have been identified from the specialist studies undertaken in support of the ESIA and the cost for the proposed rehabilitation methods and management strategies for decommissioning which will be carried out in accordance with the associated legal requirements.

A commercial agreement has been entered into between Repli and Vardocube so that relevant infrastructure and facilities established to support the proposed Repli surface and underground mining will also be used for the underground mining of the Vardocube Section of the deposit. The current agreement is that Vardocube will contribute to the quantum on a pro-rata basis using the Mineral Resource Estimate (MRE) of the entire Prieska Zinc Copper Project, which is around 18% of the total MRE for selected infrastructure that is shared, such as the TSF and shaft.

26.2 CONFIRM THAT THIS AMOUNT CAN BE DERIVED FROM THE OPERATING EXPENDITURE

In compiling and submitting their Mine Work Programme, the Applicant has confirmed that the required amount for financial provision for rehabilitation and closure can be derived from operating expenditure over the LOM.

27 DEVIATIONS FROM APPROVED SCOPING REPORT AND PLAN OF STUDY

27.1 DEVIATIONS FROM THE METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS

No deviations from the impact assessment methodology outlined in the Scoping Report and Plan of Study are applicable.

27.2 MOTIVATION FOR THE DEVIATION

No motivation applicable.

28 OTHER INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

In compliance with the provisions of sections 24(4) (a) and (b) read with section 24 (3) (a) and (7) of the National Environmental Management Act (Act 107 of 1998), the EIA report must include the:

(1) Impact on the socio-economic conditions of any directly affected person.

The socio-economic impact assessment has been undertaken and several positive and negative socio-economic impacts were identified. Mitigation measures have been recommended and included in the EMPr.

(2) Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act.

No archaeological or paleontological resources have been identified in the study area. A fossil chance-fined procedure has been included in the EMPr, as recommended by the specialists.

(3) Other matters required in terms of sections 24(4) (a) and (b) of the Act.

All reasonable and feasible alternatives in terms of site layout, location, public participation, potential impacts and mitigation have been addressed throughout the EIR.

PART B

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

29 DRAFT ENVIRONMENTAL PROGRAMME

29.1 DETAILS OF THE EAP

The details of the EAP are provided in Part A, Section 1 of the EIR.

29.2 DESCRIPTION OF THE ASPECTS OF THE ACTIVITY

The description of the aspects of the activity are provided in Part A, Section 1(h) of the EIR

30 COMPOSITE MAP

No surface infrastructure will be required as part of the proposed Vardocube mine. Please refer to Appendix 3 for the outline of the underground extent of the target orebody.

31 DESCRIPTION OF IMPACT MANAGEMENT OBJECTIVES INCLUDING MANAGEMENT STATEMENTS

31.1 DETERMINATION OF CLOSURE OBJECTIVES

Rehabilitation and closure of areas disturbed in mining and related operations will be considered to be complete when:

- All structures, equipment and infrastructure not consistent with the post closure land use have been decommissioned, demolished and removed from site;
- The area has been made safe for all post closure land users and livestock;
- All groundwater discharges from the site satisfy agreed target water quality objectives.

The Closure Plan for the Project (Appendix 7) indicates that in the planning and implementation stages of the Project, the focus of closure planning is to ensure that:

- The proposed post-closure land use(s) for the site are defined and agreed with the regulatory authorities and local communities;
- The cost of the works required to return the site to a condition consistent with the requirements of the post-closure land use(s) are defined and understood;
- The necessary financial provisions are made for closure in the prescribed manner and that these are included in the assessment of the project's economic viability;
- A plan is developed for the implementation of the rehabilitation and closure works to ensure that rehabilitation and restoration proceeds concurrently with mining operations wherever possible; and
- The accrual in reclamation and closure liabilities over the life of mine is limited through appropriate mine planning and concurrent rehabilitation to mitigate as far as possible the impacts of premature or unplanned closure.

31.2 THE PROCESS FOR MANAGING ANY ENVIRONMENTAL DAMAGE, POLLUTION, PUMPING AND TREATMENT OF EXTRANEIOUS WATER OR ECOLOGICAL DEGRADATION AS A RESULT OF UNDERTAKING A LISTED ACTIVITY

All management actions and controls identified through the impact assessment, including the specialist studies undertaken, have been included in Table 30-1, Table 30-2 and Table 31-1.

31.3 POTENTIAL RISK OF ACID MINE DRAINAGE

A geochemical characterisation of waste rock, ore and tailings material was undertaken. The findings of this assessment are described in the Geochemical Characterisation Report (Appendix 7).

The results of the study are consistent with the results of the testwork conducted for the Repli Mine Right Application and upon which the design and environmental controls for material storage and handling were based. No additional engineering or other controls are therefore recommended.

31.4 STEPS TAKEN TO INVESTIGATE, ASSESS, AND EVALUATE THE IMPACT OF ACID MINE DRAINAGE

A geochemical characterisation assessment as well as a detailed geohydrological assessment was undertaken for the underground mining of the Vardocube Section.

The geohydrological assessment considered the cumulative impact of both the Repli and Vardocube mining activities and assessed the likelihood of these activities resulting in a significant impact on the groundwater quality in the area as well as impacting on groundwater users in the area.

The geochemical assessment on the Vardocube material concluded the following:

- Seven of the nine samples tested can be classified as non-acid generating, based their acid generating and neutralising capacity. The PPG and PT samples can be classified as potentially acid forming, although the potential for acid generation is relatively low (34 and 22 kg H₂SO₄/t respectively, based on NAG data);
- The magnitude of the acid generating potential predicted from the NAG test was higher than that calculated from the acid-base accounting. This is most likely due to the relatively low reactivity of the silicate minerals, which account for much of the acid neutralising capacity.
- The acid neutralising capacity of most of the non-acid forming samples, with the exception of PEG, is of similar magnitude to the acid generating potential of the PPG and PT material, suggesting co-disposal may be an option.
- An acidified water leach test, using sulphuric acid, was performed as two of the samples could be classified as potentially acid forming. The results showed that the calcium and magnesium concentrations in the leachate were substantially higher than for the corresponding reagent water leach. The PT and SMG samples yielded manganese concentrations in the leachate that exceeded the LCT0 limit.
- All nine samples tested exceeded the TCT0 limit in and least two parameters and the LCT0 limit in at least one, but no samples exceeded either a TCT1 or LCT1 limit. Therefore, all samples can be classified as Type 3 waste, according to the National Norms and Standards for Assessment of Waste for Landfill Disposal, under the National Environmental Management: Waste Act of 2008.

The geohydrological assessment provided for the undertaking of a hydrocensus as well as the identification of aquifer pathways that could lead to groundwater contamination associated with the establishment of the structures that may result in contamination, including the TSF and WRD facilities. The pathways include:

- Vertical flow through the unsaturated soil horizon from surface sources of contamination like the historical TSF and the effluent dam. It is noted that the new TSF, and the effluent dam will be HDPE

lined and as such should not impact on groundwater quality unless they overflow or if the liners leak. The rate at which the vertical flow can take place is governed by the permeability of the soils;

- Vertical and horizontal flow through the weathered aquifer from surface sources of contamination as well as mining areas that intersect this aquifer; and
- Once the possible contamination reaches the fractured rock aquifer, the preferential flow paths would be the mapped faults. Groundwater will also flow through the rock matrix, but at much lower rates compared to the preferential pathways.

The following receptors were identified:

- Existing private groundwater users; and
- Non-perennial streams near the mining area. It is however noted that these streams are dry and this impact is therefore not anticipated to be of significance.

Although unlikely to occur, if the liner at the new TSF leaks, the geohydrological model simulations indicated that sulphate concentrations would not increase to above 500 mg/l in the upper fractured rock aquifer during the operational phase of mining. This is due to the low rate at which the liner is expected to leak and the significant vertical distance (~18m) over which contamination must travel from surface to reach this aquifer.

None of the private boreholes will be impacted by groundwater contamination originating from the PCM operations during the operational phase for the new TSF.

31.5 ENGINEERING OR MINE DESIGN SOLUTIONS TO BE IMPLEMENTED TO AVOID OR REMEDY ACID MINE DRAINAGE

Although not directly applicable to the Vardocube Mining Right Application as all tailings material will be managed by Repli, it is noted that the tailings material will be contained in an HDPE-lined, engineered facility and a groundwater monitoring programme will be implemented to detect any changes in groundwater quality.

31.6 MEASURES THAT WILL BE PUT IN PLACE TO REMEDY ANY RESIDUAL OR CUMULATIVE IMPACT THAT MAY RESULT FROM ACID MINE DRAINAGE

No residual or cumulative impacts from acid mine drainage from the proposed mining activities are anticipated. The tailings material will be contained in an HDPE-lined, engineered facility and a groundwater monitoring programme will be implemented to detect any changes in groundwater quality.

31.7 VOLUMES AND RATES OF WATER USE REQUIRED FOR THE MINING, TRENCHING OR BULK SAMPLING OPERATION

In general, water requirements for processing of the ore at the Repli processing plant is expected to be in the order of 0.61 m³ per tonne of run-of-mine (ROM) ore processed.

31.8 HAS A WATER USE LICENCE BEEN APPLIED FOR?

A water use licence will not be required for the proposed mining development. Water will be managed under the water use licence applied for by Repli Trading.

31.9 IMPACTS TO BE MITIGATED IN THEIR RESPECTIVE PHASES

The mitigation measures to be implemented are summarised in the required DMR format in Table 30-1.

31.10 IMPACT MANAGEMENT OUTCOMES

The impact management outcomes are summarized in the required DMR format in Table 30-2.

31.11 IMPACT MANAGEMENT ACTIONS

The impact management actions are summarised in the required DMR format in Table 30-3.

TABLE 31-1: IMPACTS TO BE MANAGED IN THEIR RESPECTIVE PHASES

ACTIVITIES	PHASE	SIZE AND SCALE OF DISTURBANCE	MITIGATION MEASURES	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
ADMINISTRATIVE CONTROLS					
All mining and associated activities	All phases	The total footprint of all proposed activities is approximately 30, 39 (Ha)	<ul style="list-style-type: none"> ➤ The EMPr shall be incorporated into any Environmental Management System (EMS) applicable to the site ➤ All resources required to ensure compliance with the EMPr, including budgetary, personnel and equipment shall be in place for the duration of the LOM ➤ A signed commitment to ensure compliance with the EMPr shall be obtained from Contractors appointed to undertake any of the activities on behalf of the applicant ➤ An appropriately qualified, trained and experienced person shall be designated to fulfil the compliance monitoring requirements in the EMPr ➤ The following records shall be maintained on Site: <ul style="list-style-type: none"> ➤ Environmental Authorisation ➤ Approved EMPr ➤ Emergency preparedness and response plan ➤ Documentation concerning compliance monitoring, environmental performance and EMPr implementation 	Implementation of the mitigation measures will ensure compliance with NEMA, NEMAQA, NEMWA, MPRDA and the regulations, norms and standards promulgated in terms of these Acts	Mitigation measures are required to be implemented from the commencement of site preparation activities throughout the LOM

			<ul style="list-style-type: none"> ➤ Record of all individuals receiving job-specific and SHE training ➤ Compliance monitoring and auditing data/reports and results of inspections conducted ➤ Approved SHE method statements ➤ Waste management records ➤ Equipment maintenance records ➤ Maintenance and inspection of all safety equipment e.g. fire extinguishers ➤ A completed and signed environmental incident/non-conformance report in respect of each reported environmental incident or nonconformity ➤ A completed and signed environmental incident/non-conformance register ➤ A completed and up-to-date external complaints and grievances form and register in respect of each external complaint received ➤ Emergency contact register ➤ A hazardous substance register 		
SOCIO-ECONOMIC					
All activities involving employment and procurement of goods and services	All phases	As above	<ul style="list-style-type: none"> ➤ Enhance positive impacts through implementation of the SLP ➤ Continue to reassess the risks and impacts of the development throughout its operational life. Should any change in the risk and impact profile of the development be determined, additional management controls and 	SLP Mining Charter MPRDA IFC Performance Standards	Throughout the LOM

			<p>mitigation measures must be implemented and the EMPr amended to reflect these changes</p> <ul style="list-style-type: none"> ➤ The SLP and EMPr, including all management and monitoring measures must be implemented and compliance thereto audited by a competent independent person on an annual basis ➤ The following social management plans and procedures must be developed by the Applicant prior to construction commencing: <ul style="list-style-type: none"> ➤ An emergency preparedness and response plan ➤ A comprehensive mine health and safety management plan, incorporating controls for ensuring community health and safety ➤ An influx management plan developed in collaboration with the Siyathemba Local Municipality. The plan must identify responsibilities between the Applicant and the SLM for ensuring that access to municipal services such as public health, public safety, water, sanitation, power and affordable housing are available in Prieska and Copperton; ➤ A written complaints and grievance procedure. ➤ Establish a community engagement forum for Copperton comprising of representatives of, among others, the mine management, surrounding landowners / land users, community members, authorities, and local business 		
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			<ul style="list-style-type: none"> ➤ All relevant monitoring groundwater must be made available to the community engagement forum ➤ An annual report on the progress of implementation of the programmes and commitments made by the Applicant in the mine social and labour plan should be provided to the community engagement forum, steering committee and all other relevant stakeholders. It is recommended that the report include feedback on relevant socio-economic indicators, to be agreed by the forum 		
All mine-related activities	All phases	As above	<ul style="list-style-type: none"> ➤ Implementation of a comprehensive mine health and safety programme ➤ Petrochemicals, oils, solvents, paints and other identified hazardous substances shall only be stored under controlled conditions. ➤ All hazardous materials will be stored in a secured, appointed area that is fenced and has restricted entry ➤ All applicable emergency contact details shall be confirmed and displayed at various locations across the site ➤ Speed limits for mine vehicles and personnel established ➤ Notification of relevant stakeholders when large loads are required, or road closures are to occur 	<p>Mine Health and Safety Act, 1996</p> <p>MPRDA</p> <p>National Road Traffic Act</p> <p>SLP</p> <p>Mining Charter</p>	Throughout the LOM
All mine-related activities	Decommissioning and Closure	As above	<ul style="list-style-type: none"> ➤ The impact of closure can be mitigated through the implementation of the measures in the SLP, including regular, consultative review of closure 	<p>SLP</p> <p>Mining Charter</p> <p>MPRDA</p>	Throughout the LOM, increasing in detail as mine closure approaches

			strategies and the portable skills / re-skilling programme	IFC Performance Standards	
GROUNDWATER					
Mine dewatering	Operational	As above	<ul style="list-style-type: none"> ➤ To ensure safe access for mining, water will continue to be removed from the underground workings and managed through the Repli mine dewatering system. ➤ Inspect and maintain underground pollution control facilities. ➤ Implement the groundwater monitoring programme which includes monitoring of existing boreholes to ensure continuity of water supply. ➤ Modelling scenarios suggest that borehole 105 will not be affected by mine dewatering. As this is a strong borehole on which the landowner is reliant, it may however be prudent to complete a pumping test on the borehole prior to the commencement of mining to ensure that the safe yield of the borehole is confirmed for future reference. This borehole should further be included in the mine's monitoring programme as a precautionary measure. ➤ Feedback must be provided to owners of boreholes within the affected zones regarding progress made with mining activities, concurrent rehabilitation and the outcome of monitoring programmes on a quarterly basis, when groundwater monitoring will take place, to ensure that they are informed of aspects of mining that may be of significance. ➤ Private boreholes destroyed during mining must be replaced or alternative water supply 	<p>MPRDA and NEMA principles</p> <p>Water management measures in compliance with NWA and IWUL</p> <p>IWWMP</p> <p>NWA</p> <p>NEMA</p>	Throughout the LOM in accordance with the groundwater monitoring programme

			<p>options must be negotiated with the affected landowners.</p> <ul style="list-style-type: none"> ➤ The numerical model used in the assessment should be updated, verified and re-calibrated on a regular basis as monitoring information becomes available in order to increase the level of confidence in modelling outcome. ➤ Final mine closure modelling must be prepared at least five years prior to mine closure to ensure that predictions of long-term impacts are undertaken with the highest possible level of confidence. 		
Underground Mining	Planning	As above	<ul style="list-style-type: none"> ➤ Ensure that sufficient information is available on all private boreholes inside the zone of influence to quantify existing groundwater use and demand. This information will form the basis for future assessments. ➤ Plan for and provide sufficient budget to implement the groundwater monitoring programme before any mining starts. ➤ Develop sound operating procedures that takes cognisance of impacts associated with groundwater, including spill procedures, dam design, oil and diesel storage area design, on-site environmental incident reporting, etc. ➤ Develop sound surface runoff management plans to ensure that all dirty runoff is contained and diverted to the PCD. ➤ Ensure that PCD are designed to contain all dirty water generated to prevent overflows and spillages. 	<p>MPRDA and NEMA principles</p> <p>Water management measures in compliance with NWA and IWUL</p> <p>IWWMP</p> <p>NWA</p> <p>NEMA</p>	Throughout the LOM in accordance with the groundwater monitoring programme

Underground mining	Operational, Closure and Decommissioning	As above	<ul style="list-style-type: none"> ➤ If preferential flow paths to groundwater are identified during mining, it is recommended that these features are characterised and quantified. Such geological structures include water-bearing fractures, faults and contact zones ➤ All construction vehicles, equipment and machinery shall be equipped with drip trays and spill response kits ➤ Hydrocarbon spillages shall be cleaned as soon as possible and no longer than one day after the spillage event ➤ Polluted soils are to be treated with appropriate absorbents or be removed from areas where incidents have occurred. This soil shall be properly contained before being disposed of at appropriately licensed waste management facilities ➤ Secondary containment e.g. drip trays appropriate to the hazardous substance shall be provided for all hazardous materials containers, at connection points and at other possible overflow points ➤ Final mine closure modelling must be prepared at least five years prior to mine closure to ensure that predictions of long-term impacts are undertaken with the highest possible level of confidence. ➤ The transport, storage, use and disposal of hazardous chemical substances carefully controlled 	<p>MPRDA and NEMA principles</p> <p>Water management measures in compliance with NWA and IWUL</p> <p>IWWMP</p> <p>NWA</p> <p>NEMA</p>	Throughout the LOM in accordance with the groundwater monitoring programme
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			<ul style="list-style-type: none"> ➤ Chemical toilets serviced at the required frequency by a contractor. ➤ Inspect and maintain underground water management and pollution control facilities and systems. ➤ Opportunities for the reuse of waste streams considered on an ongoing basis throughout the life of the operation. ➤ Waste generated underground segregated into general and hazardous waste and contractors appointed to remove the waste to licensed waste disposal facilities. ➤ A safety data sheet will be prepared for each waste stream classified as hazardous and the sheet will be displayed at the most appropriate location in closest proximity to the waste storage facility. ➤ Any container or storage facility holding hazardous waste will be labelled to reflect details of the contents and date of storage. ➤ Any hazardous waste which is stored in such a manner that it cannot be labelled will have a record reflecting the date and quantities of waste placed in the waste storage facility and the cumulative quantity of waste stored in the facility. ➤ Implement and maintain a groundwater monitoring programme in mine and private boreholes situated in the zone of influence identified for the mining areas. ➤ Complete regular inspections of the PCD, specifically noting incidences of overflow and 		
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			<p>leakage. If the latter is identified, measures must be taken to rectify non-compliances immediately.</p> <ul style="list-style-type: none"> ➤ Record all groundwater-related complaints and deal with each complaint within the agreed upon timeframe. ➤ Complete all rehabilitation to a satisfactory level. Effective rehabilitation of these areas must aim to reduce the rate of recharge of rainwater as far as possible. No ponding must be allowed over backfilled areas. ➤ Plan for and budget to continue with the groundwater monitoring period for a minimum of two years after mine closure. The continued need for groundwater monitoring will depend on the outcome of the final mine closure groundwater impact assessment. ➤ If preferential flow paths to groundwater are identified during mining, it is recommended that these features are characterised and quantified. Such geological structures include water-bearing fractures, faults and contact zones. The conceptual model for the project area should be updated and numerical model simulations revised to include the impact of preferential flow paths on groundwater and potential pollution movement. Simulations undertaken as part of this assessment suggests that faults associated with the historical and new TSFs may act as preferential flow paths to groundwater contamination. ➤ Updated contaminant transport simulations must be undertaken once this information is available in order to improve the confidence 		
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			levels in long-term predictions. These simulations must be completed once the final results of the geochemical study and one wet and dry season groundwater monitoring information are available. In addition, the contaminant transport model must be updated with all available information at least five years prior to mine closure to ensure that effective measures are developed to manage long-term impacts.		
AIR QUALITY					
Materials Handling, Transport of Man and Machinery (underground)	Construction	As above	<ul style="list-style-type: none"> ➤ Application of dust suppression on underground roads when necessary to ensure compliance with occupational exposure requirements. ➤ All underground equipment and vehicles properly maintained. 	NEM:AQA Dust Control Regulation GNR 827 of 2013 Ambient Air Quality Standards	Throughout the LOM in accordance with the ambient air quality monitoring programme
NOISE					
Blasting (Underground)	All phases	Not Applicable	<ul style="list-style-type: none"> ➤ Avoid / minimise human health and safety risks through design and operational controls, including the implementation of a comprehensive health and safety programme. ➤ Good public relations by ensuring both production personnel and the local community understand the nature of blast and ground vibration. ➤ Establishment of a community engagement forum and grievance mechanism by which community complaints can be submitted to the mine. 	SANS Environmental Noise Standards IFC Performance Standards	Throughout the LOM
CULTURAL HERITAGE					

Mining (Underground)	All Phases	As above	<ul style="list-style-type: none"> ➤ The possibility of the occurrence of subsurface finds cannot be excluded. Therefore, if during construction any possible finds such as stone tool scatters, artefacts or bone and fossil remains are made, the operations must be stopped and a qualified archaeologist must be contacted for an assessment of the find ➤ Construction crews must be properly inducted to ensure they are fully aware of the procedures regarding chance finds. <p><u>Chance Find Protocol</u></p> <p>The following procedure is only required if fossils are seen on the surface and when drilling or excavations commence.</p> <ul style="list-style-type: none"> ➤ When drilling or excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects, wood, bone, coal) should be put aside in a suitably protected place. This way the prospecting activities will not be interrupted ➤ Photographs of similar fossil plants must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (Appendix 7) ➤ This information will be built into the EMP's training and awareness plan and procedures ➤ Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment ➤ If there is any possible fossil material found by the developer/environmental officer/miners then the qualified palaeontologist sub-contracted for this project, should visit the site 	NHRA SAHRA	Throughout the LOM
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			<p>to inspect the selected material and check the dumps where feasible.</p> <ul style="list-style-type: none"> ➤ Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits. ➤ If no good fossil material is recovered then the site inspections by the palaeontologist will not be necessary. Annual reports by the palaeontologist must be sent to SAHRA. ➤ If no fossils are found and the excavations have finished then no further monitoring is required. 		
REHABILITATION AND CLOSURE					
Mine Closure	All Phases	As above	<ul style="list-style-type: none"> ➤ Avoid / minimise through design and operational controls. ➤ Development of an underground mine closure plan which optimises post-closure land use options. ➤ Implementation of rehabilitation measures concurrent with mining to minimise the extent of final rehabilitation required at mine closure. 	MPRDA NEMA NEMBA GN704	Throughout the LOM
EM AND RF INTERFERENCE WITH MEERKAT / SKA OBSERVATORY					
All mine activities involving the use of machinery and equipment	All Phases	As above	<ul style="list-style-type: none"> ➤ Radio frequency transmitters to comply with the Saturation threshold of (minus) -100 dBm in the territory of any of the radio astronomy stations 	Astronomy Geographic Advantage Act, 2007 and the regulations promulgated in terms thereof	Throughout the LOM

			<ul style="list-style-type: none"> ➔ Radio frequency transmitters to comply with the SARAS protection levels at the SKA Virtual Centre ➔ Electromagnetic emissions by electrical infrastructure and electrical equipment to comply with the SARAS protection levels in the territory of any of the radio astronomy station 		
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TABLE 31-2: IMPACT MANAGEMENT OUTCOMES

ACTIVITIES	POTENTIAL IMPACT	ASPECTS AFFECTED	PHASE	MITIGATION TYPE	STANDARD TO BE ACHIEVED
SOCIO-ECONOMIC					
All activities involving employment and procurement of goods and services	Local employment	Socio-Economic Environment	All Phases	Enhance through implementation of the SLP	SLP
	Local economic development				Mining Charter
	Training and development			MPRDA	
	Community infrastructure development			IFC Performance Standards	
	Local inflation			Control through planning	SLP
	Influx of job seekers - demand on municipal services				Mining Charter
	Influx of job seekers - disruption in community dynamics				MPRDA
All mine-related activities	Mine health and safety	Socio-Economic Environment	All Phases	Control through planning design and operational controls	Mine Health and Safety Act, 1996 MPRDA
All mine-related activities	Security risk		Operational	No mitigation identified	SLP
	Contribution of royalties, rates and taxes				IFC Performance Standards
	Community health and safety		All Phases	Control through planning design and operational controls	National Road Traffic Act SLP Mining Charter

					MPRDA IFC Performance Standards
	Mine closure and associated effects on the local economy		Decommissioning and Closure	Control through planning and implementation of the SLP	SLP Mining Charter MPRDA IFC Performance Standards
GROUNDWATER					
Mine dewatering	Lowering of groundwater levels in private boreholes, thus affecting the performance of the boreholes that fall within the dewatering cone	Groundwater	Construction and Operational	<ul style="list-style-type: none"> ➤ Monitor through groundwater monitoring programme ➤ Replace boreholes affected by dewatering 	MPRDA and NEMA principles Water management measures in compliance with NWA and IWUL
Underground mining	Contamination of groundwater in private boreholes, making the groundwater unfit for use	Groundwater	Operational	<ul style="list-style-type: none"> ➤ Control through design and operational controls ➤ Monitor through groundwater monitoring programme 	IWWMP NWA NEMA
AIR QUALITY					
Materials Handling, Transport of Man and Machinery (underground)	Elevated PM10 and PM2.5 Concentrations	Air quality	Operational	Control through design and operational controls	NEM:AQA Dust Control Regulation GNR 827 of 2013 Ambient Air Quality Standards
Materials Handling, Transport of Man and Machinery (underground)	Elevated dust fall levels	Air quality	Operational		
FLORA AND FAUNA					
Staff movement	Disturbance/Loss of Fauna Species	Terrestrial fauna/flora	All phases	Avoid / minimise through design and operational controls	MPRDA NEMA

					NEMWA NEMBA
NOISE					
Blasting and mining operations (Underground)	Noise impacts generated may impact on the social environment.	Noise	All phases	<ul style="list-style-type: none"> ➤ No communities are expected to be affected by the noise from operational phase activities ➤ Minimise through design and operational controls 	SANS Environmental Noise Standards IFC Performance Standards
BLASTING					
Blasting (Underground)	Impacts to human health and safety including injuries and possibly fatalities from rockfalls, blasting incidents and other underground mining hazards	Structural damage / health and safety	Operational	Avoid / minimise through design and operational controls	Blast Design Specification IFC Performance Standards Mine Health and Safety Act
	Community complaints regarding blasting				
CULTURAL HERITAGE					
Mining / blasting (Underground)	Disturbance/Loss of Significant Archaeological or Cultural Heritage Sites/Remains	Archaeology, palaeontology, and cultural heritage	All phases	Maintain / monitor through implementation of chance-find procedure	SAHRA
EM AND RF INTERFERENCE WITH MEERKAT / SKA OBSERVATORY					
All mine activities involving the use of machinery and equipment	EM and RF interference from mine equipment and machinery and the impact this may have on the MeerKAT/SKA Observatory	EM and RF Interference	All phases	Avoid / minimise through design and operational controls	Astronomy Geographic Advantage Act, 2007 and the regulations promulgated thereunder

TABLE 31-3: IMPACT MANAGEMENT ACTIONS

ACTIVITIES	POTENTIAL IMPACT	MITIGATION TYPE	TIMEFRAME FOR IMPLEMENTATION	STANDARD TO BE ACHIEVED
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SOCIO-ECONOMIC				
All activities involving employment and procurement of goods and services	Local employment	Enhance through implementation of the SLP	Mitigation measures are required to be implemented from the commencement of site preparation activities throughout the LOM	SLP Mining Charter MPRDA IFC Performance Standards
	Local economic development			
	Training and development			
	Community infrastructure development			
	Local inflation	Control through planning	As above	SLP Mining Charter MPRDA IFC Performance Standards
	Influx of job seekers - demand on municipal services			
Influx of job seekers - disruption in community dynamics				
All mine-related activities	Mine health and safety	Control through planning design and operational controls	As above	Mine Health and Safety Act, 1996 MPRDA
	Security risk			SLP IFC Performance Standards
	Contribution of royalties, rates and taxes	No mitigation identified	As above	SLP Mining Charter MPRDA IFC Performance Standards
	Community health and safety	Control through planning design and operational controls	As above	National Road Traffic Act SLP Mining Charter MPRDA IFC Performance Standards
	Mine closure and associated effects on the local economy	Control through planning and implementation of the SLP	As above	SLP Mining Charter MPRDA IFC Performance Standards

GROUNDWATER				
Mine dewatering	Lowering of groundwater levels in private boreholes, thus affecting the performance of the boreholes that fall within the dewatering cone	<ul style="list-style-type: none"> ➤ Control through design and operational controls ➤ Monitor through groundwater monitoring programme 	As above	MPRDA and NEMA principles Water management measures in compliance with NWA and IWUL NWA NEMA
Underground mining	Contamination of groundwater in private boreholes, making the groundwater unfit for use	<ul style="list-style-type: none"> ➤ Control through design and operational controls ➤ Monitor through groundwater monitoring programme 	As above	
AIR QUALITY				
Materials Handling, Transport of Man and Machinery (underground)	Elevated PM10 and PM2.5 Concentrations	Control through design and operational controls	As above	NEM:AQA Dust Control Regulation GNR 827 of 2013 Ambient Air Quality Standards
Materials Handling, Transport of Man and Machinery (underground)	Elevated dust fall levels			
NOISE				
Mining Activities (Underground)	Noise impacts generated may impact on the social environment.	Minimise through design and operational controls	As above	SANS Environmental Noise Standards IFC Performance Standards
BLASTING				
Blasting (Underground)	Impacts to human health and safety including injuries and possibly fatalities from rockfalls, blasting incidents and other underground mining hazards	Avoid / minimise through design and operational controls	As above	Blast Design Specification IFC Performance Standards
	Community complaints regarding blasting			

CULTURAL HERITAGE				
Mining / Blasting activities (Underground)	Disturbance/Loss of Significant Archaeological or Cultural Heritage Sites/Remains	Maintain / monitor through implementation of chance-find procedure	As above	SAHRA
EM AND RF INTERFERENCE WITH MEERKAT / SKA OBSERVATORY				
All mine activities involving the use of machinery and equipment	EM and RF interference from mine equipment and machinery and the impact this may have on the MeerKAT/SKA Observatory	Avoid / minimise through design and operational controls	As above	Astronomy Geographic Advantage Act, 2007 and the regulations promulgated thereunder

32 FINANCIAL PROVISION

32.1 DETERMINATION OF THE AMOUNT OF FINANCIAL PROVISION

The conceptual closure plan, including the financial provision, is included in Appendix 7.

A commercial agreement has been entered into between Repli and Vardocube so that relevant infrastructure and facilities established to support the proposed Repli surface and underground mining will also be used for the underground mining of the Vardocube Section of the deposit. The current agreement is that Vardocube will contribute to the quantum on a pro-rata basis using the Mineral Resource Estimate (MRE) of the entire Prieska Zinc Copper Project, which is around 18% of the total MRE for selected infrastructure that is shared, such as the TSF and shaft.

32.1.1 CONFIRM SPECIFICALLY THAT THE ENVIRONMENTAL OBJECTIVES IN RELATION TO CLOSURE HAVE BEEN CONSULTED WITH LANDOWNER AND INTERESTED AND AFFECTED PARTIES

All aspects of the conceptual closure planning undertaken to date, including the applicable specialist studies and the closure plan itself is made available for review and comment as part of the public participation process described in the EIR.

Throughout the LOM, the applicant should, through appropriate engagement mechanisms such as the Future Forum, established in terms of the SLP, continue to engage with interested and affected parties in order to refine and further develop the closure plan for the operation.

32.1.2 PROVIDE A REHABILITATION PLAN THAT DESCRIBES AND SHOWS THE SCALE AERIAL EXTENT OF THE MAIN MINING ACTIVITIES, INCLUDING THE ANTICIPATED MINING AREA AT THE TIMES OF CLOSURE

The Closure Plan in Appendix 7 details the conceptual rehabilitation measures to be implemented at the time of closure. The plan details the proposed closure measures to be implemented for the following:

- General reclamation and closure activities;
- Reclamation and closure activities applicable to specific infrastructure areas; and
- Rehabilitation monitoring, aftercare and maintenance.

32.1.3 EXPLAIN WHY IT CAN BE CONFIRMED THAT THE REHABILITATION PLAN IS COMPATIBLE WITH THE CLOSURE OBJECTIVES

The conceptual rehabilitation and closure plan and associated estimate of closure costs for the mine is based on ensuring that the conceptual completion criteria are achieved.

The estimate allows for:

- Decommissioning, demolition and removal from site of all infrastructure not required or aligned with the proposed post closure land use;
- Transfer of the ownership of all remaining infrastructure and services required to support the proposed post closure land use to the local authorities responsible for the administration of the area;
- Making the area safe for all post closure land users and livestock;
- No post closure water treatment is required; and
- All groundwater discharges from the site would satisfy agreed target water quality objectives and would not require additional treatment.

The estimated costs of rehabilitation and closure have been structured so as to distinguish between concurrent rehabilitation of the mine and the works required during the decommissioning phase, closure and post closure

phase. It is assumed that the rehabilitation of the mine will be carried out in conjunction with the operation of the mine and related activities by the staff employed on the mine.

32.1.4 CALCULATE AND STATE THE QUANTUM OF THE FINANCIAL PROVISIONS REQUIRED TO MANAGE AND REHABILITATE THE ENVIRONMENT IN ACCORDANCE WITH THE APPLICABLE GUIDELINE

The financial provision required for rehabilitation and closure is included as part of the Closure Plan in Appendix 7.

The financial provision cost was calculated by means of the DMR's standard method for assessment of mine closure. The total cost for rehabilitation and closure of the mine according to the DMR Guideline format is R 131 118 284 (incl. VAT). This covers both the Repli and Vardocube Mining Right Application areas.

The contribution that Vardocube would be required to make to the above total is R 13 494 390 and relates primarily to the pro rata contribution towards rehabilitation of the TSF facility as well as the shaft and other associated infrastructure.

32.1.5 CONFIRM THAT THE FINANCIAL PROVISION WILL BE APPROVED AS DETERMINED

The financial provision has been issued to the applicant as part of the feasibility study and the amount will be incorporated into the financial model of the mine. The applicant is also committed to ensuring that the financial provision is updated annually as required by legislation.

TABLE 32-1: MECHANISMS FOR MONITORING COMPLIANCE WITH AND PERFORMANCE ASSESSMENT AGAINST THE ENVIRONMENTAL MANAGEMENT PROGRAMME AND REPORTING THEREON

SOURCE ACTIVITY	IMPACTS REQUIRING MONITORING PROGRAMMES	FUNCTIONAL REQUIREMENTS FOR MONITORING	ROLES AND RESPONSIBILITIES	MONITORING AND REPORTING FREQUENCY AND TIME PERIODS FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS
All mining and associated activities	General site management and compliance monitoring	<ul style="list-style-type: none"> ⇒ Inspections and compliance audits (internal and external) ⇒ Performance assessment reporting 	<ul style="list-style-type: none"> ⇒ <u>General Manager</u> – accountable for ensuring that EMPr is implemented by all mine personnel and that there is overall compliance with EMPr 	<ul style="list-style-type: none"> ⇒ Daily and weekly inspections ⇒ Quarterly compliance audits ⇒ Annual performance assessment reporting
Materials Handling, Transport of Man and Machinery (underground)	<ul style="list-style-type: none"> ⇒ Elevated dust fallout levels ⇒ Elevated PM10 and PM2.5 emissions 	<ul style="list-style-type: none"> ⇒ A monthly dust fallout monitoring programme must be implemented ⇒ Regular communication of monitoring results to stakeholders 	<ul style="list-style-type: none"> ⇒ <u>Environmental Manager</u> – responsible for monitoring compliance with the implementation of the EMPr ⇒ <u>ECO / SHE Representatives</u> – day to day inspections, compliance monitoring and sampling as may be required 	<ul style="list-style-type: none"> ⇒ Monthly dust fallout reporting ⇒ Mitigation measures implemented from construction and throughout the LOM as applicable to the emission sources
Mining dewatering Underground a mining	<ul style="list-style-type: none"> ⇒ Lowering of groundwater levels in private boreholes ⇒ Contamination of groundwater in private boreholes, making the groundwater unfit for use 	<ul style="list-style-type: none"> ⇒ Underground water sampling and analysis ⇒ Regular communication of monitoring results to stakeholders ⇒ All existing monitoring boreholes as well as the private boreholes that fall within the zones of influence delineated in this study must be included in the quarterly monitoring programme. Private boreholes that fall inside the identified zones of influence include: <ul style="list-style-type: none"> ○ Private boreholes that may be affected by mine dewatering: 125, 124BH8 and 103. 	<ul style="list-style-type: none"> ⇒ <u>External Auditor</u> – responsible for performance assessment reporting, and auditing compliance with conditions of the EA and IWULA ⇒ <u>Independent specialists</u> – responsible for undertaking specialist work as required over the LOM 	<ul style="list-style-type: none"> ⇒ As per monitoring requirements ⇒ Mitigation measures implemented from construction and throughout the LOM as applicable to the emission sources

		<ul style="list-style-type: none"> ○ Borehole 105 must also be included in the quarterly monitoring programme as a precautionary measure. ○ Private boreholes that may be affected by contamination associated with the historical TSF: BH10 and 116BH9. ➔ All hydrocensus boreholes that fall within a 5km radius from the mining area should be monitored on an annual basis as a precautionary measure. These boreholes include: <ul style="list-style-type: none"> ○ Private boreholes within a 5km radius of all proposed new mining activities that are not already included in the quarterly monitoring programme: 104, 113, 114, 115, 119, 121, 120BH7, 122BH5, BH3 and BH6. ➔ In addition to these, the following additional monitoring boreholes are recommended, based on the outcome of model simulations: <ul style="list-style-type: none"> ○ Replacement boreholes for OCOW090 and 91 if they will be destroyed during waste rock deposition. ○ Dedicated groundwater monitoring boreholes down gradient of the new TSF as well as the RWD, to act as an early warning system in the case of liner failure. 		
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		<p>Groundwater monitoring requirements</p> <table border="1"> <thead> <tr> <th>Monitoring parameter</th> <th>Element for analysis</th> <th>Monitoring frequency</th> </tr> </thead> <tbody> <tr> <td>Depth to groundwater level</td> <td>Groundwater level</td> <td>Quarterly</td> </tr> <tr> <td>Water quality in monitoring boreholes and hydrocensus boreholes in the affected zones</td> <td>pH, EC, TDS, Hardness, Ca, Mg, N, K, Cl, SO4, NO3, NO2, F, PO4, F, Fe, Cu, Zn, Mn, Se, U</td> <td>Quarterly (Apr, Jul, Oct, Jan)</td> </tr> <tr> <td>Water quality in hydrocensus boreholes in a 5km radius</td> <td>pH, EC, TDS, Hardness, Ca, Mg, N, K, Cl, SO4, NO3, NO2, F, PO4, F, Fe, Cu, Zn, Mn, Se, U</td> <td>Annually (Jan)</td> </tr> <tr> <td>Rainfall</td> <td>Rain depth (mm)</td> <td>Daily on site</td> </tr> </tbody> </table> <p>⇒ All monitoring information must be entered into a spreadsheet for record keeping and analysis. Copies of the certificates of analyses must be kept on file at each mine for inspection.</p>	Monitoring parameter	Element for analysis	Monitoring frequency	Depth to groundwater level	Groundwater level	Quarterly	Water quality in monitoring boreholes and hydrocensus boreholes in the affected zones	pH, EC, TDS, Hardness, Ca, Mg, N, K, Cl, SO4, NO3, NO2, F, PO4, F, Fe, Cu, Zn, Mn, Se, U	Quarterly (Apr, Jul, Oct, Jan)	Water quality in hydrocensus boreholes in a 5km radius	pH, EC, TDS, Hardness, Ca, Mg, N, K, Cl, SO4, NO3, NO2, F, PO4, F, Fe, Cu, Zn, Mn, Se, U	Annually (Jan)	Rainfall	Rain depth (mm)	Daily on site		
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Rainfall	Rain depth (mm)	Daily on site																	

		<p>➤ If a significant exceedance is recorded during the monitoring programme, the following actions should be taken:</p> <ul style="list-style-type: none"> ○ Log the exceedances in the incident reporting system within 24-hours of it occurring. ○ Report the exceedances to the Environmental and General Managers as well as to the regulatory authority. ○ Undertake an investigation to identify causes of the exceedances. ○ Consult with any landowner or affected party that may be impacted by the exceedances to determine their concerns and to negotiate remedial actions. ○ Implement the necessary remedial actions according to the outcome of the investigation and consultation with the affected parties. ○ Track the incident until completion. <p>Regular monitoring reports must be prepared for internal use as well as for submission to the authorities, as required by the operations' water use licenses.</p>		
<p>Movement of man and materials</p>	<p>Wildlife road mortalities</p>	<p>➤ Logbook maintained on employee sightings / incidents</p>		<p>Ongoing throughout the LOM Mitigation measures implemented from construction and throughout the LOM as applicable to the emission sources</p>

<p>Blasting (underground) Mining and shaft operations</p>	<p>Elevated noise levels</p>	<p>➤ Implementation of the noise monitoring campaign</p>		<p>➤ Annual noise monitoring campaign</p> <p>➤ <i>Ad hoc</i> monitoring in response to complaints</p> <p>➤ Mitigation measures implemented from construction and throughout the LOM as applicable to the emission sources</p>
<p>Mining (Underground)</p>	<p>➤ Loss of cultural heritage resources</p>	<p>The following procedure is only required if fossils are seen on the surface and when drilling or excavations commence.</p> <p>➤ When drilling or excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (plants, insects, wood, bone, coal) should be put aside in a suitably protected place. This way the prospecting activities will not be interrupted.</p> <p>➤ Photographs of similar fossil plants must be provided to the developer to assist in recognizing the fossil plants in the shales and mudstones (Appendix 7).</p> <p>➤ Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.</p> <p>➤ If there is any possible fossil material found by the developer/environmental officer/miners then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the</p>		

		<p>selected material and check the dumps where feasible.</p> <ul style="list-style-type: none"> ➤ Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits. ➤ If no good fossil material is recovered, then the site inspections by the palaeontologist will not be necessary. Annual reports by the palaeontologist must be sent to SAHRA. ➤ If no fossils are found and the excavations have finished, then no further monitoring is required. 		
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32.1.6 INDICATE THE FREQUENCY OF THE SUBMISSION OF THE PERFORMANCE REPORT

The frequency of mine performance assessment reporting shall be at least annually or as otherwise determined by legislation.

In addition to the performance assessment, inspections and audits must also be undertaken as described below. A key objective of the performance assessment reviews, inspections and audits must be to identify the effectiveness of the management measures. Any gaps should be addressed, and if necessary, the EMPr updated to ensure the site requirements and management of risks and impacts are effective and practicable.

32.1.6.1 *Inspections*

SHE inspections of all parts of the operation shall be conducted daily on an *ad hoc* basis and formally at least once a week.

32.1.6.2 *Internal Auditing*

Internal SHE compliance audits shall be conducted on a quarterly basis. The purpose of the internal compliance audits shall be to confirm that all management actions outlined in the EMPr have been implemented. The mine manager will be responsible for the implementation of corrective measures that may result from the findings of such audits, which will investigate at least the following:

- Completeness of SHE documentation, including planning documents and inspection records;
- Compliance with monitoring requirements;
- Suitability of EMPr in addressing general environmental performance at the Site;
- Efficacy of management controls to address any non-compliance with monitoring requirements; and
- Training activities and record keeping.

32.1.6.3 *External Auditing*

External audits shall be completed in the manner and frequency determined in the conditions of the EA and EMPr and the prevailing legislation.

32.1.7 ENVIRONMENTAL INCIDENTS AND NON-COMPLIANCES

The reporting of an environmental incident and or non-compliance shall be as follows:

- Site personnel shall, as soon as possible, inform the Contractor or Operator (as relevant) of the incident and/or non-compliance, the severity thereof and the corrective actions taken;
- The incident and/or non-compliance details shall be recorded on a register maintained on site;
- Depending on the level of the incident, the Contractor / Operator shall inform the Owner and the relevant authorities of the incident / non-compliance; and
- Any corrective actions required following the incident and / or non-compliance, including any rehabilitation requirements, shall be implemented by the Contractor / Operator.

32.1.8 ENVIRONMENTAL AWARENESS PLAN

32.1.8.1 *Manner in which the Applicant Intends to Inform his or her Employees of any Environmental Risk which may result from their Work*

The following environmental awareness activities shall be undertaken throughout the LOM, as relevant to the mine development phases (construction, operation and closure) and activities to be undertaken by specific contractors and/or employees:

- Induction training shall be provided to all personnel and visitors accessing the site. The induction training shall include information on at least the following:
 - All SHE hazards and risks on the site;
 - Emergency procedures to be followed in the event of an incident;
 - Heritage chance-find procedure;
 - Measures to prevent accidents, injuries and impacts to the environment;
 - No-go areas, including sensitive environmental features like wetlands and watercourses; and
 - Overview of the EMPr.
- Specific training programmes for all employee groups (management, supervisor, new hire, and refresher) relative to the type of work to be conducted shall be developed and implemented. These programmes shall, as a minimum, address the following:
 - Training of employees in all aspects of their work environment, hazard recognition, first aid, personal hygiene, electrical safety, rigging and lifting, vehicle safety, fire safety, safety practices for working around machinery with moving parts and other topics that may relate specifically to a job assignment or physical location at the Site;
 - Procedures for responding to fires, explosions, spills and leaks, injuries, vehicle accidents, property damage, bomb threats and robberies and attempted robberies;
 - Hazardous substances training summarising the requirements for the handling of hazardous substances on the site and how to respond to emergency situations shall be included in site induction and refresher training programmes;
 - Toolbox talks shall be presented daily with the objective of creating awareness of the Site SHE risks and hazards and how to effectively prevent accidents, injuries and impacts to the environment; and
 - All employees shall undergo initial and refresher training on spillage prevention and response, including the use of the onsite spill response equipment.

32.1.8.2 Manner in which Risk will be Dealt with in Order to Avoid Pollution or the Degradation of the Environment

The mine must continue to reassess the risks and impacts of the development throughout its operational life. Should any change in the risk and impact profile of the development be determined, additional management controls and mitigation measures must be implemented and the EMPr amended to reflect these changes.

32.1.9 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

No specific information has been requested by the competent authority for the proposed mine development.

The financial provisions for closure and rehabilitation will be confirmed annually and all audits and associated statutory reporting requirements will be adhered to throughout the Life of Mine.

32.2 UNDERTAKING

The EAP herewith confirms:

- (a) The correctness of the information provided in this report
- (b) The inclusion of comments and inputs from stakeholders and I&APs
- (c) The inclusion of inputs and recommendations from the specialist reports where relevant, and
- (d) The acceptability of the project in relation to the finding of the assessment and the level of mitigation proposed.

ABS Africa (Pty) Ltd.

33 REFERENCES

- ABS Africa, 2018. Final Environmental Impact Assessment for the Prieska Zinc Copper Project
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DISCLAIMER

Advisory on Business and Sustainability Africa (Pty) Ltd. (ABS Africa) has prepared this report specifically for Vardocube (Pty) Ltd.

The contents of this report:

- Are based on the legal requirements for undertaking an Environmental Impact Assessment, as defined in the National Environmental Management Act, 1998 (Act No. 107 of 1998) and the scope of services as defined within the contractual undertakings between Vardocube and ABS Africa.
- Are specific to the intended development at the proposed site. The report shall not be used nor relied upon neither by any other party nor for any other purpose without the written consent of ABS Africa. ABS Africa accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.
- Reflect the best judgement of ABS Africa in light of the information available at the time of preparation. The analyses contained in this report has been developed from information provided by Vardocube and other parties. This information is not within the control of ABS Africa and ABS Africa has not audited such information and makes no representations as to the validity or accuracy thereof.

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