Draft Scoping Report Gamsberg Smelter Project

Gamsberg Zinc Smelter

Prepared for: Black Mountain Mining (Pty) Ltd

Authority References:

DEA Ref

DMR Ref

DWS Ref

SUBMITTED FOR ENVIRONMENTAL AUTHORISATION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107 OF 1998) AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT (ACT 59 OF 2008) IN RESPECT OF LISTED ACTIVITIES TRIGGERED IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT (ACT 28 OF 2002) (AS AMENDED)

SLR Project No.: 720.22013.00002
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SLR

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EXECUTIVE SUMMARY

Introduction

Black Mountain Mining (Pty) Ltd, part of the Vedanta Zinc International, owns and operates the Gamsberg Zinc Mine. The EIA process was completed in 2013 and in 2014 the Gamsberg Zinc Mine received an Environmental Authorisation (Ref: NC/EIA/NAM/KHA/AGG/2012), a Waste Management Licence (Ref: 12/9/11/L955/8); and Water Use Licence (Ref:14/D82C/ABCGI/2654)) for their open pit mining activities and concentrator plant. The Gamsberg Zinc Mine has been in mining operation since June 2016 and is currently mining up to 4 million tonnes per annum (mtpa) and producing up to 250 000 tonnes per annum (tpa) of zinc concentrate for export. Phase 2 will expand the mining capacity to 10 million tons per annum (mtpa). The Gamsberg Zinc Mine is located in the Northern Cape Province of South Africa, approximately 14 km east of the town of Aggeneys and 120 km east of Springbok along the N14.

Black Mountain Mining (Pty) Ltd is now proposing to construct a new zinc smelter and associated infrastructure to produce 300 000 tpa special high grade zinc metal by processing 680 000 tpa of zinc concentrate (Gamsberg Smelter Project). As a by-product 450 000 tpa pure sulphuric acid will be produced for both export and consumption within South Africa.

Proposed Project

Black Mountain Mining (Pty) Ltd is proposing the following:

- A smelter complex using the Roast-Leach-Electrowinning (R-L-E) with Jarosite precipitation and Jarofix conversion process;
- The development of a secured landfill facility for the disposal of the Jarofix);
- A new water 7 km pipeline from Horseshoe reservoir to the smelter complex;
- A laydown area and business partner camp for the construction phase; and
- Associated new roads and transmission line upgrades.

Need and Desirability

The Gamsberg Smelter Project is in line with the 'Beneficiation Strategy for the Minerals Industry of South Africa' (DMR, 2011) in terms of aiming to beneficiate the zinc in concentrate to produce high quality zinc ingots for sale/export. The benefits of this will fall directly to the Northern Cape Province and, specifically, the Namakwa District.

In addition, the South African National Development Plan aims to eliminate poverty and reduce inequality by 2030. South Africa can realise these goals by drawing on the energies of its people, growing an inclusive economy, building capabilities, enhancing the capacity of the state, and promoting leadership and partnerships throughout society. The Gamsberg Smelter Project will contribute to achieving this plan in terms of direct and indirect employment of people from the local and district municipalities as well as investment in the region and on a national scale.

Environmental Attributes of the Area

The regional study area is broadly defined as the Northern Cape Province and specifically the Namakwa District municipal area. The area is classified as a hot desert region with very low rainfall and very high evaporation rates and has an arid climate with an average of 98 mm/year of rain falling in the summer months.

The Gamsberg inselberg sits within what is termed the Bushmanland Inselberg Region (BIR) which consists of the Nama Karoo Biome and the Succulent Karoo Biome. The overlap of these biomes makes these inselbergs a unique feature, the "Bushmanland Inselberg Centre of Endemism". The Gamsberg inselberg is considered to be the most regionally important inselberg in the BIR in terms of its biodiversity and composition.

In 2016, the Northern Cape Province was the smallest contributor to the national GDP (2.1%). The Namakwa District Municipality, in turn, was the smallest contributor to the provincial GDB (11%). The largest industries were community services (22.5%) and mining (17.5%). The Province's economic growth rate was -2.7% in 2016. This negative economic growth can largely be attributed to contractions in the agriculture, mining, transport and

electricity sectors. However, by 2018, the Northern Cape's GDP had expanded by 2.8%, the highest of all provinces. Mining and agriculture were major contributors to the expansion.

EIA Process and Public Participation Process

Prior to the commencement of these activities an Environmental Impact Assessment (EIA) regulatory process must be conducted and approved by the DMR. In addition, Black Mountain Mining (Pty) Ltd must amend the mine's EMPr in terms of Section 102 of the Mineral and Petroleum Resources Development Act (MPRDA), read with the National Environmental Development Act (NEMA) Environmental Impact Assessment (EIA) Regulations. An EIA is required in terms of the MPRDA, the NEMA as well as for the Waste management Licence (WML) in terms of the National Environmental Management: Waste Act, 2008 (Act No.59 of 2008) (NEM:WA). Various water uses will also need to be authorized in terms of the National Water Act (NWA) through a Water Use Licence Application (WULA) to be submitted to the DWS as well as an application for an Atmospheric Emissions Licence (AEL) in terms of the National Environmental Management Air Quality Act (NEM:AQA).

SLR Consulting (Africa) (Pty) Ltd (SLR), an independent firm of environmental consultants, has been appointed by Black Mountain Mining (Pty) Ltd to manage the EIA, WULA and AEL processes.

A public participation process has been initiated and to date has included notification of interested and affected parties (I&APs) through distribution of a Background Information Document (BID), placement of newspaper advertisements, site notices, public meeting (December 2019) as well as a radio interview with Namakwa FM. I&APs will be given the opportunity to review this Scoping Report for a period of 30 days during January and February 2020 and on the EIA report at a later stage. The public participation process will continue throughout the EIA, WULA and AEL processes and IAPs will be given the opportunity to provide input thereon.

Potential impacts

Potential impacts that were identified during the scoping process are listed below:

- Negative visual impacts;
- Loss of soil and land capability through removal, erosion and compaction;
- Loss of soil and land capability through contamination;
- Physical loss and/or general disturbance of terrestrial biodiversity;
- Impact on terrestrial biodiversity due to reduced air quality from the Smelter operations;
- Reduction in surface water quality affecting third party users;
- Reduction in groundwater quality affecting third party users;
- Decrease in air quality from project emissions;
- Impact of the Gamsberg Smelter Project on climate change and the impact of climate change on the Gamsberg Smelter Project;
- Increase in noise levels;
- Effect on roads due to project related traffic;
- Loss of or damage to heritage and/or palaeontological resources;
- Positive and negative socio-economic impacts; and

These impacts will be investigated as per the Plan of Study included in this Scoping Report.

Conclusions

The EIA process is currently in the scoping phase. The project has the potential to impact on biophysical, cultural and socio-economic resources both within and in areas surrounding the Gamsberg Smelter Project. Input received from I&APs during the scoping phase will allow for the meaningful assessment of all relevant biophysical, cultural and socio-economic issues. Potential impacts will be investigated as per the Plan of Study included in Section 8 of this Scoping Report. The public participation process will continue throughout the EIA, WULA and AEL processes.

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LIST OF TABLES

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ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
AEL	Atmospheric Emissions Licence
AOL	Area of Influence
AHVWS	Automatic High Velocity Water Spray
ARD	Acid Rock Drainage
ASTM	American Standard Testing Method
BID	Background Information Document
BIR	Bushmanland Inselberg Region
BMM	Black Mountain Mining (Pty) Ltd
CAMP	Conservation Area Management Plan
CCTV	Closed Circuit Television
CGG	Continuous Galvanizing Grade
CO2	Carbon Dioxide
CO2e	Carbon Dioxide Equivalent
CSR	Corporate Social Responsibility
DALRRD	Department of Agriculture, Land Reform and Rural Development
DCDA	Double Conversion and Double Absorption
DEA	Department of Environmental Affairs
DEDAT	Department of Economic Development and Tourism
DENC	Department of Environment and Nature Conservation
DHSWS	Department of Human Settlements, Water and Sanitation
DM	Demineralised
DMR	Department of Mineral Resources
DPW	Department of Public Works
DRDLR	Department of Rural Development and Land Reform
DSD	Department of Social Development
DT	Department of Transport
EIA	Environmental Impact Assessment
EIA Regulations	Environmental Impact Assessment Regulations, 2014
EMF	Environmental Management Frameworks
EMPr	Environmental Management Programme
ERM	Environmental Resources Management

Acronym / Abbreviation	Definition
ESIA	Environmental and Social Impact Assessment
ESP	Electrostatic Precipitator
ETP	Effluent Treatment Plant
GCP	Gas Cleaning Plant
GRDP	Gross Regional Domestic Product
GHG	Green House Gas
GHS	Global Harmonised System
GN	Government Notice
Ha	Hectare
HDPE	High Density Polyethylene
HR	Human Resources
HSA	Hazardous Substances Act
I&APs	Interested & Affected Parties
IBA	Important Bird Area
IDP	Integrated Development Plan
IDZ	Industrial Development Zone
IFC PS6	International Finance Corporation Performance Standard 6
IPCC	The Intergovernmental Panel on Climate Change
ISO	International Organisation for Standardization
Km	Kilometre
ktpa	kilotons per annum
Kv	Kilovolt
LAeq's	A-weighted equivalent sound pressure level
LDV	Light Duty Vehicle
LED	Local Economic Development
LM	Local Municipality
MAE	Mean Annual Evaporation
mbgl	meters below ground level
MES	Minimum Emissions Standards
MHSA	Mine Health and Safety Act
MRA	Mining Right Area
Mt	Million tons

Acronym / Abbreviation	Definition
mtpa	million tons per annum
ML	Million Litres
mm	millimetre
MVA	Mega Volt Amp
MVWA	Medium Velocity Water Spray
MW	Mega Watt
NAAQS	National Ambient Air Quality Standards
NCNCA	Northern Cape Nature Conservation Act
NDCR	National Dust Control Regulations
NDM	Namakwa District Municipality
NEMA	National Environmental Management Act
NEM: AQA	National Environmental Management Air Quality Act
NEM:BA	National Environmental Management Biodiversity Act
NEM:PAA	National Environmental Management Protected Areas Act
NEM: WA	National Environmental Management Waste Act
NFA	National Forest Act
NFPA	National Fire Protection Association
NG	Net Gain
NGO	Non-Governmental Organisation
NHRA	National Heritage Resource Act
NIP	National Infrastructure Plan
NL	Neutral Leaching
NNL	No Net loss
NOX	Nitrous Oxides
NSDP	National Spatial Development Plan
NSSD	National Strategy for Sustainable Development
NWA	National Water Act
PAT	Potassium Antimony Tartrate
PM10	Particulate Matter 10 Microns in size
PPP	Public participation Process
PSDF	Provincial Spatial Development Framework
PV	Photovoltaic

Acronym / Abbreviation	Definition
R-L-E	Roast-Leach-Electrowinning
RO	Return Osmosis
ROM	Run of Mine
SABS	South African Bureau of Standards
SAHRA	South African Heritage Resources Agency
SANP	South African National Parks
SANS	South African National Standards
SDF	Spatial Development Framework
SHEQ	Safety, Health, Environment & Quality
SHG	Special High Grade
SIA	Social Impact Assessment
SLP	Social and Labour Plan
SMME	Small, Medium and Micro-Enterprises
SO2	Sulphur Dioxide
SPLUMA	Spatial Planning and Land Use Management Act
STG	Steam Turbine Generator
STP	Sewage Treatment Plant
t	ton
TCE	Tata Consulting Engineers
tpa	tons per annum
TSF	Tailings Storage Facility
VSD	Variable Speed Drive
WAL	Weak Acid Leach
WML	Waste Management Licence
WRC	Water Research Commission
WUL	Water Use Licence
WQ	Water Quality

1. INTRODUCTION

1.1 PROJECT INTRODUCTION

Black Mountain Mining (Pty) Ltd, part of the Vedanta Zinc International, owns and operates the Gamsberg Zinc Mine. In 2010 Vedanta Resources acquired Black Mountain Mining (Pty) Ltd from Anglo American as part of the acquisition of the zinc base metal mine take over. Following the acquisition of the Black Mountain Mining properties and rights a feasibility and optimisation of technology for the Gamsberg Zinc Mine was done.

The EIA process was completed in 2013 and in 2014 the Gamsberg Zinc Mine received an Environmental Authorisation (Ref: NC/EIA/NAM/KHA/AGG/2012), a Waste Management Licence (Ref: 12/9/11/L955/8); and Water Use Licence (Ref:14/D82C/ABCGI/2654)) for their open pit mining activities and concentrator plant. The Gamsberg Zinc Mine has been in operation since June 2016 and is currently mining up to 4 million tonnes per annum (mtpa) and producing up to 250 000 tonnes per annum (tpa) of zinc concentrate for export.

The mining activities commenced in June 2016 when overburden stripping for the open pit commenced. The mining plan for Phase 1 consisted of three smaller open pits in the footprint of the 10 million ton per annum footprint. Development of the opencast mine and concentrator plant has been done in phases. The construction of the concentrator plant commenced in 2017 with the official opening in February 2019. Phase 2 will expand the mining capacity to 10 million ton per annum (mtpa) open pit.

Black Mountain Mining (Pty) Ltd is now proposing to construct a new zinc smelter and associated infrastructure to produce 300 000 tpa special high grade zinc metal by processing 680 000 tpa of zinc concentrate (Gamsberg Smelter Project). As a by-product 450 000 tpa of 98.5% pure sulphuric acid will be produced for both export and consumption within South Africa.

1.2 SUMMARY OF ENVIRONMENTAL AUTHORISATION REQUIREMENTS

Prior to the commencement of the proposed Gamsberg Smelter Project, Environmental Authorisations are required from the following competent authorities:

- Environmental Authorisation from the Department of Mineral Resources (DMR) in terms of the National Environmental Management Act (NEMA). The proposed Gamsberg Smelter Project incorporates several activities listed in the Environmental Impact Assessment Regulations, 2014 (EIA Regulations): Listing Notice's 1, 2 and 3, published in Government Notice (GN) No. 983, 984 and 985 of 4 December 2014 and amended by GN No. 327, 325 and 324 of 7 April 2017. The EIA regulations being followed in this study are the EIA Regulations, 2014 published in GN No. 982 of 4 December 2014 and amended by GN No. 326 of 7 April 2017.
- A Waste Management Licence (WML) from the DMR in terms of the National Environmental Management Waste Act (NEM:WA). The proposed Gamsberg Smelter Project incorporates waste management activities listed in GNR 921 of 29 November 2013, as amended.
- A Water Use Licence (WUL) from the Department of Water and Sanitation (DWS) in terms of the National Water Act, 1998 (No. 36 of 1998) (NWA). The proposed Gamsberg Smelter Project incorporates water uses in terms of Section 21 of the NWA.
- An Atmospheric Emissions Licence (AEL) in terms of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM:AQA).

A new bulk water pipeline is proposed to replace the existing underground pipeline that was constructed in the 1970's which connects the Gamsberg Zinc Mine and the towns of Pella, Pofadder and Aggeneys as well as farmers along the pipeline route to the existing abstraction point at the Orange River. This pipeline requires replacement (as it is 40 years old) and would not be able to cope with the expected increased demands. The necessary

environmental and water use permits would be applied for under a separate application which will be submitted by Sedibeng Water. The new underground pipeline would pump water into a new 2 ML reservoir at the existing Horseshoe Reservoir (located to the north of the N14, approximately 1 km east of the MRA boundary) from where it would be gravity fed to the smelter complex via an additional section of the new above ground pipeline.

1.3 INTRODUCTION TO THE ENVIRONMENTAL ASSESSMENT PROCESS

An EIA is conducted in two phases. The first is the Scoping phase and the second is the EIA phase. The objectives of the Scoping phase are in line with Chapter 4, Part 3 of the EIA Regulations (2014) as listed below. Details on the EIA phase are provided in Section 7.8 of the Scoping Report.

In the context of the proposed Gamsberg Smelter Project the Scoping phase aims to:

- Identify relevant policies and legislation;
- Motivate the need and desirability of the proposed project;
- Identify and confirm the preferred activity, technology and site;
- Identify the key issues to be addressed in the EIA phase;
- Determine the level of assessment (including specialist investigations) and public participation required; and
- Identify suitable measures to enhance positive impacts and avoid, manage or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

The terms of reference generated for the EIA phase would enable the meaningful assessment of all relevant biophysical and socioeconomic issues.

1.4 STRUCTURE OF THE REPORT

This document has been prepared in accordance with the DMR Scoping Report template format and was informed by the guidelines posted on the official DMR website. In addition, this report complies with the requirements of the NEMA and EIA regulations (2014), as amended. Table 1 provides a summary of the requirements, with cross references to the report sections where these requirements have been addressed.

Table 1 Structure of the Scoping Report

DMR Template Requirements	NEMA: GNR 982, Appendix 2 (As amended)	Section of Report
-	A scoping report must contain the information that is necessary for a proper understanding of the process, informing all preferred alternatives, including location alternatives, the scope of the assessment, and the consultation process to be undertaken through the environmental impact assessment process:	
The EAP who prepared the report; Expertise of the EAP.	(a) details of: (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae;	Section 2
Description of the property.	(b) the location of the activity, including:	Section 2.3

DMR Template Requirements	NEMA: GNR 982, Appendix 2 (As amended)	Section of Report
	(i) The 21 digit surveyor general code of each cadastral land parcel; (ii) Where available, the physical address and farm name; (iii) Where the requirement information in terms (i) and (ii) is not available, the coordinates of the boundary of the property or properties.	
Locality plan.	(c) a plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Section 2.4
Description of the scope of the proposed overall activity, including listed and specified activities; Description of the activities to be undertaken.	(d) a description of the scope of the proposed activity: (i) all listed and specified activities triggered; (ii) a description of the activities to be undertaken, including associated structures and infrastructure.	Section 3
Policy and legislative context.	(e) 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 framework and instruments that are applicable to this activity and are to be considered in the assessment process;	Section 4
Need and desirability of the proposed activity.	(f) a motivation for the need and desirability for the proposed development including the need and desirability of the activity in the context of the preferred location;	Section 5
Period for which the environmental authorisation is required.	-	Section 6
Description of the process followed to reach the proposed preferred site.	(g) a full description of the process followed to reach the proposed preferred activity, site and location of the development footprint within the site, including -	Section 7
Details of the alternatives considered.	(i) details of all the alternatives considered;	Section 7.2
Details of the public participation process followed.	(ii) details of the public participation process undertaken in terms of regulation 41 of the	Section 7.3

DMR Template Requirements	NEMA: GNR 982, Appendix 2 (As amended)	Section of Report
	Regulations, including copies of the supporting documents and inputs;	
Summary of issues raised by I&APs.	(iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Section 7.4
Environmental attributes associated with the sites.	(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 7.5
Impacts identified.	(v) the impacts and risks which have informed the identification of each alternative, including the nature, significance, consequence, extent, duration and probability of such identified impacts, including the degree to which these Section impacts (aa) can be reversed; (ab) may cause irreplaceable loss of resources; and (ac) can be avoided, managed or mitigated;	Section 7.8
Methodology used in determining the significance of environmental impacts.	(vi) the methodology used in identifying and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	Section 7.9
The positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternative will have on the environment and the community that may be affected.	(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 7.10
The possible mitigation measures that could be applied and the level of risk.	(viii) the possible mitigation measures that could be applied and level of residual risk;	Section 7.11
The outcome of the site selection matrix. Final site layout plan.	(ix) the outcome of the site selection matrix;	Section 7.12
Motivation where no alternative sites were considered.	(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such and	Section 7.13
Statement motivating the preferred site.	(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity;	Section 7.14

DMR Template Requirements	NEMA: GNR 982, Appendix 2 (As amended)	Section of Report
Plan of study for the environmental impact assess process;	(h) a plan of study for undertaking the environmental impact assessment process to be undertaken, including:	Section 8
Description of alternatives to be considered including the option of not going ahead with the activity	(i) a description of the alternatives to be considered and assessed within the preferred site, including the option of not proceeding with the activity;	Section 8.1
A description of the aspects to be assessed as part of the environmental impact assessment process	(ii) a description of the aspects to be assessed as part of the environmental impact assessment process;	Section 8.2
Description of aspects to be assessed by specialists.	(iii) aspects to be assessed by specialists;	Section 8.3
Proposed method of assessing the environmental aspects including the proposed method of assessing alternatives.	(iv) a description of the proposed method of assessing the environmental aspects, including aspects to be assessed by specialists;	Section 8.4
Proposed method of assessing significance.	(v) a description of the proposed method of assessing duration and significance;	Section 8.5
The stages at which the competent authority will be consulted.	(vi) an indication of the stages at which the competent authority will be consulted;	Section 8.6
Particulars of the public participation process with regard to the impact assessment process that will be conducted.	(vii) particulars of the public participation process that will be conducted during the environmental impact assessment process; and	Section 8.7
Description of the tasks that will be undertaken during the environmental impact assessment process.	(viii) a description of the tasks that will be undertaken as part of the environmental impact assessment process;	Section 8.8
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.	(ix) identify suitable 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.	Section 8.9
Undertaking regarding correctness of information;	(i) An undertaking under oath or affirmation by the EAP in relation to: (i) The correctness of the information provided in the report; (ii) The inclusion of comments and inputs from stakeholders and interested and affected parties; and (iii) Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	Section 11
Undertaking regarding level of agreement.	(j) An undertaking under oath or affirmation by the EAP in relation to the level of agreement between the EAP and interested and affected	Section 11

DMR Template Requirements	NEMA: GNR 982, Appendix 2 (As amended)	Section of Report
	parties on the plan of study for undertaking the environmental impact assessment;	
Other information required by the competent authority.	(k) Where applicable, any specific information required by the competent authority; and	Section 9
Other matter required in terms of section 24(4)(a) and (b) of the Act.	(l) Any other matter required in terms of section 24(4)(a) and (b) of the Act.	Section 10

2. DETAILS OF THE EAP WHO PREPARED THE REPORT

2.1 CONTACT PERSON AND CORRESPONDENCE ADDRESS

SLR has been appointed as the environmental assessment practitioner (EAP) in line with Part 2, Regulation 12 and 13 of the EIA Regulations (2014), as amended. The details of the EAPs that were involved in the preparation of this Scoping Report are provided in Table 2.

Table 2 EAP Details

Details	Reviewer	Project Manager	Project Support
Name of practitioner	Stuart Heather-Clark	Kate Hamilton	Edwynn Louw
Responsibility on project	Project Director	EAP	Support to EAP
Tel No.:	021 461 1118	011 467 0945	
Fax No.:		011 467 0975	
Postal address	Unit 39, Roeland Square, Cnr Roeland Street and Drury Lane, Cape Town, Western Cape, 8001	PO Box 1596, Cramerview, 2060	
E-mail address	shclark@slrconsulting.com	khamilton@slrconsulting.com	elouw@slrconsulting.com

Neither SLR nor any of the specialists involved in the EIA process have any interest in the project other than contractually agreed payment for consulting services rendered as part of the EIA process.

2.2 QUALIFICATIONS AND EXPERIENCE OF THE EAP

Project Director (Reviewer) – Stuart Heather-Clark

Stuart has over 24 years of environmental and social consulting experience in Africa. Having worked on over 100 development projects in Africa, his key strength is identifying and managing Environmental, Social and Governance (ESG) risks for major capital projects from the concept phase through to the pre-feasibility, feasibility and implementation phases. Stuart has worked across various sectors including oil; and gas, mining, infrastructure and power.

Through leading Environmental & Social Screening Studies, Environmental & Social Impact Assessments and Environmental & Social Due Diligences for major capital project in over 13 African countries; Stuart has

developed a deep appreciation of key sustainability challenges facing development in Africa. He has excellent project management skills with the ability to manage projects from the concept phase through to project completion.

Project Manager: Kate Hamilton

Kate is a Senior Consultant based in Johannesburg and holds an Honours Degree in Environmental and Geographical Science. As a specialist environmental project manager she has over 12 years of private sector experience in Environmental Consulting. Kate has worked as a project manager in environmental management, project management and coordination and environmental monitoring, with a focus in the mining sector. Kate has worked on projects throughout the project lifecycle from exploration/ site identification through pre-feasibility to feasibility, to operation and closure for the mining sector. This includes conducting site screening and scoping studies, baseline studies, impact assessments, monitoring, management planning and implementation, and public consultation processes; for local regulatory permitting processes. Kate has worked extensively in the SADC region and has experience in managing large scale environmental projects with large integrated teams.

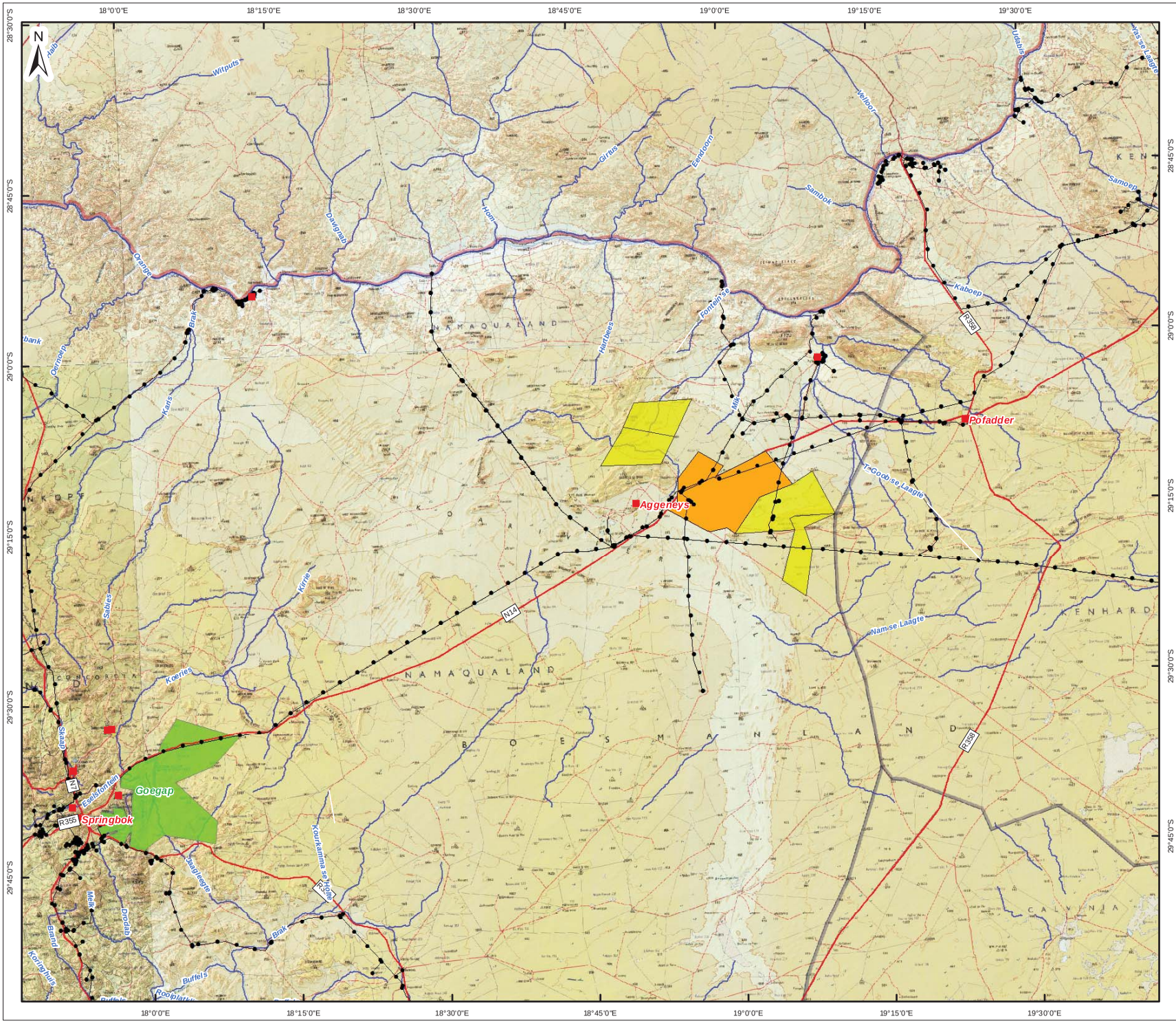
2.3 DESCRIPTION OF THE PROPERTY

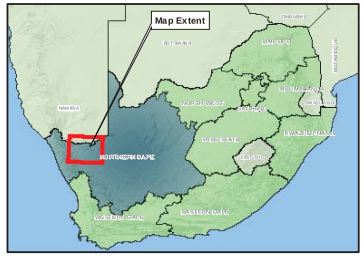
A description of the properties on which the proposed Gamsberg Smelter Project would be located is provided in Table 3.

Table 3 Description of the Property

Description	Detail	
Farm Name	Bloemhoek 61 Portion 1 Gams 60 Portion 1 Aroams 57 RE	
Application area (ha)	A surface disturbance area of approximately 22 ha for the smelter, 21 ha for the secured landfill facility, 15 ha for the laydown area and 12 ha for the business partners camp. A total footprint area of approximately 90 ha would be required. The total Mining Right Area: 9 505.73 ha	
Magisterial district	Namakwa District Municipality Khâi-Ma Local Municipality	
Distance and direction from nearest town	The Gamsberg Zinc Mine is located in the Northern Cape Province of South Africa, approximately 14 km east of the town of Aggeneys and 120 km east of Springbok along the N14.	
21 digit Surveyor General Code for each farm portion	Bloemhoek 61 Portion 1	C05300180000006100001
	Gams 60 Portion 1	C05300180000006000001
	Aroams 57 RE	C053001800000057000RE

2.4 LOCALITY MAP





Legend

- Protected Areas (NBA 2011)
- Gamsberg Nature Reserve
- Main Roads
- Power Line
- Rivers and Streams
- Gamsberg Zinc Mine Property
- Towns/Villages

0 10 20 Kilometers

Scale: 1:600 000
Projection: Transverse Mercator
Datum: Lo 23 WGS 84

Gamsberg Smelter Project

Figure 1
Local Setting

SLR
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Legend

- Gamsberg Zinc Mine Property
- Laydown Area - Area: 15 Hectares
- Business Partner Camp - Area 12 Ha
- Contractors Camp
- Existing Infrastructure
- Existing Concentrator Plant
- Roads

Proposed Infrastructure

- Proposed Bulk Water Pipeline
- Smelter Roads
- Proposed Transmission Line
- 66kv Transmission Line

Alternatives

- Alternative Secured Landfill Site
- Alternative Smelter Complex Locations

0 1 2 3 Kilometers

Scale: 1: 70 000
Projection: Transverse Mercator
Datum: Lo 23 WGS 84

Gamsberg Smelter Project

Figure 2
Proposed Infrastructure Layout Including Alternatives Regional Context

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720.22013.00002 | 2020/01/21

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3. DESCRIPTION OF THE SCOPE OF THE PROPOSED OVERALL ACTIVITY

3.1 LISTED AND SPECIFIED ACTIVITIES

The activities associated with the smelter complex and secured landfill facility are covered in Table 4. The Listed Activities in terms of NEMA (Listing notices 1, 2 and 3 published in terms of NEMA in Government Notices 982, 983, 984 and 985 of 4 December 2014) and NEM:WA (Government Notice 921 of 29 November 2013) associated with the proposed Gamsberg Smelter Project are listed in Table 5 and Table 6. Water uses identified at this stage of the project have been included in Table 6 and Listed Activities in terms of NEM:AQA and the Atmospheric Emissions Licence have been included in Table 7.

Table 4 Activities Associated with the Proposed Gamsberg Smelter Project

Description of Activity	Approximate Aerial Extent of Activity (ha)	Listed Activity and/ or Water Use
Site preparation and construction activities		
Selective clearing of vegetation (in line with a biodiversity management plan to be developed for the project).	Within the footprint of the smelter complex and the secured landfill facility: Approximately 90 ha.	GNR 984 (15) or GNR 985 (12). NEMA GNR 983 (30).
Establishing a Business Partner area.		
Stripping, handling and stockpiling of topsoil (in line with a soil management plan to be developed for the project).		
Cleaning, grubbing and bulldozing activities.		Not applicable
Establishing storm water controls (in line with a Regulation 704 compliant storm water management plan to be developed for the project).		NEMA GNR 984 (6) and (11). NWA 21(b) and 21(g).
Excavations and establishing secured landfill facility.		
Bulk earthworks including foundations, trenches, berms.		Not applicable.
Establishing additional road networks.	New road to secured landfill facility approx. 1 ha.	NEMA GNR 983 (19) and (24). NEMA GNR 985 (4).
Smelter Complex		
General building activities, erection of structures and concrete and steel work associated with infrastructure complexes and the related support facilities (including road development and power supply).	Smelter complex footprint: 22 ha Laydown area: 15 ha Business Partner Camp: 12 ha	Not applicable

Description of Activity	Approximate Aerial Extent of Activity (ha)	Listed Activity and/ or Water Use
Storage of fuel and/ or other hazardous substances. 1 x 30 m^3 diesel storage tank within smelter complex 2 x 3 m^3 diesel storage tanks for emergency generators 4 x 2 800 m^3 tanks for storage of sulphuric acid	Within smelter complex footprint: 22 ha	NEMA GNR 984 (4)
Atmospheric emissions associated with operation of the Smelter.	Smelter complex footprint: 22 ha.	NEMA GNR 983 (34) and NEMA GNR 984 (6). NEM:AQA GNR 893 4.11, 4.14 and 4.16.
Transportation		
Vehicle, machinery and/or material movement within the site boundary.	Restricted to new and existing roads.	Not applicable
Use of access road and public roads for transporting staff, consumables and general/industrial waste.	Restricted to new and existing roads.	
Transportation of product and by-product to port for export.	Restricted to new and existing roads.	
Business Partner Camp		
A new Business Partner camp will be constructed for the Gamsberg Smelter Project.	Camp to be constructed to the north of the N14. Approximately 12 ha.	
Water Supply and Management		
Potable water supply from local municipality.	New bulk water pipeline from Horseshoe Reservoirs to the smelter complex. New bulk water pipeline: additional 5 ha area to be	Not applicable
Process/make-up water supply from local municipality.		NEMA GNR 983 (9) & (45)

Description of Activity	Approximate Aerial Extent of Activity (ha)	Listed Activity and/ or Water Use
	cleared where outside of existing pipeline servitude.	
Treatment and storage of sewage and effluent.	Within overall application area of ~ 90 ha. Increase in sewage treatment plant (STP) capacity from 500 m^3/day by 500 m^3/day to treat a total of 1 000 m^3/day. Effluent Treatment Plant (ETP) will treat approximately 5 000 m^3/day.	NEMA GNR 984 (6).NEM:WA GNR 921 B (7) and (10). NWA 21 (g).
Clean water storage (new concrete reservoir of approximately 10 ML). Water storage below 50 000 m^3.	Within the smelter complex footprint: 22 ha.	NWA 21(b).
Dirty water storage and management.	Water from the STP and ETP would be pumped to the Return Osmosis Plant (RO) for treatment and will be reused in the smelter.	NWA 21 (g)
Storm water management.	Within the smelter complex footprint: 22 ha. Secured landfill facility: 21 ha	NWA 21 (b) and 21 (g).
Dust suppression.	Dust suppression with water is mainly envisaged	Not applicable.

Description of Activity	Approximate Aerial Extent of Activity (ha)	Listed Activity and/ or Water Use
	in the concentrate storage yard.	
Power Supply		
A new 132 kV transmission line would be constructed from the Eskom Aggeneys substation (approximately 20 km west of the Gamsberg Zinc Mine).	Approximately 20 km.	Not applicable.
Two 2 500 kV emergency generators will be installed within the smelter complex footprint.	Within smelter complex footprint: 22 ha.	NEMA GNR 983 (14) or 984 (4)
General and Hazardous Waste Management		
Temporary storage and sorting of general and hazardous waste at a waste/salvage yard for re-use or recycling. Hazardous wastes removed by a licensed contractor within 90 days.	Within smelter complex footprint: 22 ha.	Not applicable.
Management of brine and solids produced by the wastewater treatment plant (WWTP). Effluent Treatment Plant (ETP) and Return Osmosis (RO) Plant also within the smelter complex footprint.		NEM:WA GNR 921 Category B (7) and (10).
Removal of waste by contractor for recycling, re-use or final disposal at permitted waste disposal facilities.		Not applicable.
Secured Landfill Facility		
Return water pipeline from the secured landfill facility.	Approximately 1 km pipeline from secured landfill facility to smelter complex.	NEMA GNR 983 (10)
Disposal of Jarofix to the secured landfill facility.	Approximately 21 ha.	NEM:WA GNR 921 Category B (7) and (10). NWA 21 (c), (i) and 21 (g).

Description of Activity	Approximate Aerial Extent of Activity (ha)	Listed Activity and/ or Water Use
Disposal of ETP Cake to the secured landfill facility.	ETP cake generated would be ~21,000 tpa and would be disposed in the secured landfill facility.	NEM:WA GNR 921 Category B (7) and (10). NWA 21 (c), (i) and 21 (g).

Table 5 Description of the EIA Regulations Listed Activities Being Applied for as Part of the Proposed Gamsberg Smelter Project

Activity No.	Listed activity	Applicability of the activity
NEMA Listing Notice 1, 2014 (GNR 983 in Government Gazette 38282 dated 4 December 2014)		
9	The development of infrastructure exceeding 1 000 metres in length for the bulk transportation of water or storm water— (i) with an internal diameter of 0.36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where - (a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve or railway line reserve; or (b) where such development will occur within an urban area.	A new above ground pipeline of approximately 7 km will be constructed from the Horseshoe Reservoir to the Gamsberg smelter complex.
10	The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes – (i) with an internal diameter of 0.36 metres or more; or (ii) with a peak throughput of 120 litres per second or more excluding where— (a) such infrastructure is for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes inside a road reserve or	New above ground pipeline of approximately 2 km for leachate from secured landfill facility to smelter complex. A new pipeline of approximately 2 km will be constructed from the STP to the ETP for the treatment of water.

Activity No.	Listed activity	Applicability of the activity
	railway line reserve; or (b) where such development will occur within an urban area.	
19	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.	Where the construction of new pipelines, roads and any other construction activities requires crossing of watercourses.
24	The development of a road - (i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or (ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres; but excluding a road - (a) which is identified and included in activity 27 in Listing Notice 2 of 2014; (b) where the entire road falls within an urban area; or (c) which is 1 kilometre or shorter.	Construction of new roads around the smelter complex as well as the new road to the secured landfill facility.
25	The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of more than 2 000 cubic metres but less than 15 000 cubic metres.	Construction and operation of the new ETP and upgrade of the current STP. 5 000 m^3/day effluent generated from the smelter complex to be pumped to ETP for further treatment.
30	Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).	The removal of protected plants and trees may be required.
34	The expansion of existing facilities or infrastructure for any process or activity where such expansion will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution,	The operation of the smelter will require an atmospheric emissions licence (AEL), a Waste Management Licence (WML) and a water use licence (WUL).

Activity No.	Listed activity	Applicability of the activity
	excluding— (i) where the facility, infrastructure, process or activity is 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; (ii) the expansion of existing facilities or infrastructure for the treatment of effluent, wastewater, polluted water or sewage where the capacity will be increased by less than 15 000 cubic metres per day; or (iii) the expansion is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will be increased by 50 cubic meters or less per day.	
45	The expansion of infrastructure for the bulk transportation of water or storm water where the existing infrastructure— (i) has an internal diameter of 0,36 metres or more; or (ii) has a peak throughput of 120 litres per second or more; and (a) where the facility or infrastructure is expanded by more than 1 000 metres in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more; excluding where such expansion— (aa) relates to transportation of water or storm water within a road reserve or railway line reserve; or (bb) will occur within an urban area.	Storm water designs will cater for 1:100 year flood events.
NEMA Listing Notice 2, 2014 (GNR 984 in Government Gazette 38282 dated 4 December 2014)		
4	The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.	1 x 30 m^3 diesel storage tank within smelter complex 2 x 3 m^3 diesel storage tanks for emergency generators 4 x 2 800 m^3 tanks for storage of sulphuric acid
15	The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for—	Approximately 90 ha of indigenous vegetation will have to be cleared for the construction of the smelter complex, secured landfill facility, business partner camp and associated roads and pipelines.

Activity No.	Listed activity	Applicability of the activity
	(i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	
NEMA Listing Notice 3, 2014 (GNR 985 in Government Gazette 38282 dated 4 December 2014)		
4	The development of a road wider than 4 metres with a reserve less than 13.5 metres. g. Northern Cape ii. Outside urban areas: (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas;	New bitumen road of approximately 10 m in width from the smelter complex to the secured landfill facility. The road will be approximately 2 km long. Critical Biodiversity Areas to be assessed during the Biodiversity Specialist Study. Within 5 km from the declared protected area: farms for declared for offset include the neighbouring farm Achab. The Gamsberg Nature Reserve declared under NEMPAA is further than 5km from the Gamsberg Smelter Project.
12	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. g. Northern Cape i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; ii. Within critical biodiversity areas identified in bioregional plans;	Up to 90 ha of indigenous vegetation would need to be cleared for the construction of the smelter complex, secured landfill facility and associated facilities.

Activity No.	Listed activity	Applicability of the activity
NEM:WA Listed Activities (GNR 921)		
Category B		
7	The disposal of any quantity of hazardous waste to land.	Development of the secured landfill facility for the disposal of Jarofix, ETP Cake and precipitated salts from RO plant.
10	The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to associated waste management activity).	The secured landfill facility is being constructed for the disposal of both Jarofix, ETP cake and precipitated salts.

Table 6 Water Uses that Apply to the Gamsberg Smelter Project

Activity No.	Listed Activity	Applicability of the Activity
21 (b)	Storing water	Water would be stored in a 10 ML reservoir to be constructed with the smelter complex.
21 (c)	Impeding or diverting the flow of water in a watercourse	Watercourse crossings may be required for the new road from the smelter to the secured landfill facility as well as crossings for the proposed return water pipeline from the secured landfill facility to the smelter complex.
21 (i)	Altering the bed, banks, course or characteristics of a watercourse	
21 (g)	Disposing of waste in a manner which may detrimentally impact on a water resource	A secured landfill facility will be developed for the disposal of Jarofix and ETP cake which has the potential to leach into underground water sources.

Table 7 NEM:AQA Listed Activities for Atmospheric Emissions Licence (GN 893 in Government Gazette 37054 Dated 22 November 2013. As Amended By: GN 551 In 2015)

Activity No.	Listed Activity	Applicability of the Activity
Category 4: Metallurgical Industry		
4.11	Agglomeration Operations	Production of pellets or briquettes using presses, inclined discs or rotating drums.
4.14	Production and Processing of Zinc, Nickel and Cadmium	The extraction, processing and production of zinc, nickel or cadmium by the application of heat
4.16	Smelting and Converting of Sulphide Ores	Processes in which sulphide ores are smelted, roasted calcined or converted (Excluding Inorganic Chemicals-related activities regulated under Category 7).

3.2 DESCRIPTION OF THE ACTIVITIES TO BE UNDERTAKEN

3.2.1 Current Mining Operations

Gamsberg Zinc Mine

The Gamsberg Zinc Mine is an approved open pit zinc mine and is currently approved to mine 10 mtpa to produce zinc and lead concentrate. The information in Table 8 is sourced from the Environmental Resources Management (ERM) EIA for the Gamsberg Zinc Mine (2013)[1].

Table 8 Gamsberg Zinc Mine Existing Activities

Infrastructure	Description of Activity
Open Pit	The final open pit is expected to cover a total area of 600 ha, which is expected to be the result of the extraction of some 1.65 billion tons of material. The final depth of the open pit is estimated at approximately 650 metres, while the width and length of the pit are expected to extend 2 220 metres and 2 700 metres. The current pit is indicated in Figure 3. Blasting takes place on average once per day with the explosive's magazine situated to the south east of the existing concentrator plant. Hauling of ore to the primary crusher and waste rock to the waste rock dump is undertaken using large capacity haul trucks (typically between 220 t and 300 t capacity).
	 **Figure 3 Current Gamsberg Zinc Mine open pit (North Pit)**
Primary Crusher	Upon stripping of overburden, the ore is transported via haul trucks to the primary crusher located adjacent to the open pit along the northern slope. The bulk ore is

[1] Environmental and Social Impact Assessment Report for the Gamsberg Zinc Mine and Associated Infrastructure in the Northern Cape: FINAL REPORT. Black Mountain Mining (Pty) Ltd. June 2013

Infrastructure	Description of Activity
	transported to the primary crushers that have a total processing capacity of 10 mtpa (currently processing 4 mtpa). From the Primary Crushers the ore is transported to the Run of Mine (ROM) ore stockpile via a conveyor system. Ore is conveyed through a reclaim conveyor to the milling circuit.
Waste Rock Dumps	An estimated 1.5 billion tons of waste rock will be generated during the life of mine. The trucks transport the waste material to the edge of the inselberg where it is tipped over the edge to form a waste rock dump. In order to achieve the natural angle of repose, the footprint of the rock dump is estimated to cover 490 hectares. The current waste rock dumps can be seen in Figure 4.
	 **Figure 4 Gamsberg Zinc Mine waste rock dumps with TSF in the foreground**
Mine Bulk Fuel and Lubricant Storage Facility	The mine bulk storage tank farm is located adjacent to the Mine workshop area. This tank farm stores approximately 500 m^3 of diesel and covers a total area of approximately 2,500 m^2. Approximately 5 000 litres of various grades of lubricants are stored in a bunded area adjacent to the Mine workshop area.
Concentrator Plant	The full production capacity of the mine will be 10 mtpa of ore, the current production capacity is 4 mtpa. The concentrator plant will produce 1.1 mtpa of zinc and lead concentrate. The concentrator processing plant area consists of the following: • Milling circuit; • Ore stockpile; • Flotation; • Dewatering, filtration and zinc concentrate handling; • Tailings facility (see tailings section below); • Material lay down and storage areas; • Bulk storage of diesel and petrol (a total capacity of 100 m^3 of diesel and petrol covering an area of 400 m^2); • Equipment wash areas; and • Additional on-site plant infrastructure.

Infrastructure	Description of Activity
Tailings Storage Facility	The treatment of 10 mtpa ROM ore is expected to lead to approximately 9 mtpa of tailings material (approximately 6.9 million m^3 of slurry containing approximately 4.5 million m^3 of water). The mineral wastes (tailings) are sent to the thickener to reduce the water content and then pumped to the tailings storage facility (TSF) (Figure 5). Percolated water in the tailings dam is extracted, returned to a process plant and re-used in the concentrating process, via a return water dam. Based on the expected production of tailings material, two tailings dams in close proximity on the 290 hectare footprint will be constructed (one of which has already been constructed), with a total storage capacity of 132 million tons. The tailings dam is situated to the north of the N14.
	 **Figure 5 Tailings storage facility July 2019**
Services	Power Supply The current power supply consists of the following infrastructure: • The 220kV/66V substation; • 66 kV/11kV sub-station; and • Two 66 kV distribution lines from Aggeneys to the Gamsberg Zinc Mine.
Water	Water is currently supplied by Sedibeng Water via two existing pipelines from the Orange River. The existing water system has a common intake, low lift pump house and low lift pipeline. The low lift pumping system is feeding two circuits, namely the Black Mountain Mine circuit and the Gamsberg Zinc Mine circuit. Both the circuits consist of a flash mixer, clarifier, dosing system, sludge handling facility, balancing reservoir, high lift pump house, high lift pipelines and Horseshoe Reservoir with associated facilities. The current water demand, with the Black Mountain Mine operation and Phase 1 concentrator plant at Gamsberg, is 28 ML/day, the existing intake water pumping system has been designed for 40.8 ML/day. The existing bulk water pipeline infrastructure running from the Horseshoe Reservoirs to the Gamsberg takeoff covers a distance of approximately 4km and consists of one 400mm diameter underground pipeline and one 400mm aboveground pipeline. A 400mm HDPE diameter aboveground bulk water pipeline runs from the Gamsberg takeoff where the

Infrastructure	Description of Activity
	pipeline splits off from the Main Bulk Water Pipeline to the Gamsberg reservoir (25Ml) extending over a distance of 3km. The water supplied by these pipelines also supplies water to the towns of Aggeneys, Pofadder and Pella on the original Black Mountain Mine underground pipeline. The raw water storage dam at the concentrator plant has a total capacity of 6 800 m^3 and provides water to the plant, mine and fire hydrant systems. A process water dam is fed with recycled water from the plant, treated water and make-up water from the raw water dam and also has a total storage capacity of 25,000 m^3. The sewage treatment plant is also located at the concentrator plant and has a daily processing capacity of approximately 500 m^3/day.

3.2.2 Proposed Gamsberg Smelter Project

Black Mountain Mining (Pty) Ltd is proposing to construct a new zinc smelter and associated infrastructure to beneficiate 680 000 tpa of zinc concentrate produced by the concentrator plant.

The smelter complex would comprise of the following major components (Table 9). These components are discussed in detail in the following sections.

Table 9 Plant Complex Major Components

	Smelter Plant
1	Raw Material storage and handling:
2	Two Roasters, two waste heat recovery boilers, two Steam Turbine Generators (STG), one gas cleaning plant, one acid plant and acid loading section including acid storage tanks
3	Leaching area including calcine silo and manganese removal
4	Purification section
5	Enrichment plant
6	Gypsum removal section
7	Cell house
8	Melting and casting including product storage
9	Zinc dust plant
	Utility Services/Facilities
1	Raw water reservoir, water treatment plant, cooling towers
2	Power supply
3	Effluent Treatment Plant (ETP) and Oxygen/Ozone plant (for Manganese removal)

	Smelter Plant
4	Laboratory
5	Central stores
6	Workshop
7	Plant office
8	Weighbridge
9	Access road
10	Gate house and security
11	Raw water reservoir, water treatment plant, cooling towers and air compressors
	Non Plant Facilities
1	Business partners camp
2	Sewage treatment plant
3	Change house
4	Canteen
5	Fire and first aid station
	Secured Landfill Facility for Waste Disposal and evaporation ponds
	Water supply pipeline
1	Section of pipeline from Horseshoe Reservoirs to Gamsberg Zinc Mine

3.2.3 Smelter Plant

The conventional roast-leach-electro winning (R-L-E) process has been chosen for the production of zinc metal at the Gamsberg Smelter (the alternatives analysis is included in Section 7.1). The full process will involve the treatment of zinc concentrate from the concentrator plant to produce high grade zinc ingots for export. The following sections describe each of the processes within the smelting process. The process flow is summarised in Figure 6.

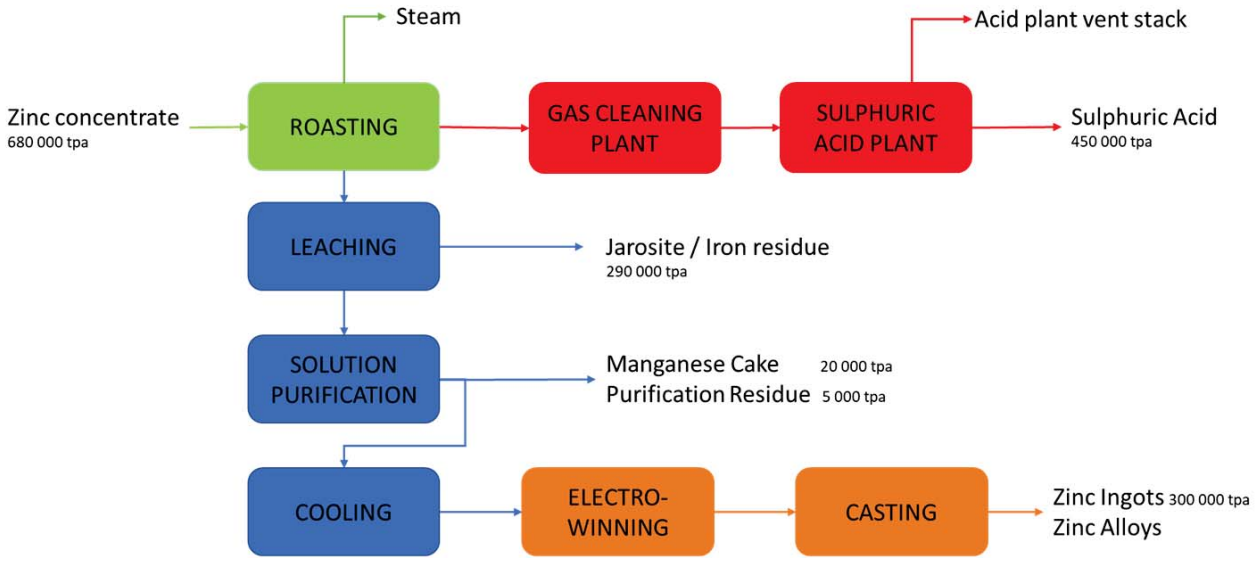

Figure 6 Process Flow Diagram

All technical information in this section was taken from the Tata Consulting Engineers Limited "Pre-feasibility Study Report: 250ktpa Zinc Smelter Refinery with Infrastructure at Gamsberg, South Africa" dated August 2019.

Raw Material Handling and Storage

Zinc concentrate would be transported from the Gamsberg concentrator plant using internal roads by side tipper trucks to the designated stockpiles within the smelter complex footprint (50 trucks per day carrying a volume of 30 tonnes/truck). A total of 680,000 tpa of zinc concentrate from the concentrator plant would be fed into the smelter. Two stockpiles with storage for five days each are proposed. Front-end loaders would then be used to reclaim material from the stockpiles and feed concentrate into the ground hoppers. From the ground hoppers material would be extracted by weigh feeders which in turn would feed the material to the belt conveyor. Zinc concentrate would be transferred into the respective day bins at each roaster plant via a series of conveyor belts. Dross material from the cathode melting and casting process would be added to the feed material before the vibrating screen. Several spraying nozzles in the concentrate storage hall, as well as on the conveying belt before the concentrate feed bin, would moisten the concentrate.

The concentrate composition and particle size is included in Table 10 and Table 11.

Table 10 Major Elements in the Concentrate

Element	Unit	Min.	Max.	Design
Zn	%	48.0	54.0	50.0
Pb	%	0.1	1.0	0.5
SiO2	%	0.5	3.0	3.0
Cu	%	0.2	1	0.3
Pb+Si+Cu	%	0.4	7.7	4.5

Element	Unit	Min.	Max.	Design
Mn	%	2.0	4.5	3.5
Fe	%	9	11	10
S	%	29	34	31
C	%	0.0	0.5	0.2

Table 11 Particle Size Distribution of Concentrate

Size Micron	Gamsberg Cumulative % passing		Design Range	
	Coarse	Fine	Coarse	Fine
500	100.0	100.0	100.0	100.0
300	99.3	100.0	99.3	100.0
75	94.8	100.0	68.0	100.0
53	84.1	99.7	43.0	99.7
38	69.8	98.0	29.0	98.0
25	56.9	81.3	19.0	81.3

Roasting Plant

The roasting plant comprises a number of processes which are discussed in Table 12.

Table 12 Roasting Plant Process

Process	Process Description
Pre-treatment of fine feed material	Gamsberg concentrate is much finer than usual zinc concentrates and requires granulation before feeding to the roaster. During the granulation process concentrate undergoes size enlargement which is facilitated through the addition of water or a purified solution. The size is enlarged to optimum values for fluidized bed processing. Granulator discharge is stored in a buffer bin, which is an integral part of the granulator. The associated weighing belt, conveyor, rotary feeder and slinger feeder distributes granulated material across the furnace bed area.
Roaster	The concentrate is roasted in a fluid bed composed of dead roasted concentrate (zinc oxide - ZnO). Process air is injected to the roaster with the roaster air blower. The process air is controlled via a variable speed drive (VSD) at the blower motor and the adjustable inlet guide vanes (IGV). It serves both as a carrier medium for the fluidized bed and as a source of oxygen for the predominant reaction, which converts zinc sulphide to zinc oxide and sulphur dioxide. The reaction in the roaster is strongly exothermic, and the gases leave the roaster at a temperature of approximately 930 °C – 975 °C and with an SO_2 concentration

Process	Process Description
	of approximately 10% by volume, dry basis. A slight draught suction is maintained at the roaster gas outlet to ensure the safety of the roaster operation and operate the system in slight suction to eliminate dust and SO_2 emissions. The SO_2 blower of the acid plant controls the required draft. Calcine is the metal containing portion of the concentrate after the sulphurous component has been roasted off. Calcine produced at the roasting plant is used as feed material to the leaching plant.
Calcine Discharge System	During normal operation calcine is discharged at the roaster, waste heat boiler, cyclones and the hot electrostatic precipitator (ESP). Calcine from the roaster and waste heat boiler requires primary cooling as well as grinding before feeding to the leaching process.
Waste Heat Recovery Boiler	The hot, dust-laden gas stream leaving the roaster is drawn into the waste heat boiler. A water-tube boiler is installed behind the fluid bed reactor, where the dust-laden and SO_2-containing roaster off-gases are cooled. For the purpose of controlling the bed temperature, the fluid bed roaster comprises a certain number of cooling coils which are connected to the boiler water circulation system. The waste heat boiler is a horizontal-pass boiler directly connected with the gas outlet flange of the roaster. In the boiler, the dust-laden gases are cooled down from roasting temperature to about 350 °C before entering the dust precipitation system. The boiler produces steam in a forced circulation system and is equipped with two circulating pumps. Each pump is capable of handling the maximum rating of the boiler continuously. The stand-by steam-driven circulating pump would start automatically when the electric power supply fails or when the flow of circulating water falls below a pre-set quantity. The water-steam mixture, produced in the forced circulation system, would be separated in the steam drum by means of a demister. The superheated steam collected in the steam drum would then be used in the downstream processing units for heating and also for power generation through steam turbine generator.
Hot Gas Cleaning	The hot gas cleaning consists of the pre-de-dusting cyclone stage and the hot gas Electro static precipitator (ESP). From the exit of the boiler the cooled and dust-laden gas would be guided to two parallel cyclones for pre-de-dusting. Final de-dusting occurs in the hot ESP. Calcine from the de-dusting cyclone and hot ESP proceeds to a series of two rotary valves before reaching the collecting point from where it is stored in calcine silos.
Wet Gas Cleaning	Hot gases containing some dust and fumes would be further cleaned before feeding the gases to the sulphuric acid plant to ensure a quality acid product, eliminate corrosion issues and other issues in the downstream acid plant. In the wet gas cleaning plant, the gases would be processed in the following six stages: the quench tower; the high-efficiency scrubber; the packed gas cooling tower with sodium silicate dosing system; the first stage wet ESP's; the second stage wet ESP; and mercury-removal stage.
Acid Plant	The sulphuric acid (H_2SO_4) plant is designed based on sulphur dioxide (SO_2) feed gas from the roasting and gas cleaning plant. The plant would be based on the double conversion and double absorption (DCDA) process, whereby the converter consists of four beds. In the conversion and acid sections of the plant, the following exothermal chemical reactions take place: a. Conversion of SO_2 to sulphur trioxide (SO_3) (the reaction is performed in the converter in contact with catalyst vanadium pentoxide.); and b. Production of sulphuric acid ($SO_3 + H_2O \rightarrow H_2SO_4$) (the reaction would occur in the interim and final absorption towers).

Process	Process Description
	The following are the main processing units in the acid plant: a. Air filter system and SO_2 blower; b. Converter section with gas/gas heat exchangers; c. Strong acid system: drying and absorption, chemical pure acid production; and d. Acid plant preheating. The purpose of the converter section is to convert SO_2 to SO_3 promoted by a catalyst. This reaction is highly exothermic and follows thermodynamic equilibrium depending on temperature, gas composition and pressure. Excess heat is used to heat up process gas leaving the SO_2 gas blower and intermediate absorption tower. During start-up sequences for heating the plant to reaction temperatures, a preheater system is used to achieve operating conditions in the converter including the heat exchangers. Cold SO_2 containing gas from the outlet of the SO_2 gas blower would be preheated to the required catalytic temperature utilizing existing steam from the various catalytic beds of the converter. The product acid is then cooled and stored in Acid storage tanks for despatch and sale.

Leaching

The feed material to the leaching plant is the metal containing calcine, which is produced at the roasting plant. The main function of the leaching plant is to dissolve and to recover the zinc contained in the calcine as a solid free, pre-purified neutral zinc sulphate solution. The leach residue together with the iron, precipitated as sodium Jarosite, is removed as a cake with an iron content of approximately 25%. The leaching plant is a continuous operating plant and can be divided into the following main units: calcine storage and dosing; neutral leaching (NL); weak acid leach (WAL), manganese removal; conversion section, Jarosite filtration, Jarofix and magnesium removal. These units are discussed in Table 13.

Table 13 Leaching Process

Process	Process Description
Calcine storage and dosing	The storage system consists of two calcine storage silos, one manganese dioxide (MnO_2) bin, one sodium sulphate (Na_2SO_4) bin and one calcine day bin. The calcine storage silos serve as a buffer between the roasting plant and the leaching plant, allowing a roaster shutdown of approximately seven days without disturbing the operation of the leaching section. Calcine produced in the roasting section would be conveyed to the calcine silos by a pneumatic calcine transport system. Chain conveyors and a bucket elevator transport the calcine between the storage bins and the day bin. The bins and conveyors would be connected to the de-dusting units. The extracting of calcine from the day bin would be done with two parallel units, each consisting of a variable speed rotary valve, a weighing belt conveyor and a screw conveyor for controlled addition of calcine. Na_2SO_4 and MnO_2 required for the process are stored in storage bins.
Neutral leaching (NL-)	In the first neutral leaching section, approximately 70% of the total zinc is dissolved. The main aim is to leach the zinc oxide from the calcine and oxidise the ferrous iron to a ferric state. In addition to being an important zinc leaching step, the NL step is also an important purification step. Impurities like iron (Fe), arsenic (As), antimony (Sb) and germanium (Ge) would be precipitated in the last tanks of neutral leaching. NL consists of one receiving tank, five leaching tanks, two thickeners and two thickener overflow tanks. Receiving tanks and

Process	Process Description
	leaching tanks are covered and equipped with agitators and stacks with air ejector fans. Tanks are equipped with injectors for oxygen gas. The last three leaching tanks are equipped with elements for indirect steam heating. The receiving tank and the five leaching tanks would be arranged in a cascade and are interconnected with an overflow launder, so that the solution fed to the first tank would flow using gravity to all the tanks and to the thickener without pumps. The main acid bearing solutions, which would be used to leach the calcine added into the neutral leach step, are the spent electrolyte from the tank house with approximately 180 g/l free H_2SO_4 and the thickener overflows from the WAL step and conversion step (approximately 30-40 g/l free H_2SO_4). The solution mixture from the receiving tank, with a free acidity of about 100 g/l H_2SO_4, flows to the first leaching tank. The acidity would be lowered in the leaching tank series by calcine addition in two steps. The calcine feeding rate is controlled based on the pH readings to maintain acidity in the third tank overflow. The main goal would be to stabilize the final thickener overflow pH to 4.7-5.0 to achieve better settling properties in the thickener. To control the ferrous iron content in the last leaching tank, MnO_2, is added to the launder before the receiving tank. However, MnO_2 dosing would be reviewed due to naturally high manganese levels in the Gamsberg concentrate. Oxygen gas would be injected into the leaching tanks to keep manganese levels below 4 g/l in the electrolyte and to support the ferrous iron oxidation to ferric form in the NL environment. A potassium permanganate ($KMnO_4$) addition facility is also envisaged. In the last leaching tanks, due to the high pH, the ferric iron would be precipitated as iron hydroxide. The suspension would then flows to the NL thickeners (normally in series) for solid liquid separation. To accelerate the separation diluted flocculant would be added to the launder before thickening. Slurry drawn from the thickener underflow would consist mainly of zinc ferrites, some unreacted calcine, insoluble and precipitated iron hydroxides which would then be pumped to the WAL step. The overflows of the two NL thickeners would be collected in two neutral leach overflow tanks from where the solid free neutral solution would be pumped to the next processing step, manganese removal. Flocculant would be prepared in a common area and then supplied to all thickeners in the plant. Flocculant for the conversion area would be prepared using an acidic solution.
Manganese removal	Manganese would be removed from the side stream of spent electrowinning solution by oxidizing with ozone in multiple agitated tanks connected with the overflow launder. Precipitated MnO_2 slurry would flow by gravity to the thickener for solid-liquid separation. Flocculant would be added to accelerate the solid-liquid separation. Overflow from the thickener would then be sent to the electrowinning circulation tank with underflow filtered and washed in a vacuum belt filter. Filtrate and wash water would then be pumped to the electrowinning circulation tank. Ozone is recommended as the method for removing manganese, however, further studies would be carried out to decide upon suitable precipitation process due to the high cost of ozone generation. Other methods of manganese precipitation like SO_2: Air/O_2 and Caro Acid have also been considered. Manganese Dioxide (MnO_2) will be stored as a by-product for sale.
Weak Acid leaching (WAL)	Feed to WAL would be the underflow from the NL thickener. The main function of the WAL step would be to dissolve the remaining zinc oxide, which was not dissolved during NL, and to reach a zinc oxide leaching efficiency of more than 95%. WAL would consist mainly of four leaching tanks, one thickener and one overflow tank. All leaching tanks would be covered and equipped with agitators, indirect steam heating elements and stacks with air

Process	Process Description
	ejector fans. Overflow from the thickener would be pumped to NL and the underflow is pumped to the conversion process.
Conversion process and Jarosite filtration	The main function of the conversion process would be to simultaneously leach the zinc ferrite and precipitate iron as sodium Jarosite. The conversion process consists of ten leaching tanks arranged in series, three counter current decantation (CCD) thickeners, one thickener overflow tank and one condensate tank. Each tank would be covered and equipped with an agitator, a vent stack, an oxygen injector and steam heating elements. WAL underflow would be pumped from the feed launder to conversion tanks along with MnO_2 for iron oxidation and Na_2SO_4 (Soda Ash) for Jarosite formation. In addition to spent acid from the tank house, fresh acid would also be dosed to maintain sufficient free acid for the optimum process conditions. For Jarosite formation the following conditions are required: acidity in the range of 30 to 40g/l, all iron in ferric form, sodium ion concentration in the range of 1-3g/l, a solution temperature 96 °C, a long residence time and Jarosite seeds. The slurry from the magnesium removal plant (vacuum belt filter cake) containing basic zinc sulphate and gypsum crystals, and gypsum removal thickener underflow would be pumped into the launder before the ninth conversion tank to recover zinc and discard solid gypsum along with the Jarosite. The suspension from the last conversion tank would flow via launder to the first thickener for solid-liquid separation. Underflow from the first thickener would then be pumped to the other two thickeners for counter current washing. Overflow from the thickener would be collected in a tank and pumped mainly to NL and the manganese removal plant for re-pulping. The Jarosite slurry collected in the last thickener underflow cone would be pumped to two horizontal vacuum belt filters. Filtrate would then be returned to thickener (and part to manganese removal area). Cake is further re-pulped with process water and sent to the Jarofix section.
Jarofix	In the Jarofix section, Jarosite filter cake is mixed with a lime solution and cement and stored in a curing bay for further disposal in a secure landfill area. Lime solution is provided from the common lime preparation area. The Jarofix section consists of cement silos, a cement extraction system and a paddle mixer for lime and cement mixing.
Magnesium removal	The magnesium removal plant would be required to maintain a magnesium tenor at 10 g/l Mg in process solutions. A fraction of the spent electrolyte from the cell house would be bled off to the effluent treatment section instead of being returned to the leaching plant. This bleed stream would control accumulations of magnesium, other soluble alkalis, halides and sulphate in the recalculating electrolyte. With the Gamsberg concentrate, the magnesium would be the impurity which sets the minimum purge rate. The magnesium removal section would consist of two precipitation tanks, one thickener and one belt filter. The purge stream would be treated with lime for neutralisation of the free acid to create gypsum and to raise the pH to 6.3 to precipitate the zinc as a basic zinc sulphate. This would leave the magnesium in solution as magnesium sulphate along with minor amounts of aluminium, sodium and potassium sulphates. This solution would be combined with the other purge streams for disposal to the effluent treatment plant (ETP). The solids resulting from this precipitation step would contain the basic zinc sulphate and gypsum. The resulting slurry would be sent back to the conversion unit for recovery of the zinc and disposal of the gypsum with the Jarosite residue.

Purification

The purification of the neutral solution would be carried out in two steps: hot purification for the removal of copper (Cu), cadmium (Cd), cobalt (Co) and nickel (Ni) as major impurities and the polishing step to ensure the required quality of the purified solution.

Table 14 Purification Process

Process	Process Description
Hot purification	The hot purification section consists of heat exchangers, seven purification tanks, eight parallel filter presses and reagent preparation and dosing systems. The solution would be heated up using a heat exchanger to around 87°C and fed into purification tanks. The pH-control in the hot purification tanks would be done by increasing or decreasing the addition of spent electrolyte into each tank. To improve the precipitation of the impurities, the filter cake from the polishing step is recycled to the hot purification step. The zinc dust (purification reagent) for the sedimentation reaction in the purification tanks would be delivered from the zinc dust plant. To improve the reactivity of the zinc dust, copper sulphate and potassium antimony tartrate (PAT) is added. The amount of copper and antimony added to the first hot purification tank would be such as to obtain a copper and antimony concentration of 30 to 40 ppm and 0.5 to 1.0 ppm respectively. Copper sulphate ($CuSO_4$) and antimony PAT would be mixed with water in the reagent preparation tanks. This Cu and Sb solution would then be pumped into the feed launder. Charcoal is added to remove organic components such as oil from the solution. Pressure filters would be fed from the last purification tank to remove cemented impurities and excess zinc dust from the solution. Filtrate would then be sent to the polishing step and re-slurried cake sent to the enrichment step.
Polishing	In the polishing step, mainly cadmium that may have slipped through in the purification step, would be removed. The polishing step consists of mainly, zinc dust dosing systems, four purification tanks, and seven chamber filter presses. The pre-purified solution (filtrate from the hot purification filter presses) flows via the launder to the first polishing step by gravity. The process temperature for the polishing step is approximately 70-82°C. No heating or cooling of the solution is required. After the polishing step tanks, the solution containing cemented Cd and Cu as well as some excess zinc dust is filtered in pressure filters. Cleaned filtrate would then be sent to the filtrate tanks for further pumping to the cooling towers. The filter cake collected in the polishing filter presses would mainly consist of Zn dust and some minor amounts of Cd and Cu which would be returned to the hot purification step. A separate Cu removal system from the Cu cake is envisaged to produce saleable grade $CuSO_4$ solution for use in the concentrator plant.

Enrichment Plant

The enrichment plant would be designed to recover as much of the Zn as possible from the hot purification filter press cake and to keep all other unwanted impurities in the cake. The amount of treated cake will depend on the impurities content of the calcine leached in the leaching section. The enrichment unit consists of four leaching tanks, a sodium hydroxide (NaOH) solution tank and four filter presses. The leached cake will be filtered and washed and stored. Filtrate is then returned to the hot purification for conversion.

Gypsum Removal

Gypsum removal would be required to purge calcium from the electrolyte circuit and control the build-up of gypsum in the cell house and leaching plant equipment. The neutral solution that is saturated with gypsum will be cooled in three atmospheric cooling towers from 86°C to 34°C. This causes crystallization of gypsum from the solution. The gypsum would then be then removed in a thickener. The thickener overflow would be taken to the purified solution storage tanks and the underflow pumped to the conversion process.

Cell House

In the cell house the Zn from the purified solution would be deposited as metallic zinc on the aluminium cathodes. This cathode Zn is then removed from the cathodes and sent to the melting and casting plant where the cathodes are melted and cast to special high grade (SHG) zinc ingots. To have a production buffer between leaching electrolysis plant sections, four solution storage tanks are proposed, two for purified solution and two for spent electrolyte. The tank house would consist of the following electrolyte circulation systems:

- Electrolytic cells, each equipped with aluminium cathodes and lead silver anodes;
- Electrolyte return launder system;
- Concrete electrolyte circulation tanks each equipped with circulation pump and spent transfer pump;
- Atmospheric cooling towers;
- Electrolyte feed launder system;
- Transformer rectifier with the corresponding bus bar system;
- Electrode handling system consisting of cathode stripping, anode cleaning and flattening;
- Reagent preparation station; and
- Cell cleaning system.

The purified, loaded electrolyte produced in the leach/purification process would be fed to the circulating stream of Zn electrolyte to replenish Zn in solution at a rate equal to that being plated. Heat generated by the electrolytic process would be transferred to the electrolyte as it passes through the cells and evaporative cooling towers to maintain the solution temperature at 38°C. Spent electrolyte would be withdrawn from the circuit and pumped to the leaching plant to balance purified solution inflows and to meet leaching needs.

Each pair of rows would be equipped with a fully automated crane for the removal and replacement of cathodes for stripping for Zn deposits. Each crane would also remove and replace the anodes for cleaning. The anode cleaning and straightening system would consist of the following main equipment:

- Stripping crane
- Anode shuttle car;
- High pressure water supply unit;
- Anode lift and flattening machine;
- MnO_2 separator (classifier);
- MnO_2 ball mill;
- Pump sump for MnO_2 slurry; and
- MnO_2 slurry buffer tank.

The cathode handling and stripping equipment would consist of:

- Full automatic stripping cranes;
- Full automatic cathode stripping machines. The cells would be cleaned periodically to remove manganese dioxide sludge from the bottom. This sludge would be combined with the anode cleanings and washed to remove entrained electrolyte. The sludge would be removed in tote bins for disposal. Three different chemical reagents would be added to the electrolyte circuit to improve the cathode zinc quality. The following reagents would be added:

Strontium carbonate- precipitates dissolved lead thus reduces lead in the cathode zinc;

Liquorice- liquorice solution would be added as a foam builder to reduce the acid mist in the tank house atmosphere; and

Gelatine- gelatine solution would be added as an impurity suppressor.

Melting Casting

Cathode zinc from the cell house would be melted using three induction furnaces (one alloy furnace). Molten metal would be withdrawn from the furnaces by centrifugal pump to the continuous casting section which would consist of two slab ingots casters and one jumbo caster or continuous galvanizing grade (CGG) jumbo ingots. The ingots would be automatically stacked into bundles and strapped for shipment. Forklift trucks would be used to move the bundles to temporary storage facilities and into trucks for shipment. Dross would be skimmed from the top of the metal bath into bins and transported to the dross separation facility. The zinc dross would be charged into ball mills to separate the metallic fraction of the dross from the powdery oxidised material. Metallics would be returned to the melting furnaces and the oxide transported to the concentrate handling section for retreatment in the roaster.

Zinc Dust Plant

The zinc dust plant would be designed to produce the zinc dust (fine and coarse) form zinc slabs, which would be required at the purification plant. This plant would be an integrated with the melting and casting plant and would consist of induction furnaces, atomizing furnaces, double expansion chamber/ bin, double deck zinc dust screen and two Zn dust bins (one for coarse and one for fine dust).

3.2.4 Wastes and By-Products Generated by the Smelter Process

The wastes and by-products generated during the smelting process have been summarised in Table 15 and Table 16 respectively.

Table 15 Wastes Products Generated

Waste types	Volume (tpa)	Disposal
Fe cake stabilized (dry), Jarofix	290 000	SLF
ETP cake (dry)	24 000	SLF
Evaporation pond salts, (dry)	67 000	SLF
Cell house sludge (dry)	1 800	SLF

Table 16 By-products for Sale

By-products	Volume (tpa)	Disposal
Manganese cake (dry)	17 500	Sale
Cu-Cd cement (dry)	2 600	Sale
Co-Ni cement (dry)	410	Sale
Sulphuric Acid (wet)	545 000	Sale

3.2.5 Utility Services/ Facilities

Water Supply

Water Demand

Water required for the Gamsberg Smelter Project, would include water for the process plant, drinking, sanitation and other miscellaneous uses such as the canteen, safety showers, etc. The individual water demand for the various consumers, the existing Gamsberg Zinc Mine activities including the concentrator plant as well as the proposed smelter complex and all associated activities is presented in Table 17**.** The figures indicated for the towns of Aggeneys, Pofadder and Pella have considered the increased demand due to the existing and future developments, including the Phase 2 expansion of the Gamsberg Zinc Mine concentrator plant and the Gamsberg Zinc Smelter (this project).

Table 17 Demand in ML/Day for Existing and Proposed Plant

Consumers	BMM Operations		Gamsberg Operations		
	1.6 MTPA (Existing)	2.0 MTPA (Future)	Concentrator-1 (Existing)	Concentrator-2 (Future)	Smelter-1 (This Project)
Plant	3	0.5	7	6	8
Mining	3	0.5	2	1.5	
Aggeneys town	4		0.75	0.6	1.5
Pofadder town	1			0.2	0.5
Pella town	3			0.2	0.2
Total average	14	1	9.75	8.5	10.2
Total Cumulative	14	15	24.75	33.25	43.45

Plant Water System

Water received from Horseshoe Reservoir (as supplied from Sedibeng Water) would be treated with sodium hypochloride in the new water treatment plant located on the north west side of the smelter complex. Water would be conveyed from Horseshoe Reservoir by a gravity fed pipeline. The water treatment begins in the Clarified Water Reservoir, which would be a concrete reservoir of approximate 10 ML capacity (equivalent to one day's water requirement). The various water supply and treatment components of the smelter complex are further described in Table 18.

Table 18 Plant Water System

Water System	Water System Description
Make Up Water System	It is envisaged that the makeup water for the process plant would be taken from the Clarified Water Reservoir.
Cooling Water System	Four separate cooling water circuits (CT-1, CT-2 & CT_3) for roaster-1 and roaster-2 and the CT-4 circuit for melting, casting, purification and other miscellaneous areas have been considered. The cooling water recirculation circuit would consist of a cooling tower, cold water basin; cooling water feed pumps and other necessary arrangements.
Demineralised Water System	Demineralised (DM) water is required for the Waste Heat Recovery Boiler. The DM water unit would consist of an ultra-filtration module, cartridge filter, return osmosis (RO) module, degasser unit, mixed bed filter, necessary pumps and intermittent storage tanks. The DM water unit would be fed water from the plant filter water reservoir .
Potable Water System	The potable water system would consist of a dual media filter, filtered water storage tank, sodium hypochlorite dosing system for disinfection and two drinking water supply pumps. Potable water would be supplied via pumps and piping network for use in the ablutions, for drinking, washing and other uses in the office, canteen and kitchen as well as for use in safety showers.
Storm Water	Storm water drains would be constructed within the smelter complex as well as alongside the roads whereby clean and dirty water can be separated. Clean water cut-off drains would be constructed to divert clean water runoff around the plant area into natural water courses. All plant runoff would be collected in drains and discharged through a silt trap to the storm water pond located to the south of the smelter complex at a lower contour for easy flow of storm water, from where it would be pumped out to a process water dam (details to be finalised but will be based on the 1:100 year rainfall event) as and when required. The storm water pond would be trapezoidal in shape and constructed using soil. Adequate lining, most likely a concrete slab but still to be confirmed, would be provided to prevent leakage of water into the ground.
Fire Water System	A dedicated storage volume equivalent to 2 hours pumping capacity would be kept in the plant site storage reservoir for the fire water system. The fire water system would be provided with pumps, piping network and other associated facilities as per the appropriate National Fire Protection Association (NFPA)/ South African National Standards (SANS) codes. An external fire hydrant system would be provided around all buildings/ facilities. Internal hydrants would also be provided for multi-storied buildings and basements. An Automatic High Velocity Water Spray (HVWS) system would be provided to protect large oil filled transformers. Generally, the oil filled transformers with a capacity of 10 MVA and above or oil storage capacity of more than 2 000 litres would be protected by a HVWS system. A Medium Velocity Water Spray (MVWS) system would be provided for hydraulic/ lubricating oil cellars and major cable vaults in electrical buildings. Water-based automatically activated medium expansion foam-based protection systems would be provided for oil storage tanks. An inert gas flooding system would be provided for server rooms/ PLC rooms/ battery rooms and chemically corrosive areas. Portable fire extinguishers would be provided inside all buildings.

Effluent Treatment Plant

The effluent treatment plant (ETP) would be located on the western side of the smelter complex as the salts/ ETP Cake (Table 15) from the ETP would be dispatched to the secured landfill facility which would be located approximately 1 km to the west. Water from the ETP would be recycled into the smelter complex for re-use.

Sewage Treatment Plant

The sewage treatment plant has been planned in conjunction with the existing sewage treatment plant built for the concentrator plant. The existing sewage treatment plant is a modular unit and can thus be expanded as necessary. The current volume of sewage being treated at the sewage treatment plant is 500 m^3/day. The capacity would be doubled to 1 000 m^3/day for the proposed Gamsberg Smelter Project. The wastewater from toilets from the various buildings would be collected in the inspection chambers, constructed outside the buildings and would be transferred to the sewage treatment plant through underground sewer pipes. After treatment in the sewage treatment plant, treated sewage water would be used for the gardens, horticulture and dust suppression, both in the smelter complex and the construction camp area.

Compressor Room

The compressor room is located in the north eastern section of the smelter complex and would be a steel structural building with an approximate area of 200m^2.

Laboratory

No separate building has been envisaged for the laboratory. This facility would be housed inside the leaching, purification and utility substation premises.

Central Stores

The central stores would be located on the north eastern side of the smelter complex to enable efficient movement of vehicles carrying materials to and from the stores. The central stores would be used for keeping small items of equipment, spare parts, auxiliary and consumable materials. This would be a steel structural building with an area of approximately 800 m^2. An adjacent open storage area of 400 m^2 has also been considered. Storage of materials with a potential for soil contamination would be on paved surfaces while storage of items unlikely to result in contamination would occur on unpaved surfaces e.g. pipes etc.

Reagent Stores

Reagent stores will be located within the smelter complex and will have a footprint of approximately 100 m^2. Wet and dry reagents will be stored in this area.

Workshop

The workshop would also be on the north eastern sides of the smelter complex and would be used for machinery repairs. The workshop would have an approximate covered area of 450 m^2.

Plant Office

No separate plant office building has been considered. The office would be approximately 450 m^2, located on the ground floor of the leaching, purification and utility substation premises.

Weighbridge

One weighbridge for the weighing of concentrate, finished product vehicles, store material vehicles etc. would be placed near the entry gate and would fall within the smelter complex footprint.

Access Roads

The approach road to the smelter complex would be the existing approach road connecting the N14 to the concentrator plant and the Gamsberg Zinc Mine itself. The road network within the smelter complex would

consist of varying materials depending on the vehicular traffic requirement. The road leading to the secured landfill facility would be a bitumen road of approximately 10 m in width.

Gate House and Security Office

The security and induction building is located adjacent to the main gate of the smelter complex and would consist of a security office, control room, guard room, induction room and visitor's room. The area of the security and induction building is approximately 240 m^2 and falls within the smelter complex footprint.

The security office with security check area and turnstile gate facilities would be located at the main gate of the smelter complex on the south east side. The change room would be located next to the entry gate. Separate gates for the movement of heavy vehicles and Light Duty Vehicle (LDV)/ cars would be provided adjacent to each other. The heavy vehicle gate would be 10 m wide and the LDV gate would be 8 m wide. Personnel entry to the smelter would be through the security office only. Another gate of 10 m width would be installed leading to the secured landfill facility to the south west of the smelter complex. Chain linked barbed wire fencing at a height of 1.5 m would be erected around the perimeter of the smelter complex. The total area within the smelter complex fencing would be 22 ha.

CCTV monitoring at strategic locations is foreseen for surveillance of the smelter complex and human movement in and around the site.

Canteen

One canteen has been planned with a kitchen facility. The canteen would be single storey building with an area of approximately 800m^2 and would have a dining capacity for 350 people. The canteen would be positioned in the central part of the smelter complex.

3.2.6 Facilities Outside the Smelter Complex

New Bulk Water Pipeline

A new aboveground 630 mm HDPE pipeline would be laid down from the Horseshoe Reservoirs to the proposed new 10Ml reservoir to be placed within the smelter complex. The proposed new pipeline section will be approximately 7km long (Figure 2).

Plant Power Requirements

The estimated power demand for the 300 ktpa smelter including infrastructure and other utility loads are as follows:

- Maximum demand: 150 MW; and
- Maximum demand: 158 MVA (with 0.95 power factor).

The ESKOM grid substation nearest to the plant site is the 400/220/66 kV Aggeneys substation. This substation is currently being fed from the Eskom Aries substation through a 400 kV single circuit twin conductor transmission line. Eskom is planning to install another 400 kV incoming line to the Aggeneys substation to strengthen the substation with added capacity and reliability. At this substation, 400 kV is stepped down to 220 kV and 66 kV levels through suitably sized transformers to feed other substations/consumers.

A new 132 kV power line would be constructed by Black Mountain Mining (Pty) Ltd from Eskom's Aggeneys substation (approximately 20 km west of the Gamsberg Zinc Mine) to supply the increased power demands for the operation of the smelter. The new transmission lines would be largely within the existing servitude of both the existing 400 kV and the 66 kV transmission lines. The 66 kV transmission line currently supplies the Gamsberg Zinc Mine. A new switch yard would be required within the Aggeneys substation to facilitate the new approved (ERM, 2013) 132 kV transmission line which would require an increase in the current footprint of the substation. The transmission line would enter the smelter complex from the south west. Accordingly, the switch yard at the

smelter complex would be located on the south side of the smelter. The Cell House, which would be the largest consumer of power, would be located adjacent to the switch yard.

Power distribution for the smelter complex is proposed at the 11 kV level. The 132 kV power supply received at the plant substation would thus be stepped down to 11kV and an 11 kV switchboard would be formed for the distribution of power to the downstream 11 kV switchboards for the following plant units:

- Cell House;
- Roaster-1 including material handling;
- Roaster-2 including material handling; and
- Leaching and purification.

Power generation from the Waste Heat Recovery Boilers during roaster operation would be directly fed to the 11 kV Roaster-1 and 2 switchboards.

The emergency power system, required in the event of grid power failure, would provide an alternate source of power to essential processes and auxiliary loads. In addition, emergency power would be made available for critical lighting. Emergency loads are proposed to be supplied from two 2 500 kVA emergency diesel generator sets. The actual capacity of diesel generator set would be decided during the engineering stage. Emergency fuel for the generators will be stored next to the generators in fuel bowsers and will consist of two 3 m^3 storage tanks.

Business Partner Camp

The business partner camp would consist of worker's, supervisor's and manager's accommodation. These buildings would be temporary porta-cabin type.

Laydown Area

The space for the construction office and storage area would be provided within a boundary fence demarcating the laydown area to the south of the smelter complex. The laydown area would have a footprint of approximately 15 ha.

Change House

One change house has been planned to be installed for the smelter. The change house would consist of an area of about 1 300 m^2 with separate change rooms for males and females including; showers, toilets, laundry (wash and dry) and an equipment room (heating/ pumps).

Fire and First-Aid Station

No separate building has been envisaged. The Fire and First-Aid station for the Phase 1 Concentrator would be used.

3.2.7 Secured Landfill Area for Waste Disposal

The preferred location of the secured landfill facility with respect to the Smelter is shown in Figure 2. The secured landfill facility is planned to be approximately 1 km to the west of the smelter complex and would be connected by a paved/ bitumen road for the transportation of the Jarofix and ETP cake for disposal. The initial design of the secured landfill facility would be sized based on the generation of Jarofix for the first 5 years. The total design will accommodate 15 years of disposal in cells with lifespans of about 5 years each such that the first cell can be closed when the advanced Fumer technology becomes viable. The Fumer technology would oxidize, and thus stabilise, the Jarosite to a product that would not leach and could be used for road construction or in cement industry.

3.2.8 Pre-Construction and Construction Phases

The pre-construction phase will consist of the following activities:

- Selective clearing of vegetation (in line with a Biodiversity Management Plan to be developed for the project which in turn will be aligned with the overarching Gamsberg Biodiversity Action Plan);
- Establishing a construction Business Partner' area;
- Stripping, handling and stockpiling of topsoil (in line with a Soil Management Plan to be developed for the project);
- Cleaning, grubbing and bulldozing activities;
- Establishing storm water controls (in line with a Regulation 704 compliant Storm Water Management Plan to be developed for the project);
- Excavations and establishment of reservoirs;
- Bulk earthworks including foundations, trenches and berms;
- Establishing new access roads; and
- General building activities, erection of structures and concrete and steel work associated with infrastructure complexes and the related support facilities (including road development and power supply).

Employment Opportunities

The number of employment opportunities to be generated during the construction phase will be approximately 6 000.

Construction Schedule

Construction of the smelter complex would take 22 months and it would take approximately four months for commissioning.

Construction Water Requirements

Water for the construction phase will be provided from the existing pipelines supplying water to the Gamsberg Zinc Mine and the Concentrator.

Construction Power

Four to five 11/0.4kV mini-substations in a ring main configuration would be used for the distribution of construction power. Construction power would be tapped from the existing 11kV overhead power line which runs in between the existing concentrator plant switchyard and the existing Tailings Storage Facility (TSF) (north of the N14).

3.2.9 Operational Phase

Employment numbers

Approximately 1 200 jobs would be generated during the operational phase.

Life of Smelter

The smelter is currently planned to be operational for a period of 15 years in alignment with the Life of Mine.

Operational hours

Once the smelter complex has been commissioned the smelter will operate 24 hours per day, 365 days per year.

3.2.10 Decommissioning and Closure

Broadly speaking, the decommissioning phase would include the removal of infrastructure from site and the final rehabilitation of areas. In consultation with I&APs (especially nearby landowners) and the authorities the final post closure land use would be identified during the Environmental Impact Assessment (EIA) process. This will be aligned with the mine closure objectives already developed for the Gamsberg Zinc Mine.

An updated closure plan would be included in the EIA in line with the requirements of the NEMA EIA Regulations, 2014 (as amended) and Financial Provisioning Regulations, 2015 (GNR.1147 of 2015).

4. POLICY AND LEGISLATIVE CONTEXT

This section outlines the applicable key legislative requirements being considered for the project (Table 19).

Table 19 Policy and Legislative Framework

Applicable legislation and guidelines used to compile the report	How does this development comply with and respond to the policy and legislative context
The South African Constitution, 1996	The proposed Gamsberg Smelter Project must comply with South African constitutional and common law by conducting its construction and operational activities with due diligence and care for the rights of others. Section 24 (a) of the South African Constitution states that everyone has the right to an environment that is not harmful to their health and well-being. This provision supersedes all other legislation.
Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) and Regulations, as amended.	A Section 102 Amendment will be applied for in terms of the MPRDA.
Mine Health and Safety Act, 1996 (Act No. 29 of 1996)(MHSA) and Regulations.	Smelter operations will be governed by the MHSA and associated Regulations.
National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as amended	An integrated NEMA and NEM:WA application will be undertaken and submitted to the Department of Mineral Resources (DMR) (this document and process).
Environmental Impact Assessment Regulations, 2014 (EIA Regulations 2014) and Environmental Impact Assessment Regulations Listing notices 1, 2 and 3 published in terms of NEMA in Government Notices 982, 983, 984 and 985 of 4 December 2014 (as amended by Government Notices 324, 325, 326 and 327 of 7 April 2017)	
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA)	
List of Waste Management Activities published in terms of NEM:WA in Government Notice 921 of 29 November 2013 (as amended)	
Waste Classification and Management Regulations published in terms of NEM:WA in Government Notice 634 of 2013	As from 8 December 2014 Government implemented the One Environmental System. As a result, residue stockpiles and residue deposits are no longer excluded from the ambit of the NEMWA. Accordingly, the aforesaid Regulations find application to all waste types generated at the Gamsberg Zinc Mine including residue to be generated as part of the proposed Smelter operations.
National Norms and Standards for the Storage of Waste, published in terms of NEM:WA in Government Notice 926 of 2013	These regulations have informed project planning and will be taken into account in the assessment and management of waste for the project.
National Waste Information Regulations published in terms of NEM:WA in Government Notice 625 of 2012	

Applicable legislation and guidelines used to compile the report	How does this development comply with and respond to the policy and legislative context
National Norms and Standards for the Assessment of Waste for Landfill Disposal, published in terms of the NEM:WA in Government Notice 635 of August 2013	
Regulations pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations, published in terms of NEMA in Government Notice 1147 of 2015 (as amended)	These regulations will inform the financial provisioning for the project.
Guideline on the Need and Desirability, Department of Environmental Affairs, 2017	This guideline has been taken into account as part of project planning.
Public Participation guideline in terms of NEMA EIA Regulations, Department of Environmental Affairs, 2017	This guideline has informed the public participation process for the project.
National Guideline on minimum information requirements for preparing Environmental Impact Assessments for mining activities that require environmental authorisation, published in terms of NEMA in Government Notice 86 of 2018	This guideline has been taken into account as part of project planning.
National Water Act, 1998 (Act No. 36 of 1998) (NWA) The regulations in terms of section 26 read in conjunction with section 12a of the water act, 1956 (Act No. 54 of 1956)	The existing water use licence authorising the Gamsberg Zinc Mine project was issued on 30 September 2014 and subsequently amended in 2016. The water use licence authorises the (i) storing of water (ii) impeding or diverting the flow of water in a watercourse (iii) disposing of waste in a manner which may be detrimental to a water resource and (iv) removing, discharging or disposing of water found underground. The new Water Use Licence Application will cover Section 21 (b) storage of water, Section 21 (c) impeding or diverting the flow of water in a watercourse, Section 21 (i) altering the bed, banks, course or characteristics of a watercourse, and Section 21 (g) disposing of waste in a manner which may detrimentally impact on a water resource.
National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM:AQA) List of Activities which Result in Atmospheric Emissions, published in terms of NEM:AQA in Government Notice 893 of 2013 (as amended)	The project will trigger Minimum Emission Standards (MES). The MES of concern for the project include: Category 4: Metallurgical Industry Subcategory 4.11 – production of pellets or briquettes using presses, inclined discs or rotating drums.; Subcategory 4.14 – the extraction, processing and production of zinc, nickel or cadmium by the application of heat; and Subcategory 4.16 – processes in which sulphide ores are smelted, roasted calcined or converted (excluding Inorganic Chemicals-related activities regulated under Category 7).

Applicable legislation and guidelines used to compile the report	How does this development comply with and respond to the policy and legislative context
National Ambient Air Quality Standards (NAAQS), published in terms of NEM:AQA in Government Notice 1210 of 2009	National Ambient Air Quality Standards (NAAQS) are available for inhalable particulate matter less than 2.5 µm in diameter (PM2.5) as gazetted on 29 June 2012 (no. 35463), inhalable particulate matter less than 10 µm in diameter (PM10), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), carbon monoxide (CO), lead (Pb) and benzene as gazetted on 24 December 2009.
National Dust Control Regulations, published in terms of NEM:AQA in Government Notice 827 of 2013	South Africa's Draft National Dust Control Regulations were published on 27 May 2011 with the dust fallout standards passed and subsequently published on the 1st of November 2013 (Government Gazette No. 36974). These are called the National Dust Control Regulations (NDCR). The purpose of the regulations is to prescribe general measures for the control of dust in all areas including residential and light commercial areas. The regulation also specifies that the method to be used for measuring dust fall and the guideline for locating sampling points shall be ASTM D1739 (1970), or equivalent method approved by any internationally recognized body. It is important to note that dust fall is assessed for nuisance impact and not inhalation health impact.
Regulations regarding Air Dispersion Modelling	Air dispersion modelling provides a cost-effective means for assessing the impact of air emission sources, the major focus of which is to determine compliance with the relevant ambient air quality standards. Regulations regarding Air Dispersion Modelling were promulgated in Government Gazette No. 37804 vol. 589; 11 July 2014, (DEA, 2014) and recommend a suite of dispersion models to be applied for regulatory practices as well as guidance on modelling input requirements, protocols and procedures to be followed. The Regulations will be applied to the development of the EIA.
National Greenhouse Gas Emission Reporting Regulations, published in terms of NEM:AQA in Government Notice of July 2017 National Pollution Prevention Plans Regulations, published in terms of NEM:AQA in Government Notice of July 2017	A Climate Change study will be undertaken to assess the carbon footprint from the Smelter as well as an analysis of greenhouse gas (GHG) emissions. Carbon tax regulations applicable for direct emissions associated with the Smelter.
Hazardous Substances Act, 1973 (Act No. 15 of 1973) (HSA)	This Act will inform the planning, assessment and management of hazardous substances associated with the project.
National Forest Act, 1998 (Act No. 84 of 1998) (NFA)	Insofar as the clearance of the footprint area for the smelter complex and the secured landfill facility requires that protected trees be removed, Black Mountain Mining (Pty) Ltd will have to obtain a licence from the Minister responsible for environmental affairs.
National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003) (NEM:PAA) National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	The Gamsberg Zinc Mine is situated in the Bushmanland Inselberg area (39 403 ha) that includes 429 fauna and flora species of which 67 are unique to the area and 87 are classified as globally threatened (BMM Biodiversity Management Plan, 2015). The Bushmanland Inselberg Region has been earmarked since the 1990s for protected

Applicable legislation and guidelines used to compile the report	How does this development comply with and respond to the policy and legislative context
(NEM:BA) and Regulations on Threatened or Protected Species and on Alien Invader Plants	area development. The National Protected Area Expansion Strategy identifies this region as a national priority area. A permit will be required if the removal of listed threatened or protected species is required.
Alien and Invasive Species List, Government Notice 864 of 2016 Mining and Biodiversity Guideline (2013) Draft National Biodiversity Offset Policy, 2017	The Act, regulation and guideline have informed project planning and will be taken into account in the assessment and mitigation of impacts. Depending on residual impacts after mitigation within critical biodiversity areas or highly sensitive biodiversity features, biodiversity offsets may need to be specified.
National Heritage Resource Act, 1999 (Act No. 25 of 1999) (NHRA)	SAHRA previously issued comment in terms of Section 38(5) of the NHRA Doc. Ref: 9/2/066/0001) where they stated that the mining of zinc ore itself will not impact on any significant fossil resources.
Spatial Planning and Land Use Management Act, 2013 (Act No. 16 of 2013) (SPLUMA) National Development Plan 2030	The Act, development plans, development frameworks and by-laws have informed project planning and the need and desirability of the project, and will be taken into account in the assessment and mitigation of impacts.
National Spatial Development Plan (NSDP)	The principles of the NSDP state that spatial development should, if appropriate, accommodate and promote private economic ventures, which could support sustainable economic growth, relieve poverty, increase social investment, and improve service delivery.
Northern Cape Provincial Spatial Development Framework (PSDF)	The Northern Cape PSDF recognises the importance of the mining sector in the province's economic growth. However, it also aims to manage any direct detrimental impacts of resource use, and promote positive socio-economic conditions once the resource use has reached its productive life cycle.
National Infrastructure Plan (NIP) (2012)	The South African Government adopted a National Infrastructure Plan in 2012. The primary objective of the Plan is to transform the country's economic landscape, while simultaneously creating significant numbers of new jobs, strengthening the delivery of basic services, and promoting integration with other African economies.
Northern Cape Planning and Development Act, 1998 (Act No. 7 of 1998)	The Act aims to provide for a single system of development, planning and land management in the Province. It contains a set of principles to, amongst other things, promote spatial restructuring and development, sustainable development and land use management.
Namakwa Integrated Development Plan (IDP)	The District Municipality IDP lists the following main objectives: • Ensuring the delivery of basic services which include water, sanitation, electricity and waste management; • Creation of job opportunities through the community public works programme; • Building municipal capacity to enable municipalities to collect their revenue;

Applicable legislation and guidelines used to compile the report	How does this development comply with and respond to the policy and legislative context
	• Ensuring sustainable economic and social transformation in the District; • Promote a society with a renewed sense of identity and confident in their skills and knowledge; and • Bridging the digital divide.
Namakwa District Municipality Local Economic Development Strategy	The Namakwa Local Economic Development Strategy (2007) identifies the mining sector, amongst others, as an important sector for economic growth of the District. The Strategy encourages processing and beneficiation of minerals into final product to increase economic development and employment opportunities.
Khâi-Ma Integrated Development Plan (2012-2017)	The Khâi-Ma IDP identifies the municipality's strategies for addressing the socio-economic development needs of its local communities. It highlights the key development focus areas agreed upon with communities and prominent stakeholders in the Khâi-Ma municipal area. These emphasise employment, housing and basic services delivery, as well as encouraging investment through strengthening local economic development.
Khâi-Ma Rural Spatial Development Framework (SDF) Plan (2010)	The Khâi-Ma SDF guides and informs land development and management in the municipal area. These include, amongst others, improved living standards, health and safety and local economic development. The mining, agricultural and tourism sectors are also highlighted as important sectors to drive local economic growth in the area. However, the SDF recognises that mining activities could pose a significant threat to local biodiversity in the area.
Provincial Environmental Legislation: The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) (NCNCA)	Any clearance of protected species would require a permit.
Environmental By-Laws	Environmental by-laws for the Namakwa District are in the process of being approved. Currently no by-laws are in operation within the district.

5. NEED AND DESIRABILITY OF THE PROPOSED ACTIVITIES

5.1 NEED AND DESIRABILITY GUIDELINE INTRODUCTION

The DEA guideline on need and desirability (GNR 891, 20 October 2014) notes that while addressing the growth of the national economy through the implementation of various national policies and strategies, it is also essential that these policies take cognisance of strategic concerns such as climate change, food security, as well as the sustainability in supply of natural resources and the status of our ecosystem services. In 2017, the DEA published an updated guideline, although this is yet to be formally gazetted. The 2017 guideline on need and desirability provides that addressing the need and desirability of a development is a way of ensuring sustainable development – in other words, that a development is ecologically sustainable and socially and economically justifiable – and ensuring the simultaneous achievement of the triple bottom-line.

When considering how the development may affect or promote justifiable economic and social development, the relevant spatial plans must be considered, including Municipal Integrated Development Plans (IDP), Spatial Development Frameworks (SDF) and Environmental Management Frameworks (EMF). The assessment reports need to provide information as to how the development will address the socio-economic impacts of the development, and whether there would be any socio-economic impact resulting from the development on people's environmental rights. Considering the need and desirability of a development entails the balancing of these factors. Consistent with the aim and purpose of the EIA, the concept of "need and desirability" relates to, amongst others, the nature, scale and location of the development being proposed, as well as the wise use of land and natural resources.

The National Strategy for Sustainable Development and Action Plan 2011 - 2014 (NSSD 1) (2011) states the following:

- In the first instance, it recognises that the maintenance of healthy ecosystems and natural resources are preconditions for human wellbeing. In the second instance, it recognises that there are limits to the goods and services that can be provided. In other words, ecological sustainability acknowledges that human beings are part of nature and not a separate entity.
- What is needed and desired for a specific area should primarily be strategically and democratically determined beyond the spatial extent of individual EIAs. The strategic context for informing need and desirability may therefore firstly be addressed and determined during the formulation of the sustainable development vision, goals and objectives of Municipal IDPs and SDFs during which collaborative and participative processes play an integral part, and are given effect to, in the democratic processes at local government level.
- When formulating project proposals and when evaluating project specific applications, the strategic context of such applications and the broader societal needs and the public interest should be considered. In an effort to better address these considerations and their associated cumulative impacts, the NEMA also provides for the compilation of information and maps that specify the attributes of the environment in particular geographical areas, including the sensitivity, extent, interrelationship and significance of such attributes which must be taken into account. Whether a proposed activity will be in line with or deviate from the plan, framework or strategy per se is not the issue, but rather the ecological, social and economic impacts that will result because of the alignment or deviation. As such, the EIA must specifically provide information on these impacts in order to be able to consider the merits of the specific application. Where a proposed activity deviates from a plan, framework or strategy, the burden of proof falls on the applicant (and the EAP) to show why the impacts associated with the deviation might be justifiable. The need and desirability of the development must be measured against the abovementioned contents of the IDP, SDF and EMF for the area, and the sustainable development vision, goals and objectives formulated in, and the desired spatial form and pattern of land use reflected in, the area's IDP and SDF. While project-level EIA decision-making therefore must help us stay on course by finding the

alternative that will take us closer to the desired aim/goal, it is through Integrated Development Planning (and the SDF process) that the desired destination is firstly to be considered and the map drawn of how to get there.

The key components of the Need and Desirability Guideline are listed below and discussed in this section:

- Securing ecological sustainable development and use of natural resources; and
- Promoting justifiable economic and social development.

5.2 ECOLOGICAL SUSTAINABLE DEVELOPMENT AND USE OF NATURAL RESOURCES

Due to the nature of mining projects, impacts on biodiversity and the role that it plays in the ecosystem are inevitable. The Gamsberg Zinc Mine has been developed in a sensitive ecological area and as part of the requirements of the Environmental Authorisation issued for the Gamsberg Zinc Mine an Offset Agreement is currently in place as well as a Biodiversity Management Plan (BMP) with a supporting Conservation Area Management Plan (CAMP) to manage the impacts of the mine. This BMP will be updated to include the Proposed Gamsberg Smelter Project.

The implementation of Biodiversity Offset Agreement has resulted in the Proclamation of the Gamsberg Nature Reserve as Gazetted in the Northern Cape Provincial Gazette on 5 August 2019. The Gamsberg Nature Reserve was proclaimed as a Protected area under the National Environmental Management Protected Area Act and the Management Plan as required by the NEMPA are currently being compiled by DENC. This will safeguard the conservation of succulents within the secured Gamsberg Nature Reserve for future generations.

Initial indications are that through careful planning and placement of infrastructure, key sensitive areas can be avoided in the development of the Gamsberg Smelter Project. The project site for the smelter complex and the secured landfill facility have been selected following an analysis of a number of alternative sites and locations and their potential impact on the surrounding environment (Section 7.2), particularly the location of constrained and irreplaceable habitats[2]. Ongoing systematic biodiversity planning management will be crucial to maintaining the balance between the economic and social benefits and the impact on the sensitive ecology.

5.3 PROMOTING JUSTIFIABLE ECONOMIC AND SOCIAL DEVELOPMENT

According to DMR (2011) "*South Africa has been a resource economy in excess of a century. An independent evaluation of South Africa's non-energy insitu mineral wealth is estimated at US$2.5 trillion (Citibank report, May 2010), making the country the wealthiest mining jurisdiction. However, a considerable amount of South Africa' s mineral resources are exported as raw ores or only partially processed. Although South Africa has steadily improved its ratio of beneficiated to primary products exported since the 1970s, these ratios are still well below the potential suggested by the quality and quantity of its mineral resources endowment. The Government's industrialisation policy calls for a paradigm shift in mineral development, strategic investment in assets to maximise long-term growth beneficiation projects, enhance value of exports, increase sources for consumption of local content, and create opportunities for sustainable jobs. Minerals are a vital input to an industrialisation programme, which is intended to accelerate manufacturing in South Africa (for local consumption and export). Competitive access to minerals for local beneficiation is one of the key success factors for the country's industrialisation initiative.*"

The Gamsberg Smelter Project is in line with the 'Beneficiation Strategy for the Minerals Industry of South Africa' (DMR, 2011) in terms of aiming to beneficiate the zinc in concentrate to produce high quality zinc ingots for

[2] "Conservation status" is either 'Irreplaceable' or 'Constrained' and accords with 'Critical (Irreplaceable)' and 'Natural Habitat (Constrained)' designations required by the Vedanta Standard.

sale/export. The benefits of this will fall directly to the Northern Cape Province and the Namakwa District specifically.

In addition, the South African National Development Plan[3] aims to eliminate poverty and reduce inequality by 2030. South Africa can realise these goals by drawing on the energies of its people, growing an inclusive economy, building capabilities, enhancing the capacity of the state, and promoting leadership and partnerships throughout society. The contribution of the Gamsberg Smelter Project to the National development Plan is discussed in the following sections.

5.3.1 Vedanta's Beneficiation Philosophy

Beneficiation to final metal at the mine source has long been part of Vedanta's philosophy. This ensures that all benefits of beneficiation, including socio-economic benefits associated with the value chain maximisation, is realised within the country and the region in which the metal is mined. In the recent past, Vedanta have developed successful smelters and other downstream value addition businesses operating in various parts of the world.

About the Planned Zinc Smelter at Gamsberg

In line with the Vedanta beneficiation philosophy and the call from the Government of South Africa for beneficiation and maximum value addition, the intention is to develop and construct a world-class zinc smelter at the Gamsberg Zinc Mine. The establishment of the proposed beneficiation plant will make Gamsberg a fully integrated zinc production site, with the mine, concentrator and smelter complex at a single location, making it the first integrated zinc manufacturing facility in South Africa. This has the potential to become one of the largest zinc complexes in the world.

In line with the group's commitment to Southern Africa, the proposed investment would have a positive impact on the Northern Cape, creating employment and further development opportunities in the region. The proposed new Gamsberg Smelter has the potential for the following:

- An estimated direct capital investment of 800 million USD in its construction phase over a period of 3 years.
- Employment of approximately 6 000 employees during the construction phase and around 1 200 employees for continuous operations at steady state.

Social and Economic Development (SED)

Vedanta's Gamsberg Smelter Project would bring socio-economic benefits to the less developed regions, in particular, the Northern Cape would directly benefit from the Gamsberg Smelter Project. The potential benefits are outlined below:

1) Contribution to GDP

- Operational expenditure of the Gamsberg Smelter Project is expected to add R 4.5 billion per year to South Africa's GDP.
- Operational expenditure has a strong multiplier effect on the economy: for every R 1 million in GDP generation, R 3.63 million are generated in the economy.
- In addition, there will be a one-off contribution of R 4.3 billion to GDP due to capital expenditure.

2) Contribution to tax collections

[3] https://www.gov.za/issues/national-development-plan-2030. Accessed 21 January 2020

- Operational expenditure of the Gamsberg Smelter Project is expected to provide additional R 1.1 billion per year to South Africa's tax collections.
- Operational expenditure has a strong multiplier effect on tax collections: for every R 1 million in tax paid, R 3.8 million in government revenue is generated in the economy.
- In addition, there would be a one-off contribution of additional R 1 billion to tax collections due to capital expenditure.

3) Employment contribution

- When considering the operational expenditure, a total of ~1 200 jobs will be directly created.
- When also taking into account all effects on the economy, the potential exists for a total of ~9 000 jobs to be created.
- Operational expenditure has a strong multiplier effect: For every 1 person employed by the smelter, an additional ~ 7 jobs are supported in the economy.
- In addition, the construction phase would create 6 000 jobs both directly and indirectly.

Zinc Metal Usage in South Africa and Downstream Industrialisation

Zinc is the fourth most common metal in use, trailing only to iron, aluminium and copper with an annual world consumption of 14 million tons. About 70% of the world's zinc originates from mining, while the remaining 30% comes from recycling secondary zinc. Zinc metal is used mainly in galvanising of steel, almost 60%, because of its excellent anti corrosive properties and the balance of 40% for brass, bronze, production of other alloys and chemicals like zinc oxide.

South Africa today fully imports zinc metal from across the globe and its annual requirement is 100 000 tons mainly for the steel galvanising industry. The Gamsberg Smelter Project has the potential not only to satisfy the entire domestic zinc demand but also to make South Africa a net exporter of zinc finished metal. This has the potential to bring in new downstream zinc metal value addition industries.

Sulphuric acid at a volume of approximately 1 000 tons per day would be produced as a by-product of the smelting process. The sulphuric acid would be utilised by downstream industries such as phosphate fertiliser manufacturers, detergent manufacturers and other chemical industries thus enhancing downstream industrialisation.

5.4 LOCAL AND DISTRICT MUNICIPAL DEVELOPMENT

The investment in the Gamsberg Smelter Project is technical and labour intensive and promotes greater investment in housing and bulk and reticulation infrastructure into the Khai-Ma Local Municipality to accommodate the future population growth along with amenities to support this envisaged growth. Black Mountain Mining (Pty) Ltd has already initiated discussions with the local authority in this regard. This is in line with the President of the Republic of South Africa's philosophy for mining companies to partner with the government in the delivery of essential services such as decent housing and infrastructure.

Black Mountain Mining (Pty) Ltd has initiated preliminary discussions with stakeholders about the prospects of partnering in the establishment of a fertilizer plant to make use of the sulphuric acid that will be produced as a by-product by the zinc smelter. This investment in a fertilizer plant will offer the local, provincial and national agriculture industry access to fertilizer at competitive local prices therefore contributing to the country's successful land reform projects and a vibrant agriculture sector guaranteeing rural livelihoods and food security.

Although provincial growth and development plans mostly focus on municipal priorities over a five-year cycle, they do provide some insight and guidance in terms of future planning for the municipalities. SDFs which usually have a longer life cycle aim to guide and facilitate the implementation of IDPs for the municipality. The vision of

the Northern Cape Provincial Growth and Development Strategy (PGDS) and SDF is to build a prosperous, sustainable growing provincial economy to reduce poverty and improve social development. The following sections outline the documents relevant to the Gamsberg Smelter Project and their applicability.

5.4.1 The Northern Cape Provincial Spatial Development Framework (PSDF)

The Northern Cape PSDF aims to act as an enabling mechanism that responds and complies with the National Spatial Development Framework (NSDF). The latter encourages lower sphere spatial development plans and frameworks (such as the PSDF) to create an environment that promotes a developmental state. The Northern Cape PSDF (2012) aims to serve as a mechanism towards enhancing the future of the Province and its people.

The Northern Cape PSDF recognises the importance of the mining sector in the province's economic growth. However, it also aims to manage any direct detrimental impacts of resource use and promote positive socio-economic conditions once the resource use has reached the end of its productive life cycle.

The development of the Gamsberg Smelter Project would be a hub for development in the area and would boost economic development as driven by the Northern Cape PSDF by generating both direct and indirect business opportunities. The focus of the Social and Labour Plan (SLP) is to establish independent economic activity in the area to reduce the reliance on mining as main driver for economy and minimise the impact on the economy when the mine reaches the end of life.

5.4.2 The Namakwa Local Economic Development Strategy (2007)

The Namakwa Local Economic Development Strategy identifies the mining sector, amongst others, as an important sector for economic growth of the District. The Strategy encourages processing and beneficiation of minerals into final product to increase economic development and employment opportunities. The development of the Smelter ties in with this strategy as well as being in compliance with the Namakwa IDP which highlights the need to create job opportunities in the Namakwa District.

The Gamsberg Smelter Project aims to generate 6 000 employment opportunities during the construction phase and 1 200 opportunities during the operational phase. As far as possible, and where the skills exist, these employment opportunities will go to local labour.

5.4.3 The Khâi-Ma IDP (2012-2017)

The Khâi-Ma IDP (2012-2017) identifies the municipality's strategies for addressing the socio-economic development needs of its local communities. It highlights the key development focus areas agreed upon with communities and prominent stakeholders in the Khâi-Ma municipal area. These emphasise employment, housing and basic services delivery, as well as encouraging investment through strengthening local economic development.

The Gamsberg Zinc Mine SLP was developed in agreement with Khâi-Ma to align with their IDP. Therefore, the future updated SLP for the Gamsberg Smelter Project will increase the contribution due to the increased revenue value.

5.4.4 The Khâi-Ma Rural SDF (2010)

The Khâi-Ma Rural SDF (2010) guides and informs land development and management in the municipal area. These include, amongst others, improved living standards, health and safety and local economic development. The mining, agricultural and tourism sectors are also highlighted as important sectors to drive local economic growth in the area. The SDF also recognises that mining activities could pose a significant threat to local biodiversity in the area.

The development of the Gamsberg Smelter Project would be a hub for development in Khâi-Ma and would boost economic development by generating both direct and indirect business opportunities. Vedanta also has strict

health and safety policies (Figure 8) for the protection of both its employees and those communities in the vicinity of the Gamsberg Smelter Project.

5.5 SUMMARY OF POTENTIAL BENEFITS FROM THE GAMSBERG SMELTER PROJECT

In summary, the development of the Gamsberg Smelter Project would result in the creation of employment opportunities for local communities as well as investment in the national and local economy as depicted in Figure 7.

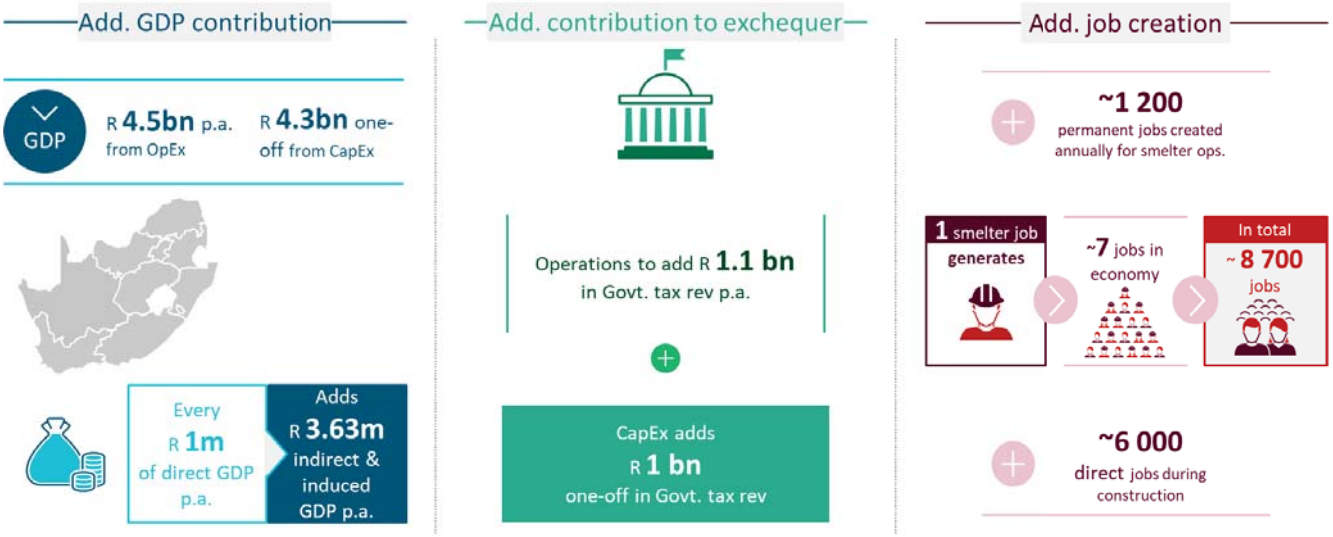

Figure 7 VZI Socio-economic Investment Related to the Development of the Gamsberg Smelter Project

Black Mountain Mining (Pty) Ltd also has an Environmental, Social and Governance (ESG) Strategy in line with which all their operations are run, which focuses on safety, Corporate Social Responsibility (CSR) and the environment. This strategy is summarised in Figure 8.

SAFETY

- ZERO HARM
- Safety our First Value – campaign launched
- **Culture of Care & Respect**: safety days, family days, wellness programs
- **Leadership**: VFL's, Safety Summits
- **Competency**: SOPs, PTOs, hazard, risk identification, legal compliance training
- **Business Partner Safety Management**: Pre-engagement safety assessments, BP HSE heat map
- **Critical Risk Management**: Vedanta Critical Control Standards, Cardinal rules, baseline & issued based Risk assessments

CSR

- **Aggeneys Public Clinic** : >600 patients / month
- **Community Skills Development** : 250 out of school youths training at Okiep TVET
- **Leadership Development** : School Principals (Khai-Ma) & Business Executives
- **V-Fi** : launched Aug'18, 6 free hotspots reaching 7500 people
- **Broad-Based Livelihood** : Jan'19, Focus on multiple livelihoods - food security, organic agriculture, business tools & income creation etc.
- **Medical Drive** : Cataract Surgery >3250 patients screened > 1100 operated. Pink Drive – 2018, 211 clinical breast examinations, 64 mammograms, 186 pap smears and 136 PSA

ENVIRONMENT

- ZERO WASTE, ZERO DISCHARGE
- Successfully operating in 1 of 35 global biodiverse hotspots (Succulent Karoo biome)
- > 105k plants & 500k seeds harvested – donated to SANBI & Karoo Desert Botanical Garden
- Gamsberg Research & Rehab Centre – plants grown from collected seeds for rehabilitation
- Biodiversity Offset Agreement - >21k hectares secured for Gamsberg Nature Reserve – being transferred to NC Provincial Government
- DENC – "BMM in compliance with Agreement"
- Partnership with IUCN – biodiversity assessments & review & verify performance,

SAFETY
– OUR FIRST VALUE –

Figure 8 Black Mountain Mining (Pty) Ltd ESG Strategy

6. PERIOD FOR WHICH THE ENVIRONMENTAL AUTHORISATION IS REQUIRED

Environmental authorisation is required for a total life of the Smelter of 15 years, not including the 36 months for construction and commissioning.

7. PROCESS FOLLOWED TO REACH THE PROPOSED PREFERRED ALTERNATIVE

7.1 MITIGATION HIERARCHY

Implementing the mitigation hierarchy is crucial when considering alternative sites and alternative infrastructure layouts.

The mitigation hierarchy is defined as:

- **Avoidance**: measures taken to avoid creating impacts from the outset, such as careful spatial or temporal placement of elements of infrastructure, in order to completely avoid impacts on certain components of biodiversity.
- **Minimisation**: measures taken to reduce the duration, intensity and / or extent of impacts (including direct, indirect and cumulative impacts, as appropriate) that cannot be completely avoided, as far as is practically feasible.
- **Rehabilitation/restoration**: measures taken to rehabilitate degraded ecosystems or restore cleared ecosystems following exposure to impacts that cannot be completely avoided and/ or minimised.
- **Offset:** measures taken to compensate for any residual significant adverse impacts that cannot be avoided, minimised and / or rehabilitated or restored, in order to achieve no net loss (NNL) or a net gain (NG) of biodiversity[4]. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk, protecting areas where there is imminent or projected loss of biodiversity.

The mitigation hierarchy was applied to the project as summarised in Figure 9.

[4] In terms of IFC PS6, no net loss is typically required for significant adverse impacts on natural habitat, while net gain is required for impacts on critical habitat

	Mitigation approaches	Actions
AVOID	➢ Smelter placement ➢ Secured Landfill Facility placement ➢ Pipeline alignment ➢ Buffers around sensitive sites ➢ Transport of slurry to smelter ➢ Paving of internal access roads to reduce dust	▪ Three smelter sites were identified and selected for location on low sensitivity vegetation in proximity to the mine; ▪ Three Secured Landfill Facility site options identified on low sensitivity vegetation (two north of N14, one south of N14); ▪ Water pipeline routing within the servitude of the existing pipeline between the mine and Horshshoe Reservoir; ▪ A buffer zone of ~250 m will be specified for maintaining a working distance for roads, construction and other infrastructure from sensitive biodiversity areas; ▪ Roads to and from smelter will be paved to limit dust impacts on vegetation; ▪ Transport options of slurry to smelter considered: conveyor, pipeline and trucking: trucking selected (technical).
MINIMISE	➢ Minimise construction footprints ➢ Culverts for animal movement ➢ Staff/contractor awareness and codes of conduct ➢ Strict controls on vehicle driver behaviour ➢ Cover trucks for dust control ➢ Alien species control (*Prosopis* & Fountain Grass)	▪ Construction footprints will be minimised, especially near high sensitivite vegetation; ▪ Construction of culverts over washes (e.g. between smelter and waste site) designed to allow passage of small animals (i.e. bottom of culvert to be level with ground on either side); ▪ Tool box talks and posters to be developed for contractor awareness of biodiversity sensitivity (e.g. limit on vehicle and pedestrian trampling, collection of succulents and fauna etc.); ▪ Designate vehicle routes, parking and turning circles to limit uncontrolled driving off-road; ▪ Wash/disinfect trucks and equipment entering area from outside in designated wash bay, monitor & remove alien plants.
RESTORE	➢ Translocation of plants, if viable ➢ Restoration of construction footprints	▪ Biodiversity study to confirm threatened plants in smelter project footprints and viability of translocation; ▪ Specialist to confirm restoration requirements for construction areas.
OFFSET	➢ To be determined – outcome of additional air quality modelling	▪ Long-term monitoring to evaluate potential air quality influences on succulent vegetation as basis for confirming possible offset requirements.

Figure 9 Project Implementation of the Mitigation Hierarchy

7.2 DETAILS OF ALL ALTERNATIVES CONSIDERED

This section describes land use or development alternatives, alternative means of carrying out the operation, and the consequences of not proceeding with the proposed Gamsberg Smelter Project.

The main project alternatives to be considered include:

- Locality;
- Site alternatives (smelter complex and secured landfill facility);
- Distribution of concentrate;
- Transportation of product/ by-product;
- Technology;
- Power supply; and
- The “no-go” alternative.

7.2.1 Locality Alternatives

As an initial alternative assessment, three geographically separate locations were considered for the smelter project based on access to the potential ports that would be used for export of the zinc ingots and the sulphuric acid by-product and proximity to the mine as the supplier of the raw material for the smelter. These locations were:

- Port of Saldanha;
- Port of Richards Bay; and
- Gamsberg Zinc Mine.

These alternative locations are assessed in Table 20. Based on this comparative assessment and the consideration of the advantages and disadvantages of all three locations against the various criteria, the Gamsberg Zinc Mine was selected as the preferred location.

Table 20 Assessment of Alternative Locations

No.	Criteria	Port of Saldanha – Location 1	Port of Richards Bay - Location 2	Gamsberg Zinc Mine – Location 3
1	Land and land development	Land for Smelter, secured landfill facility and township would need to be identified and acquired. Extent of Land development work may be substantial.	Land for Smelter, secured landfill facility and township would need to be identified and acquired. Extent of Land development work may be substantial.	Adequate land available within the MRA and Aggeneys for Smelter, secured landfill facility and township. Land development work would be minimal.
2	Auxiliary Services			
a	Water	Availability of required water for Smelter and township to be identified and developed.	Availability of required water for Smelter and township to be identified and developed.	Existing Sedibeng pipeline from Pella Drift intake system.

No.	Criteria	Port of Saldanha – Location 1	Port of Richards Bay - Location 2	Gamsberg Zinc Mine – Location 3
		Water is currently a scarce resource in the Saldanha area due to insufficient rainfall and high demand due to various industries in the area.		The Gamsberg Zinc Mine has an approved 44ML abstraction limit from the Orange River.
b	Power	Existing power infrastructure in place so minor amendments likely to be required for power supply.	Existing power infrastructure in place so minor amendments likely to be required for power supply.	New 132 kV transmission line to be constructed from Aggeneys substation. Possibility of renewable power sources to be developed (Section 7.2.6).
3	Services facility	New Workshop, laboratory, fire station etc. for the smelter complex to be established.	New Workshop, laboratory, fire station etc. for the smelter complex to be established.	Workshop, laboratory, fire station etc. at the existing concentrator plant could be utilised.
4	Township	New township / expansion of existing towns with infrastructure facilities to be developed.	New township / expansion of existing towns with infrastructure facilities to be developed.	Additional housing to be constructed at Aggeneys.
5	Transport of Concentrate	Transportation of zinc concentrate from Gamsberg Zinc Mine to Saldanha Port over a distance of approximately 600 km.	Transportation of zinc concentrate from Gamsberg Zinc Mine to Richards Bay Port over a distance of approximately 1 700 km.	Transportation of zinc concentrate within the Gamsberg Zinc Mine MRA (maximum of 2 km).
6	Transportation of zinc Ingots and By-products	Short distance for transport to the Port for export.	Short distance for transport to the Port for export.	Transportation of zinc ingots and by-products to either Saldanha or Richards Bay Ports from the Gamsberg Zinc Mine over distances of 600 km or 1 700km respectively.
7	Operational Aspect	Large storage space for the raw materials to be constructed at the smelter complex to ensure sufficient raw materials for smelter operation.	Large storage space for the raw materials to be constructed at the smelter complex to ensure sufficient raw materials for smelter operation.	Minimal storage space required due to close proximity of concentrator plant and supply of raw material.
9	Socio-economic	There is already a significant socio-economic impact (positive and negative) in this region due to the high concentration of industries associated with the Saldanha	There is already a significant socio-economic impact (positive and negative) in this region due to the high concentration of industries associated with the Richards Bay Industrial Development Zone (IDZ).	The northern Cape is a focus area for development. Employment and other opportunities created due to the smelter complex development will have a

No.	Criteria	Port of Saldanha – Location 1	Port of Richards Bay - Location 2	Gamsberg Zinc Mine – Location 3
		Bay Industrial Development Zone (IDZ).		large impact on local populations.
10	Advantages	Due to the proximity to the Port of Saldanha this location has the advantage of shorter distances for the transportation of the finished product and by-product for export via the Port. Storage requirements for finished product at the Port would be minimum. Well established towns in close proximity providing facilities and amenities for employees.	Due to the proximity to the Port of Richards Bay this location has the advantage of shorter distances for the transportation of finished products for export via the Port. Storage requirements for finished product at the Port would be minimum. The existing Foskor plant (producer of Phosphoric acid) located near the Richards Bay Port, is a potential consumer of sulphuric acid. Thus, if the smelter complex were situated here it would have the minimum distance for transportation of sulphuric acid (by-product). There is, however, currently limited demand for acid in the Foskor plant. Well established towns in close proximity providing facilities and amenities for employees.	The site for the Smelter Complex, secured landfill facility and township would be within the Gamsberg Zinc Mine MRA. No additional land needs to be acquired for the smelter complex and secured landfill facility. Auxiliary facilities i.e. water and power for the Smelter Complex would be met mostly by enhancement of existing facilities. The time taken for the development of the smelter complex and secured landfill facility would be minimised due to existing facilities. Both the Namakwa IDP and the Khâi-Ma IDP have a focus on employment opportunities in the Northern Cape.
11	Disadvantages	The location considered is a green field area. Saldanha is a water scarce area and there is already significant demand from other industries in the area. The raw material would be sourced from the Gamsberg Zinc Mine, which would require transportation of raw material over approximately 600 km on existing public roads. There is sensitive biodiversity near the Port of Saldanha which would need to be avoided.	Logistics cost for Richards Bay location is significantly higher than for the other locations due to the longer distance from the concentrator plant. The location considered is a green field area. The raw material would be sourced from the Gamsberg Zinc Mine which would require transportation of raw material over approximately 1 700 km on existing public roads. Due to the distance from the supply of raw material (concentrator plant) there is a risk of inadequate supply for the	Logistics cost for Gamsberg Zinc Mine location is higher than for the Saldanha location but less than the Richards Bay location. Expansion of Aggeneys and other towns required to accommodate additional employees. Sensitive biodiversity at Gamsberg Zinc Mine will need to be avoided. To cater for any irregularities of transportation of finished products from Gamsberg Zinc Mine to the Port of export, adequate storage

No.	Criteria	Port of Saldanha – Location 1	Port of Richards Bay - Location 2	Gamsberg Zinc Mine – Location 3
		Cumulative air quality impacts would likely be a concern. Due to the distance from the supply of raw material (concentrator plant) there is a risk of inadequate supply for the Smelter due to the transport logistics.	Smelter due to transport logistics.	area for the finished products i.e. zinc ingots and sulphuric acid needs to be provided at the Port /close to the Port. This will require acquisition of a larger area at the Port/ near the Port.

7.2.2 Site Alternatives

Within the Gamsberg Zinc Mine MRA three alternative sites have been identified and assessed for both the smelter complex and the secured landfill facility. The alternative sites can be seen in Figure 10 with the comparative assessment included in Table 21 and Table 22.

A comparative assessment has been undertaken for both the smelter complex and the secured landfill facility to determine the preferred sites in terms of various environmental and social criteria. For each criteria a score of between 1 to 3 was allocated, with 1 representing the most preferred options and 3 the least preferred option. The numbers were then added together to produce a final number, the lowest of which represents the preferred site.

Where the scoring of the criteria across all three alternative sites was the same, this criterion was removed from the assessment thus leaving only the distinguishing criteria to be considered as part of the site determination. The criteria that received the same score for all three alternatives have been greyed out in Table 21 and Table 22.

Smelter Complex

The comparative assessment for the three alternative sites for the smelter complex is included in Table 21. The major determining factors for the comparative site assessment were visual, proximity to constrained or irreplaceable[5] vegetation type, air quality and traffic as the impact from other environmental criteria was determined to be very similar for the three alternative sites and therefore not distinguishing factors.

Based on the comparative assessment, the preferred site for the smelter complex is Site 3. Although all sites will be visible from the N14 and surrounding areas, Site 3 is assumed to be marginally less so due to the waste rock dumps from the mine in the background. Site 3 also scores the best in terms of traffic impact due to its close proximity to the concentrator plant, thus requiring shorter distances for movement of concentrate and no need for crossing the N14. Site 3 is also preferable in terms of air quality impacts due to its positioning closer to the centre of the mining area thus minimising the cumulative impacts on air quality. In terms of the proximity to constrained or irreplaceable vegetation types, Site 3 is not located directly in constrained/ irreplaceable areas but is closer to these areas than Site 1.

When considering all the criteria, Site 3 is considered to be the preferred site for the smelter complex.

[5] "Conservation status" is either 'Irreplaceable' or 'Constrained'and accords with 'Critical (Irreplaceable)' and 'Natural Habitat (Constrained)' designations required by the Vedanta Standard.

Secured Landfill Facility

The comparative assessment for the three alternative sites for the secured landfill facility is in Table 22. The major determining factors for the comparative site assessment were visual, proximity to constrained or irreplaceable vegetation type, air quality and traffic as the impact from other environmental criteria was determined to be very similar for the three alternative sites and therefore not distinguishing factors.

While from an environmental and social perspective Site 1 and Site 3 have received the same total score, the distinguishing factor is likely to be the relatively higher costs of transporting the waste material to Site 1, rendering Site 3 as the preferred site (see Section 7.2.3). However, due to the proximity of Site 3 to both constrained and irreplaceable vegetation types, strict mitigation measures will need to be put in place to avoid additional impact on these areas.

The option for co-disposal into the existing TSF is being tested from a chemical and technical perspective and if considered viable would be separately assessed.

Legend

- Gamsberg Zinc Mine Property
- Laydown Area - Area: 15 Hectares
- Business Partner Camp - Area 12 Ha
- Contractors Camp
- Existing Infrastructure
- Existing Concentrator Plant
- Roads

Proposed Infrastructure

- Proposed Bulk Water Pipeline
- Smelter Roads
- Proposed Transmission Line
- 66kv Transmission Line

Alternatives

- Alternative Secured Landfill Site
- Alternative Smelter Complex Locations

Botanical Sensitivity

- Irreplaceable
- Constrained

0 500 1 000 Meters

Scale: 1:25 000
Projection: Transverse Mercator
Datum: Lo 23 WGS 84

Gamsberg Smelter Project

Figure 3
Proposed Infrastructure Alternatives for the Smelter Complex and Secured Landfill Facility

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Table 21: Comparative Site Assessment for the Smelter Complex

1 = Preferred; 3 = Least preferred

	Criteria	Alternative Site Options			Discussion
	Aspect/ Impact	Site 1	Site 2	Site 3	
1	Visual impact	3	2	1	All three options will be visible from the N14 highway, however, site 1 is assumed to have the least impact due to the waste rock dumps in the background, which will slightly diminish the impact.
2	Loss of soil and land capability through removal, erosion, compaction and contamination				The soil type is likely to be the same for all three options due to them being located on the plains area.
3	Physical loss and/or general disturbance of constrained or irreplaceable vegetation types	2	2	3	Although all three sites have been chosen to avoid any of the constrained or irreplaceable vegetation types, Site 1 and site 2 are situated the furthest away from irreplaceable areas.
4	Reduction in surface water quality affecting third party users	2	2	3	Site 3 is situated closer to a wash than site 1 and site 2.
5	Reduction in ground water quality affecting downstream users				All three localities are likely to have the same impact on groundwater, however, this will be refined during the EIA phase.
6	Reduced air quality from project emissions	2	2	1	Site 1 and 2 are further from the operational mining area and are thus likely to have a more significant impact on cumulative air quality. As such Site 3 is preferred.
7	Increase in noise levels				Due to the general lack of sensitive receptors in the near vicinity, the noise impact from all three sites is assumed to be similar.
8	Effect on roads due to project related traffic	3	2	1	Site 1 will have the highest impact in terms of traffic on the N14 due to the need to transport concentrate across the road for processing. Site 2 will require a longer

	Criteria	Alternative Site Options			Discussion
	Aspect/ Impact	Site 1	Site 2	Site 3	
					distance for transportation of concentrate but will not require that the N14 be crossed. As such Site 3 is the best in that concentrate needs only to be moved a short distance. In terms of export of product and by-product, all sites would be the same in terms of impact.
9	Loss or damage to heritage and/or palaeontological resources				None of the proposed site options would interfere with known existing heritage resources.
10	Positive and negative socio-economic impacts				All three options have the potential to have positive and/or negative socio-economic impacts. There is no relative score difference.
11	Positive and negative impacts on community health				It is not likely that emissions from the smelter construction and operations would have far reaching impacts and as such minimal negative impacts are expected.
12	Impact on surrounding land uses				All options are within the MRA and are thus unlikely to have any direct impact on surrounding land uses.
	Total	**12**	**10**	**9**	**Site 3 is the preferred option.**

Table 22: Comparative Site Assessment for the Secured Landfill Facility

	Criteria	Alternative Site Options			Discussion
	Aspect/ Impact	Site 1	Site 2	Site 3	
1	Visual impact	1	3	2	All three options will be visible from the N14 highway, however, Site 1 is assumed to have the least impact due to the TSF in the background.

	Criteria	Alternative Site Options			Discussion
	Aspect/ Impact	Site 1	Site 2	Site 3	
2	Loss of soil and land capability through removal, erosion, compaction and contamination	3	3	2	The soil type is likely to be the same for all three options due to them being located on the plains area. Some potential for soil contamination if Jarosite/ Jarofix needs to be transported. Hence it is preferable to minimise the distance between the smelter complex and the secured landfill facility. Thus, assuming that the preferred smelter complex site is site 3, site 3 is preferred for the secured landfill facility.
3	Physical loss and/or general disturbance of constrained or irreplaceable vegetation type	2	2	3	Site 1 and 2 are situated in close proximity to the constrained vegetation type to the south, while Site 3 is situated in close proximity to the irreplaceable vegetation type.
4	Reduction in surface water quality affecting third party users	2	3	3	Access road to site 3 and potentially site 2 will cross a wash. Check other sites for similar possible impacts.
5	Reduction in ground water quality affecting downstream users				The impact on aquifers is not understood at this stage. Potential groundwater impacts will be further assessed in the EIA phase.
6	Reduced air quality from project emissions	2	2	1	Site 1 and 2 are further from the operational mining area and are thus likely to have a more significant impact on cumulative air quality. As such Site 3 is preferred.
7	Increase in noise levels				Due to the general lack of sensitive receptors in the near vicinity, the noise impact from all three sites are assumed to be similar.
8	Effect on roads due to project related traffic	3	3	1	Sites 1 and 2 will have the highest impact in terms of traffic on the N14 due to the need to transport Jarosite/ Jarofix across the road for storage/disposal. In addition, the related costs for transporting the Jarofix over the longer distance would be much higher.

	Criteria	Alternative Site Options			Discussion
	Aspect/ Impact	Site 1	Site 2	Site 3	
9	Loss or damage to heritage and/or palaeontological resources				None of the proposed layout options would interfere with known existing heritage resources.
10	Positive and negative socio-economic impacts				All three options have the potential to have positive and/or negative socio-economic impacts. There is no relative score difference.
11	Positive and negative impacts on community health				It is not likely that emissions from the smelter construction and operations would have far reaching impacts and as such minimal negative impacts are expected.
12	Impact on surrounding land uses				All options are within the MRA and are thus unlikely to have any impact on surrounding land uses.
	Total	**13**	**16**	**12**	**Site 3 is the preferred option.**

7.2.3 Alternative Distribution of Concentrate

Three alternatives have been considered for the transfer of concentrate from the concentrator plant to the preferred site of the smelter complex (Table 23).

Table 23 Comparison of Alternatives for Transfer of Concentrate to the Smelter Complex

	Description	Advantages	Disadvantages
Truck	Transport of concentrate using dual or triple bin trucks.	No additional alterations required to the concentrator plant.	Fuel intensive.
Conveyor	Transport of concentrate using a pipe or belt conveyor.	Reduced costs associated with operating of trucks.	Would necessitate modifications in the concentrate storage section of the concentrator plant, which has not been designed for. Potential dust generation.
Pipeline	Transport of concentrate using a pipeline. Concentrate will need to be in a slurry form.	Reduced costs associated with operating of trucks.	Would necessitate modifications in the concentrate storage in the concentrator plant which has not been designed for.

The transfer of concentrate to the smelter complex by truck has been assessed to be the preferred alternative as it would require no expensive and time-consuming design changes to the existing concentrator plant. In addition, the short distance to the smelter complex over which the concentrate needs to be transported makes it the preferred option.

7.2.4 Alternative Transportation of Zinc Ingots

The potential forms of transport for the product and by-product from the smelter complex to the Port of export are assessed in Table 24.

Table 24 Comparison of Alternative Transport Options for Zinc Ingots and Sulphuric Acid

	Description	Advantages	Disadvantages
Transport by Road	The existing roads (N14, N7 and R399) from Gamsberg Zinc Mine to the Saldanha Port would be used for the transportation of zinc ingots and sulphuric acid. Approximately 30 trucks per day of zinc ingots and 30 trucks per day of sulphuric acid would be required.	No new roads are required. Capital cost is minor. The transportation can be done through transport Business Partners. No delays due to road construction periods.	Transport costs are high. Heavy road traffic on the existing roads. Additional carbon emissions associated with trucking. Trucks would need to pass through the town of Springbok.

	Description	Advantages	Disadvantages
			Potential driver fatigue, which will need to be managed.
Transport by Rail	Gamsberg is not connected with the South African railway network. The nearest rail head is at Loop 10 (on the existing Transnet Sishen-Saldanha railway line), approximately 160 km south of the Gamsberg Zinc Mine. A new rail connection would need to be laid from the existing Loop 10 railway line up to the Gamsberg Zinc Mine smelter complex. A railway yard would need to be established at the Saldanha Port for storage and handling of zinc ingots and sulphuric acid.	Minimal impact on existing roads. Transport costs are low. Potentially lower carbon emissions.	No railway lines exist in the area and would thus need to be constructed. Major capital cost. Long timelines for construction. Reconfiguration of the Gamsberg site required to cater for onloading of product / by-product onto rail wagons. Ability to secure regular space on the railway line uncertain given the demands from Sishen.
Transport by Road and Rail	The nearest rail head is at Loop 10. zinc ingots and sulphuric acid would be transported by road using the existing road network (DR 084/01) to Loop 10. From Loop 10, it would be transported by rail to the Saldanha port. The distance from Loop 10 to the Saldanha port is approximately 450 km. Transfer of materials from trucks/tankers to the railway would be done at loop 10. The road from the Gamsberg smelter complex to Loop 10 as well as the existing facilities at Loop 10 would need to be upgraded to cater for the increased traffic and would include: • Widening and improvement of the existing road (DR 084/01) from Gamsberg Zinc Mine to Loop 10; and • Augmentation of rail facilities at loop 10 for handling the increased traffic volumes.	Minor construction time, just some upgrades to existing roads. Transport costs are medium. Infrastructure exists but upgrades would be required.	Proposed upgrades to the existing road and Loop 10 would take some time. Medium capital cost for upgrades. Double handling of product / by-product required at Loop 10 to transfer from trucks to rail. Reconfiguration of the Gamsberg site and Loop 10 facilities required to cater for onloading and offloading of product / by-product. Ability to secure regular space on the railway line uncertain given the demands from Sishen. Need to increase facility size as current shed not sufficient for metal and concentrate storage.

Road transportation has been assessed to be the preferred alternative, at this stage.

7.2.5 Alternative Technologies

To identify the possible processing technologies available for treatment of the Gamsberg concentrate, a process selection study was carried out by Vedanta Zinc International at conceptual level which involved identifying the technologies currently being used by the largest zinc producers worldwide as a benchmark. In addition to this, a

secondary search into developing technologies was also conducted to identify any emerging processing options (TCE, 2014). The study resulted in the selection of the following two process options:

- Roast-Leach-Electrowinning (R-L-E) with Jarosite precipitation; and
- High Pressure/ Atmospheric Acid Leach (HPAL).

The survey of the largest global zinc producers confirmed that conventional Roast-Leach-Electrowinning (R-L-E) is by far the most commonly used processing route with excess of 85% of the zinc producers using variations of the process (TCE, 2014).

The advantages of R-L-E include:

- Technology risk is less with R-L-E with it being the most commonly used technology for zinc smelting worldwide. There are very few zinc smelters operating with the HPAL technology.
- Operational knowledge is available within the Vedanta Group with four zinc smelters currently operating using R-L-E.

7.2.6 Alternative Power Supply

A zinc smelter is a power intensive plant and electrical power plays a major role in the operation with power outages severely affecting production capacity. As such it is essential that power sourcing be reliable with 100 % availability for uninterrupted operation of the plant. The following alternative power sources have been assessed to decide upon the most suitable power sourcing option:

- Eskom grid substation;
- Captive solar power plant;
- Wind based power plant; and
- Eskom grid along with renewable (solar and wind) mix.

Table 25 Power Supply Alternatives

Type of Power	Description	Advantages	Disadvantages
Eskom grid substation	A new 132 kV transmission line would be constructed by Black Mountain Mining (Pty) Ltd from the Eskom Aggeneys substation (approximately 20 km west of the Gamsberg Zinc Mine) to supply the increased power demands for the operation of the smelter. A new switch yard will be required within the Aggeneys substation to facilitate the new 132 kV transmission line.	Minimal construction time required. Limited impact on biodiversity due to construction within the existing servitude.	Non-renewable power therefore additional carbon footprint. Power outages anywhere on the national grid could affect the smelter operations.
Captive solar power plant	The Gamsberg site experiences about 2 345 kWh/m^2 /annum of global irradiance on a horizontal surface which is considered a good amount for solar energy generation. There are a number of solar PV operations in the area thus indicating the suitability for this type of renewable power in the area.	Renewable power. Consistent power supply more likely as less reliant on the Eskom grid.	Insufficient power supply for the smelter complex. Long time lag for the permitting and construction. Major capital investment.

Type of Power	Description	Advantages	Disadvantages
			Potential biodiversity impact required due to clearing large areas of land for photovoltaic (PV) cells.
Wind based power plant	Wind turbines require a significant amount of wind as well as consistency in order to make them viable.	Renewable power. Low maintenance. Job creation.	Insufficient power supply for the smelter complex. Long time lag for the permitting and construction. Major capital investment. Requires consistent wind for consistent power supply. Noise and visual impacts. Impacts on avifauna and bats.
Eskom grid along with renewable (solar and/or wind) mix	Standalone renewable energy with solar or wind individually may not be a reliable source considering the availability to meet the complete demand of the plant. Based on shared data it has been studied that Grid power in combination with a proper mix of renewable (solar and wind) energy may be a cost effective and reliable option.	Consistent power supply. Partially renewable therefore a smaller carbon footprint that grid alone.	Large capital investment. Biodiversity impact required due to clearing large areas of land for photovoltaic (PV) cells.

The preferred power alternative at this stage is to source all power from the Eskom national grid. However, at a later stage the incorporation of renewable power will be assessed to supplement / replace a component of the power supply from ESKOM.

7.2.7 "No-go" Alternative

The "no-go" alternative means that the status quo remains, meaning that no smelter would be constructed and operated on site. In this case the raw zinc concentrate will still be exported as is without beneficiation of the zinc.

The 'No-Go' would not result in additional jobs being created during the construction phase, as well as more long-term employment opportunities for the operational phase. It should be noted that those are direct employment opportunities at the Gamsberg Smelter Project and not the additional spin-off opportunities that would be generated as a result of increased spending power in the area and outside procurement of goods and services. The economic contribution of the smelter, both nationally and regionally, would not be recognised due to the revenue difference between selling concentrate and final special high grade zinc metal. As discussed in

Section 5.3 the national strategy seeks to beneficiate metals to increase the value and the associated economic contribution.

The Pella Bulk Water Pipeline (subject to a separate Basic Assessment process) would not be upgraded should the Gamsberg Smelter Project not go ahead as there would be no need for the increased water supply. This would mean that the aging pipeline remain in place with the associated regular maintenance requirements and frequent pipeline shutdowns resulting in irregular water supply for all towns and communities supplied by the existing underground pipeline.

A by-product of the zinc smelting (R-L-E) process is large quantities of sulphuric acid which can be sold as a raw material to other companies for processing. An example of such a business is fertilizer plants which use large quantities of sulphuric acid in their process. This could result in additional businesses investing in the area.

And finally, should the Gamsberg Smelter Project go ahead there would be increased potential to implement SLP programmes and invest in the communities in terms of training and other social projects.

7.3 DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED

This section describes the public participation process (PPP) undertaken to date in line with Chapter 6 of the EIA Regulations (2014), as amended. The intention of the PPP is to inform I&APs, in sufficient detail, of the proposed Gamsberg Smelter Project in order that I&APs may contribute meaningfully to the EIA process.

The PPP included notification of I&APs through distribution of a Background Information Document (BID), placement of a series of newspaper advertisements, placement of site notices and public scoping meetings.

A key aspect of public consultation is the notification of landowners, occupiers and users of land within and adjacent to the application area. The landowners, non-government organisations (NGOs), Community Forums, Ward Councillors and Lessee's who have been identified in this area and shall be kept informed in writing of the ongoing environmental regulatory process for the Gamsberg Smelter Project.

7.3.1 Interested and Affected Party (I&AP) Database

As part of the PPP an I&AP database has been developed for the project. I&APs identified for the project include:

- landowners/residents, lawful occupiers, land users and ward councillors within and adjacent to the mining right application area;
- ratepayer organisations, community leaders and community structures;
- community forums and action groups;
- non-government organisations and associations and non-profit companies working in the area;
- mines, industry and businesses in the area;
- parastatals; and
- service providers.

The latest copy of the I&AP database is included in Appendix E. The database will be updated on an ongoing basis throughout the EIA process. If there are any additional I&APs that should be included in the I&AP database, please notify SLR and/or send SLR their contact details to:

SLR Consulting

Candice Sadan

(021) 461 1118 (Tel)

(011) 467 0978 (Fax)

csadan@slrconsulting.com

PO Box 1596, Cramerview 2060

7.3.2 Background Information Document

A Background Information Document (BID) was compiled for the proposed Gamsberg Smelter Project. The purpose of the BID was to notify I&APs about the proposed Gamsberg Smelter Project and the EIA process, notify I&APs of the planned scoping information-sharing sessions and provide contact details of where queries or comments can be made. The BID was distributed by email and by hand (starting on 9 September 2019).

A copy of the BID is included in Appendix E.

7.3.3 Landowner and Occupier Notifications

During the week of 14 to 18 October 2019, notification letters and BID were sent via email to all I&APs on the database. In addition, BIDs were distributed by hand at focus group meetings undertaken by the Social consultant from 9 to 13 September 2019.

7.3.4 State Department Notifications

On 16 October 2019, a notification letter and BID were also sent to the following authorities:

National Authorities:

- Department of Mineral Resources (DMR);
- Department of Environmental Affairs (DEA);
- Department of Human Settlements, Water and Sanitation (DWS);
- Department of Agriculture, Forestry and Fisheries (DAFF);
- South African National Parks (SANP); and
- South African Heritage Resources Agency (SAHRA).

Regional Authorities:

- Department of Agriculture, Land Reform and Rural Development (DALRRD);
- Department of Mineral Resources (DMR);
- Department of Social Development (DSD); and
- Department of Human Settlements, Water and Sanitation (DHSWS).

Provincial Authorities:

- Department of Agriculture, Land Reform and Rural Development (DALRRD);
- Department of Economic Development and Tourism (DEDAT);
- Department of Environment and Nature Conservation (DENC);
- Department of Cooperative Governance, Human Settlement and Traditional Affairs;
- Department of Health;
- Department of Roads and Public Works;
- Department of Social Development;
- Department of Transport; and

- Department of Human Settlements, Water and Sanitation (DHSWS).

Local and District Authorities:

- Namakwa District Municipality (NDM);
- Khâi-Ma Municipality; and
- Ward 3 Councillor: Aggeneys

7.3.5 Advertisements and Site Notices

Advertisements were placed in the following newspapers:

- The Plattelander, 20 September 2019; and
- The Gemsbok, 20 September 2019.

A copy of the newspaper advertisements and site notices are included in Appendix E.

In addition, site notices in both English and Afrikaans were placed at the following venues (erected 5 and 6 September 2019):

- Black Mountain Mine security office;
- Gamsberg Zinc Mine security office;
- OK Bazaars in Aggeneys;
- Store in Pella;
- Pella Clinic; and
- Khâi-Ma Municipality, Pofadder.

Proof of these site notices is included in Appendix E.

7.3.6 Public Scoping Meeting

Public scoping meetings were held from 2 December 2019 to 5 December 2019 in order to present the Gamsberg Smelter Project to the I&APs. Meeting minutes and the presentations are included in Appendix E. The public meetings were held at the following venues:

- Aggeneys North Recreation Club, Aggeneys, 8893

Date: 2 December 2019

Time: 16:00 to 18:00

- Pella Community Hall, 129 Katedraal Str. Pella, 8892

Date: 3 December 2019

Time: 10:00 to 12:00

- Pofadder Community Hall, Corner of Voortrekker and Skool Street, Pofadder, 8890

Date: 4 December 2019

Time: 14:00 to 16:00

- Pofadder Farmers Union Hall, Pofadder

Date: 4 December 2019

Time: 17:00 to 18:30

- Namakwa FM Radio Interview

Date: 5 December 2019

Time: 08:00 to 08:30

7.3.7 Review of the Draft Scoping Report

Public Review of Draft Scoping Report

Draft Scoping Report in English, a Non-Technical Summary in English and Afrikaans and accompanying documents will be made available at the following public places within the Project area for a 30 day public review period:

- Pofadder Public Library;
- Pofadder Local Municipal Offices;
- Springbok Municipal Offices;
- Springbok Library;
- Aggeneys Public Library;
- Pella Public Library and Local Municipality; and
- Project website.

The Non-Technical Summary of the Draft Scoping Report in both English and Afrikaans will be distributed to I&APs:

- via email and post to I&APs on the I&AP database; and
- via email to municipal structures.

In addition, registered I&APs would be notified of the availability of the Scoping Report for review via SMS notification. Electronic copies of the Draft Scoping Report will be made available on the SLR and the VZI website.

DMR Review of Scoping Report

Upon completion of the public review period, the Final Scoping Report will be submitted to the DMR for review.

7.4 SUMMARY OF THE ISSUES RAISED BY I&APS

The comments and responses table is included in Table 26.

Table 26 Comments and Responses

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
1	**Environmental related comments and responses**				
1.1	K.A. Fortuin	X	Email, Emailed registration form, 18 October 2019	How will the pollution be controlled? Environmental impacts and their controls? Social impacts on residing community? Water consumption control?	Various specialist studies including ground water, surface water and air quality are being undertaken to identify [potential impacts and provide mitigation measures. These will be addressed in the EIA and EMPr which will be circulated for public review at a later stage in the process.
1.2	M. Botha	X	Emailed registration form, 18 October 2019	Who is the CEA for the smelter? There is incomplete or non-compliant mitigation from previous environmental authorisations. How will this be managed in the EIA process? DEFF is not listed as regulatory authority or an interested party.	I&AP is urged to review the documentation for the EIA process and send in specific areas where non-compliance has been noted. I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project. A focus group meeting with the Department of Environment and Nature Conservation, Northern Cape, with whom BMM signed the original Gamsberg Biodiversity offset Agreement, will be held once the specialist biodiversity studies and air quality model are completed to get their inputs, comments and recommendations.
1.3	I. Basson o.b.o Pella NCMACA Branch	X	Emailed letter, 28 October 2019	Firstly, we are sorry that we are responding so late, but we had to hold a meeting with our role players first. By email we thank you for taking us into account with the 3rd pipeline of the Orange River by Pella to Gamsberg. Secondly, we as Pella residents and riparian farmers have discovered a few years back that the invader plants are sucking up Orange River water at a tremendous rate. It	Black Mountain Mining (Pty) Ltd is proposing to upgrade the existing underground pipeline on behalf of Sedibeng Water. In order to do this the existing underground pipeline will be removed and a new one installed. This proposed pipeline upgrade will be undertaken as a separate Basic Assessment process and will have the relevant specialist study done to inform the project.

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
				stands along the banks of the river all the way to Witbank ridge. Thirdly, we as Pella residents have also discovered that the Orange River is saturated and will not be able to supply a third pipeline, so we say no to a third pipeline. It will not happen in the next 10 years, not in our river and not on our land. Sorry. Fourth, As Pella community forum, in 2017 we asked Vedanta to remove the invasive plant by the roots from the riverbanks. To date nothing has happened so where do they think the river should get enough water for their pipeline? They should have listened to us and done as we said, then maybe the Orange River could have been saved. We are sorry, but we refuse the construction of a third pipeline, because we want to protect this little bit of water for our community and future generations. We will not allow any pipeline construction. We wish you a thousand failures in the future.	
1.4	S.A.C Hockaday	X	Emailed registration form, 1 November 2019	I would like to know if any measures were considered to limit direct and indirect greenhouse gas emissions.	A Climate Change specialist study has been commissioned for the Gamsberg Smelter Project to assess the emissions from the project and the potential impact on greenhouse gases.
1.5	A. Young o.b.o the Mesemb Study Group	X	Emailed registration form, 6 November 2019	Current safeguards concerning preservation of succulent flora at the Gamsberg have been shown to be inadequate and until these issues are resolved no further developments that are likely to negatively impact the biodiversity of the Gamsberg should be undertaken. What specific measures will be taken by the mine to ensure that the floral	As part of the Gamsberg Smelter Project a Biodiversity specialist study is being undertaken to understand the current impacts from the Gamsberg Zinc Mine as well potential impacts from the operation of the smelter and associated facilities on the vegetation of the area. In addition to this an Offset Agreement is currently in place as well as a Biodiversity Management Plan (BMP) to manage

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
				biodiversity in the area is protected as a result of this development?	the impacts on the mine. This BMP will be updated to include the Proposed Gamsberg Smelter Project. In addition, a focus group meeting with the Department of Environment and Nature Conservation, Northern Cape, with whom BMM signed the original Gamsberg Biodiversity offset Agreement, will be held once the specialist biodiversity studies and air quality model are completed to get their inputs, comments and recommendations. Implementation of Biodiversity Offset Agreement has resulted in the Proclamation of the Gamsberg Nature Reserve as Gazetted in the Northern Cape Provincial Gazette on 5 August 2019. The Gamsberg Nature Reserve was proclaimed as a Protected area under the National Environmental Management Protected Area Act and the Management Plan as required by the NEMPA are currently being compiled by DENC. This will safeguard the conservation of succulents within the secured Gamsberg Nature Reserve for future generations.
1.6	P. Mokomele o.b.o the Industrial Development Corporation	X	Emailed registration form, 12 November 2019	How will waste be treated and what will be the environmental effects?	Waste produced by the Gamsberg Smelter Project is proposed to be stored in a new Secured Landfill Facility. A full specialist ground and surface water studies will be undertaken to inform requirements and any potential impacts.
1.7	P. Mokomele o.b.o the Industrial Development Corporation	X	Emailed registration form, 12 November 2019	Will the building of a smelter mean that there will be more people coming to the area? How will the influx be handled? Has the capacity of the municipality in terms of infrastructure been assessed to accommodate (the project?).	Black Mountain Mining (Pty) Ltd will ensure that the Business Partners follow the required recruitment process to maximise the use of local skills as far as possible. There is a skills database in place which is planned to be reviewed in consultation with the DoL and the Khâi-Ma Municipality.

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
					A Socio-economic specialist study has been commissioned to assess the potential impact on the local infrastructure.
1.8	K. Purnell, o.b.o Wilderness Foundation Africa	X	Emailed registration form, 15 December 2019	Wilderness Foundation Africa is concerned with the loss of biodiversity and whether it is being offset sufficiently.	As part of the Gamsberg Smelter Project a Biodiversity specialist study is being undertaken to understand the current impacts from the Gamsberg Zinc Mine as well potential impacts from the operation of the smelter and associated facilities on the vegetation of the area. A focus group meeting with the Department of Environment and Nature Conservation, Northern Cape, with whom BMM signed the original Gamsberg Biodiversity offset Agreement, will be held once the specialist biodiversity studies and air quality model are completed to get their inputs, comments and recommendations. Implementation of Biodiversity Offset Agreement of Gamsberg has resulted in the Proclamation of the Gamsberg Nature Reserve as Gazetted in the Northern Cape Provincial Gazette on 5 August 2019. The Gamsberg Nature Reserve was proclaimed as a Protected area under the National Environmental Management Protected Area Act and the Management Plan as required by the NEMPA are currently being compiled by DENC. This will safeguard the conservation of succulents within the secured Gamsberg Nature Reserve for future generations.
1.9	K. Purnell, o.b.o Wilderness Foundation Africa	X	Emailed registration form, 15 December 2019	We are very concerned with the fallout from sulphur and its impacts on the surrounding environment, which could affect a large area around the smelter. This needs to be adequately addressed through a thorough modelling of the sulphur fallout in the EIA.	An Air Quality specialist study is being undertaken to understand emissions from the proposed Gamsberg Smelter. These emissions will be modelled to give an understanding of potential impacts on the surrounding environment as well as mitigation measures provided to minimise potential impacts.

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
					In addition, the Gamsberg Smelter has been designed with the latest technology to minimise emissions during the acid making process and adhere to relevant national guidelines.
2	**Technical / Technology related comments and responses**				
2.1	J. Crowder o.b.o Standard Bank	X	Email, 18 October 2019	Thank you very much for the information. Do you perhaps have timelines for the proposed project please?	Pending approval of the EIA and EMPr construction is hoped to start in 2021. The construction phase will take 2 to 3 years.
2.2	J. Leader	X	Emailed registration form, 18 October 2019	Is there a proposed finish date yet?	Pending approval of the EIA and EMPr construction is hoped to start in 2021. The construction phase will take 2 to 3 years.
2.3	S. Meijers o.b.o ELB Engineering Services	X	Emailed registration form, 22 October 2019	Has phase 2 been considered in your layouts?	Phase 2 has been considered and will also be assessed cumulatively with additional impacts from the proposed Gamsberg Smelter Project.
2.4	C. Steyn o.b.o Connolee Investment	X	Emailed registration form, 25 October 2019	I am interested in the renewable energy section.	Thank you for your comment. I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
2.5	S.A.C Hockaday	X	Emailed registration form, 1 November 2019	I would like to know the measures taken to ensure water conservation.	The design of the smelter has looked at minimising water consumption to the benchmark with existing zinc smelters with similar capacity around the world and has been designed for effluent recycle system & zero liquid discharge. Black Mountain Mining (Pty) Ltd will also not exceed the current water allowance.
2.6	S.A.C Hockaday	X	Emailed registration form, 1 November 2019	I would like to know the process alternatives considered and how the electrolytic process was selected to ensure it is appropriate to the resource	A process selection study was carried out by Vedanta Zinc International at conceptual level which involved identifying the technologies currently being used by the largest zinc

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
					producers worldwide as a benchmark. The study resulted in the selection of the following two process options: • Roast-Leach-Electrowinning (R-L-E) with Jarosite precipitation; and • High Pressure/ Atmospheric Acid Leach. The survey of the largest global zinc producers confirmed that conventional Roast-Leach-Electrowinning (R-L-E) is by far the most used processing route within excess of 85% of the zinc producers using variations of the process.
2.7	S.A.C Hockaday	X	Emailed registration form, 1 November 2019	I would like to know if the use of renewable energy sources were considered as alternative to grid electricity dependence.	A zinc smelter is a power intensive plant and electrical power plays a major role in the operation with power outages severely affecting production capacity. As such it is essential that power sourcing be reliable with 100 percent availability for uninterrupted operation of the plant. The following alternative power sources are being considered: • Eskom grid substation; • Captive solar power plant; • Wind based power plant; and • Hybrid model (including both Eskom and renewable source) Eskom grid along with renewable (solar and wind) mix. Considerable focus is placed on utilising alternative/hybrid energy sources such as wind and solar power sources, and not total reliance on the ESKOM grid.
2.8	N. Uys o.b.o Minerals to Metals	X	Emailed registration form, 13 November 2019	Is the use of the term smelter not misleading? Our understanding is that it is a Roast-Leach-Electrowinning (R-L-E) process as opposed to a smelter.	The full Gamsberg Smelter Project description is included in the Draft Scoping Report which will be sent out for public comment. Any additional comments/ queries can be

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
	Initiative, University of cape Town			Roasting: A pyrometallurgical process where ore/concentrates is heated to below its melting point, in the presence of air, in order to oxidise impurities. In the case of zinc sulphide ores, sulphur is oxidised. Most common equipment for this process is a rotary kiln. Smelting: A pyrometallurgical process where metals are extracted from ore/concentrate heating above the melting point of all constituents in a furnace and separating into metal rich (blister, matte) and oxide-rich (slag) phases that are tapped separately from the furnace. Questions: Technology • What was the driving factor for the Roast-Leach-Electrowinning (R-L-E) technology choice? o What is the fuel source for the roasting step (coal, gas, diesel), where is it coming from and how is it stored? o What are the exhausts from the R-L-E process? o What is the expected CO2 footprint? o Are there any deleterious metals/dust in the exhaust gas? o Has gas dispersion been modelled? o Has any means of CO2 capture been considered? • What other technology options (as opposed to R-L-E) were considered (e.g. pressure leaching)? Products	submitted during this public review period and will be responded to. Zinc smelter is the most commonly used terminology worldwide for extracting zinc metal from zinc bearing concentrate. Conventional R-L-E is one of the processes routes which we intend to follow to treat the Gamsberg zinc concentrate. At the Gamsberg Zinc Smelter it is the intention to apply the Roasting process, where in the presence of air, the zinc sulphide is oxidised to zinc oxide and sulphur in concentrate is oxidised to sulphur dioxide which is cleaned and converted to sulphuric acid. The process is exothermic and auto thermal. The technical process queries have been addressed in Section 3.2.2. I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
				• Apart from zinc and sulphuric acid, are there any other proposed or potential sellable products (e.g. metal impurities such as silver, indium, germanium which are removed during purification)? If there are potential other sellable products, what is hindering their inclusion in the process flowsheet? • Is there a reliable market for sulphuric acid? o If so where is the market? o How will it be stored and transported? • Is there potential for a close-by facility for fertiliser production? o Is there a market for fertiliser? • Will all the concentrate be processed by the proposed refining process, or will a portion of the concentrate be exported? Waste • What are the proposed waste management strategies? o In terms of leach residues, impurity removal products, flue-gas precipitates, etc. o What is the current plan for iron precipitates (Jarosite) and gypsum products? o Have any other options for minimisation/elimination of waste production been considered? • What is the expected deportment of deleterious elements into waste streams? Utilities	

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
				• Is the Eskom Aggeneys Substation the sole source of the plant's electricity requirements? o What is the anticipated electrical power demand for the process, particularly the energy intensive electrowinning step? o Can Eskom Aggeneys Substation accommodate this additional electricity demand? o What are the impacts associated with this (locally and nationally)? o What additional environmental concerns need to be addressed in building the power line from the substation? Given an already constrained national grid, what is the 'backup' plan if Eskom's electricity provision is constrained (periods of less or no electricity)?	
3	**Procurement of Services (people offering their services) related comments and responses**				
3.1	C.G. March	X	Emailed registration form, 16 October 2019	Mostly interested in the job creation aspects as well as the prospect(ive) projects social economic development objectives.	During the construction phase approximately 6 000 jobs will be created and 1 200 during operations. During the construction phase the Business Partners will be aligned with Black Mountain Mining (Pty) Ltd/ Department of Labour (DoL)/ Khâi-Ma Municipality requirements. For the operational phase the normal Black Mountain Mining (Pty) Ltd recruitment process will be in place. Black Mountain Mining (Pty) Ltd have invested more than R100 million in LED projects incl. community development between April 2014 and December 2019 towards empowering of community members. Black Mountain Mine (Pty) Ltd has further committed to spend close to R150

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
					million over the next five years (2019-2023) on local economic development initiatives.
3.2	E. Beukes	X	Emailed registration form, 17 October 2019	With the development of the new Gamsberg mine there has been no significant differences in our communities in terms of development and economic empowerment despite millions of rand raised through the SLP being spent. How will the new smelter help improve the economic empowerment of our local communities? How can it help to employ fewer contractors outside the Northern Cape who are impoverishing our small businesses? How can incumbent contractors be forced to subcontract small businesses for the purpose of building them? Will the mine stop bringing in (external, outside Khâi-Ma) people and companies while we have local capacity? Compared to Postmasburg which expanded to the new mines, how will the smelter contribute so that we see similar development in our towns? "Contact details for L. Steenkamp provided."	Black Mountain Mining (Pty) Ltd currently contributes towards the employment of approximately 2 850 people (direct/indirect). Of the 1 804 people directly employed, Khâi-Ma employees represent 25% of the total employment and Namakwa as a whole 61%. Gamsberg has contributed significantly to the local employment increase experienced since the start of its plant operations in 2018. Currently 177 community members are enrolled at the TVET College in Upington. This is planned to increase to 250-300 over 2020. All candidates will have the opportunity to be employed. Black Mountain Mining (Pty) Ltd will ensure that the Business Partners follow the required recruitment process. Black Mountain Mining (Pty) Ltd have invested more than R100 million in LED projects including community development between April 2014 and December 2019 towards empowering of community members. Local skills will be prioritised for employment. There is a skills database in place which is planned to be reviewed in consultation with the DoL and the Khâi-Ma Municipality. L. Steenkamp has been registered on the I&AP database to receive any and all future public communications regarding the project.
3.3	G. Stock, o.b.o Moolmans	X	Emailed registration form, 17 October 2019	Please to keep us informed of the EIA development as it progresses.	I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
3.4	I. Andrea o.b.o Southey Contracting	X	Emailed registration form, 17 October 2019	We were part of Phase 1 and completed the scaffolding for civils and mechanical work without any injuries.	Thank you for your comment. I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
3.5	M. van Kuijeren o.b.o B&W Instrumentation & Electrical	X	Emailed registration form, 17 October 2019	B&W complied 100% on the Vedanta Environmental Management Phase throughout the Project Construction Phase. B&W complied 100% on the Vedanta Safety Management Plan, achieving 100% Safety Audit via Vedanta and their Safety Agents 8 months in a row. B&W also received the Safety Excellence award for the Gamsberg 1st Phase presented by Vedanta CEO and Chairman. B&W also won the Reticulation Contractor of the Year by the ECA (Electrical Contractors Association) for the OHL and Sub-station Installation Scope of Work on the Gamsberg Project. B&W was runner-up for the National Safety Award Contractor of the Year by the ECA for the Gamsberg Project. B&W was also runner-up for the Installation Contractor of the Year-Industrial by the ECA for the Gamsberg Project.	Thank you for your comment. I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
3.6	T. Padotan o.b.o Roadlab	X	Emailed registration form, 17 October 2019	We conduct civil engineering materials testing.	Thank you for your comment. I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
3.7	C. Steyn o.b.o EOH	X	Emailed registration form, 27 October 2019	Job opportunities should be positive.	During the construction phase approximately 6 000 jobs will be created and 1 200 during operations. During the construction phase the Business Partners will be aligned with Black Mountain Mining (Pty) Ltd/ Department of Labour (DoL)/ Khâi-Ma Municipality requirements.

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
					For the operational phase the normal Black Mountain Mining (Pty) Ltd recruitment process will be in place.
3.8	M. Vogel o.b.o CSG Foods (Pty) Ltd	X	Emailed registration form, 5 November 2019	We are South African registered company and a subsidiary of CSG Group of Companies. CSG Foods specialize in Camp Construction, Camp Management, Catering, Cleaning, Laundry and Related Services. We will without hesitation take you to some of our current sites in order to introduce you to our current clients for reference purposes and will be able to assist you immediately with proposed solutions and pricing you might require.	Thank you for your comment. I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
3.9	P. Mokomele o.b.o the Industrial Development Corporation	X	Emailed registration form, 12 November 2019	I would be interested in knowing how unemployment will be impacted.	During the construction phase approximately 6 000 jobs will be created and 1 200 during operations. During the construction phase the Business Partners will be aligned with Black Mountain Mining (Pty) Ltd/ Department of Labour (DoL)/ Khâi-Ma Municipality requirements. For the operational phase the normal Black Mountain Mining (Pty) Ltd recruitment process will be in place.
3.10	D. Bursic o.b.o Novatec	X	Emailed registration form, 12 November 2019	As supplier of control system (system integrator), LV equipment (MCC, PLC, RIO, LCS and other similar types) on Gamsberg Project phase 1, we are showing interest for future project phases (smelter, second concentrator plant) that will follow.	I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
3.11	R. Stuurman, o.b.o Desert Road Inn	X	Emailed registration form, 18 November 2019	As the Social and Labour Plan says, local small business must be uplifted. We as small business owners in Khâi-Ma gained nothing from the projects at Gamsberg. I hope this project will not be the same as the first one.	Black Mountain Mining (Pty) Ltd has spent just over R4.2 million towards small business support and enterprise development. It is Black Mountain Mining (Pty) Ltd's aim to ensure that SMME mentoring and support are implemented and provided.

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
					There is a process in place for businesses to register to provide services. However, due to the large quantities usually required it is often difficult for small businesses to provide the required services etc.
3.12	R. Nortje, o.b.o Rowena's Cottage	X	Email, 18 November 2019	As an entrepreneur, and as an interested party, I would like to congratulate you in development that is taking place in our Municipal Area. Question will be who will benefit in this project and how? With the first development of the current Plant that is operational, outside company's benefited and left with the Capital. Will it be the repeat of future beneficiaries? I am a black female business owner. My business does purified water whereby the machine is an upmarket RO 4000 Reverse Osmosis Machine. My company did not benefit from the first project. Pofadder itself was not developed and business shift to Springbok and Kakamas. Are we going to see a repeat? My Company's name is Rowena's Cottage, producing 'Pofadder Water'.	There is a process in place for businesses to register to provide services. However, due to the large quantities usually required it is often difficult for small businesses to provide the required services etc.
3.13	S. Williams o.b.o BVI	X	Emailed registration form, 19 November 2019	BVI Consulting Engineers was involved with the previous phase 1 of this project.	Thank you for your comment. I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
3.14	B. Harley, o.b.o B&W Instrumentation and electrical	X	Email, 22 November 2019	Thank you for the comprehensive report on the project and indeed the existing environment. B&W were involved extensively on the concentrator project particularly when building the overhead line from Aggeneys to site regarding the line route and the process and procedures we had to adhere to. Both B&W and the client team I believe achieved the goals set in maintaining and preserving the environment ensuring absolute minimum damage and relocation. B&W	Thank you for your comment. I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
				will be attending the public meeting at Pofadder on the 4th of December 2019.	
3.15	N. Bruhns, o.b.o FCS	X	Emailed registration form, 26 November 2019	We are Suppliers, based in Upington in the Northern Cape, and would be so glad if you list us as an interested party for the Gamsberg Smelter and Bulk Water Pipeline Project. Please be so kind and keep us updated.	I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
4	**I&AP registration related comments and responses**				
4.1	M. Letsoso, o.b.o NCPG	X	Email, 16 October 2019	Kindly send all future mail to sharonplaatjies@ncpg.gov.za as MLetsoso@ncpg.gov.za will be no longer available.	Thank you for the update. The database has been updated accordingly.
4.2	A. Van Schalkwyk o.b.o Waltons	X	Email, 16 October 2019	Please remove me from this mailing communication, thanks.	Thank you for the update. The database has been updated accordingly.
4.3	L. Ntobela o.b.o NCPG	X	Email, 16 October 2019	Please forward mail to reneewilliams@ncpg.gov.za and lucretiavanderwesthuizen@ncpg.gov.za	Thank you for the update. The database has been updated accordingly.
4.4	F. Scott o.b.o Osborn Engineered Products SA	X	Email, 16 October 2019.	Osborn Engineered Products will be interested in participating on this Project, I will submit the document back to you.	Comment noted. No further correspondence received to date.
4.5	A. Costa o.b.o the IDC	X	Email, 16 October 2019	I don't require communications on this matter, thank you.	Thank you for the update. The database has been updated accordingly.
4.6	Dr L. Kirsten o.b.o SMEC	X	Email, 16 October 2019	We are not an interested or party in relation to this notice. It should therefore be ok if you removed me from the circulation list.	Thank you for the update. The database has been updated accordingly.

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
4.7	I. Coetzee o.b.o Radio NFM	X	Emailed registration form, 16 October 2019	"Request I&AP registration."	I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
4.8	A. Duff o.b.o MV Switchgear	X	Email, 17 October 2019	We would appreciate receiving any further applicable information.	I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
4.9	L. Smith o.b.o NCPG	X	Email, 18 October 2019	1. Ms D Stander - Environmental Management 2. Dr L Mabona - Infrastructure Management Please receive this communique for your attention and noting. The HOD requests that this office be kept updated in this regard.	I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
4.10	JA. Kruger	X	Email, 18 October 2019	"Additional I&AP contact details provided for Cassie Kruger."	I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
4.11	K.A. Fortuin,	X	Email, Emailed registration form, 18 October 2019	How many IAP participants do you have, and can anyone join? Also, when will the first meeting be held and where? Lastly, is there a formal process of research being done on this project?	I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project. Initial public meetings were held from 2 to 5 December 2019 which all registered I&AP's were informed of. Further meetings will be held later in the process.
4.12	M. Swarts o.b.o Labex	X	Emailed registration form, 18 October 2019	Suppliers of lab equipment and chemicals	Thank you for your comment. I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
4.13	M. Ferreira o.b.o Quality Tube Services	X	Emailed registration form, 18 October 2019	We are very interested in the project. Supply of steel pipe and related fittings as well as rubber lining and HDPE lining and HDPE pipes and fittings.	Thank you for your comment. I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
4.14	R. Stuurman o.b.o Desert Road Inn	X	Emailed registration form, 18 October 2019	As a small business owner, my question is whether they will give us businesses in Khâi-Ma opportunity to benefit from the project? On the original project there were only promises.	There is a process in place for businesses to register to provide services. However, due to the large quantities usually required it is often difficult for small businesses to provide the required services etc.
4.15	C. Vele o.b.o Industrial Analytical	X	Emailed registration form, 18 October 2019	To be the supplier of certified reference materials, high purity compounds, chemicals and claisse fusion equipment for sample preparation.	Thank you for your comment. I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
4.16	JA. Wessels	X	Emailed registration form, 8 November 2019	May I please be given opportunity to comment on the EIA documentation/reports.	All registered I&APs will be afforded the opportunity to comment on the scoping report and EIA report when these reports are distributed for public review.
4.17	D. McIvor o.b.o Baltimo Engineering Agency	X	Email, 19 November 2019	Please include us on correspondence relating to this project.	I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
4.18	H. Yingsheng, o.b.o ENFI	X	Email, 20 November 2019	Sorry for the late reply due to annual leave. I copied in Maggie. She will contact you.	I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
4.19	M. Lee, o.b.o ENFI	X	Email, 21 November 2019	Thank you very much for your information. Please feel free to let us know if there's any updated or request.	Thank you for your comment. I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.
4.20	J. Whon	X	Email, 25 November 2019	As discussed over the phone, could you please send me more info regarding this EIA?	I&AP has been registered on the I&AP database to receive any and all current and future public communications regarding the project.
4.21	R. Kamish. O.b.o Mainstream	X	Email, 10 January 2020	Could you kindly register myself as an Interested and Affected Party?	I&AP has been registered on the I&AP database to receive any and all future public communications regarding the project.

#	I&AP Details		Date and mode of communication	Issue raised	Response (as amended for the purposes of the scoping report)
	Renewable Power				

7.5 THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE PROJECT AND ALTERNATIVES

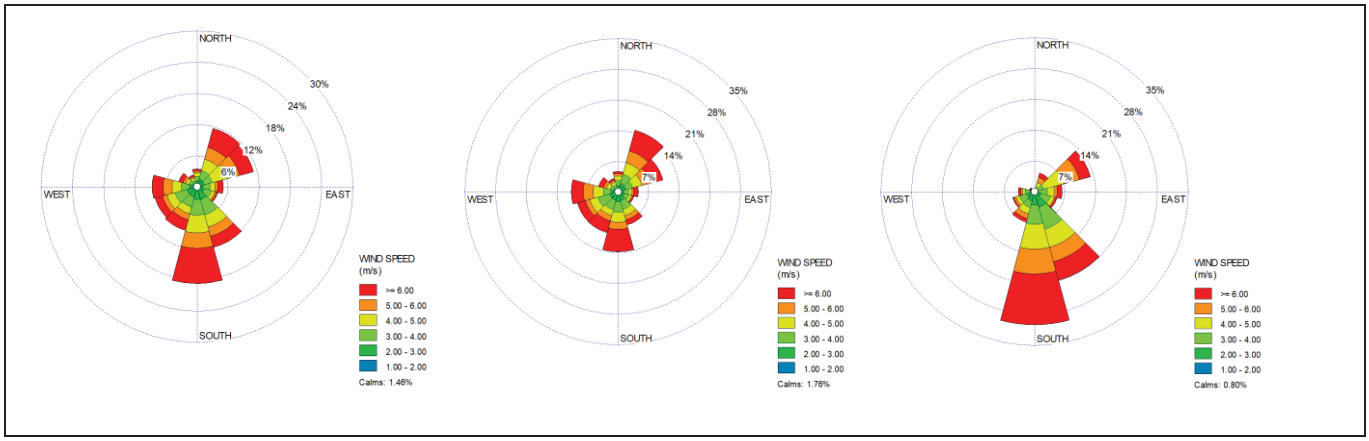
7.5.1 Type of environment affected by the proposed activity

Climate

The area is classified as a hot desert region with very low rainfall and very high evaporation rates, has an arid climate although rainfall (average of 98 mm/year) occurs in summer and winter as the area lies in a transition zone between winter and summer rainfall areas. Summers are hot and mean maximum temperatures in January, the hottest month, range between 30.7°C and 35.4°C. During winter, mean maximum temperatures range from 17.8°C to 20°C with significant temperature reductions at night.

The mean annual average temperatures are just below 20°C with very hot summers and cool to mild winters. The Mean Annual Evaporation (MAE) of 2,650mm was determined by the 1990 WRC publication "Surface Water Resources of South Africa." (SRK, 2010).

Wind over the period 2016 to 2018 (as modelled by Airshed, 2019) is primarily from the south. During the day, the predominant wind direction is from the south and the north-northwest ().



Period average wind rose | Day-time wind rose (06:00 – 22:00) | Night-time wind rose (22:00 – 06:00)

Figure 11 Wind Roses for the Period 1 January 2016 to 31 December 2018 (A -

Topography

According to ERM (2013) the local topography is characterised with undulating plains, containing low growing shrubby vegetation and grasses. The surrounding plains are approximately 750 – 900 meters above mean sea level (mamsl), with the highest areas of the Gamsberg inselberg varying between 1 100 – 1 150 mamsl. The Gamsberg inselberg is approximately 7.2 km east – west and approximately 4.6 km north – south. Erosion along the top of the inselberg has resulted in the creation of a basin within the feature, which subsequently varies between 60 – 70 m below the rim of the inselberg.

Geology/ Geochemistry

Regional Geology

The Gamsberg zinc deposit is developed in a medium to high grade metamorphic volcano-sedimentary succession belonging to the Aggeneys Sub-Group of the Bushmanland Group. This Group is bordered to the east

by the Hartbees River Thrust, to the north by the Groothoek Thrust and Wortel Belt, and it is overlain by Karoo-age rocks to the south. Together these Groups occur within the Namaqualand Metamorphic Complex, which consists of Precambrian metamorphic rocks and intrusives formed or metamorphosed during the Namaqua Orogeny (ERM, 2013).

Geochemical Context of the Gamsberg Deposit

According to ERM (2013) opencast mining of the Gamsberg deposit disturbs rocks from the Pella Quartzite, Gams Iron and Koeris Formations. Exposure of these rocks to oxygen and water could lead to oxidation of elements that currently occur in a reduced state. The oxidation of sulphide minerals on exposure could generate metal oxides, sulphate and acidity (H+). Where base or alkali minerals are present they may neutralise this acidity. If there is sufficient net acidity to lower the pH of water in contact with the rock/mine waste material then metal leaching may occur, because metals are generally more soluble at low pH. The resultant acid rock drainage (ARD) could pose a threat to surface and groundwater resources in the area.

Soils and Land Capability

Soils

A soils baseline study was undertaken by SRK Consulting in December 2009. According to their findings the study area consists of an "extensive peneplain above which the Gamsberg Inselberg rises some 200 m". Soils associated with the peneplain are generally red in colour and are found overlying a solid Dorbank or calcrete (cemented carbonate) horizon. Soil depths range from 10 – 60 cm. These red soils, where sufficiently deep (30-60 cm), can be pre-stripped and used for rehabilitation purposes. Soils associated with the Inselberg are predominantly shallow and pebbly, gravelly or stony, and are found amongst areas of bare rock outcrop. These soils cannot be used for rehabilitation purposes. Plans for soil stripping should be compiled on the basis that certain soils are inherently suitable for rehabilitation purposes, whilst others are not.

Eleven individual soil units (types) were identified and mapped during soil investigations (Table 27).

Table 27 Soil Types Identified in the Project Area

Soil Units	Dominant Soils		Brief Description of the Soils	Land Form	Land Capability Class
	Soil Form	Family			
Kn1	Knersvlakte Coega	1000	Shallow red sand on dorbank or calcrete	Peneplain	VI
Kn2	Knersvlakte	2000	Shallow gravelly red sand on gravelly dorbank	Gentle lower slopes	VII
Gr1	Garies	1000	Moderately deep to shallow red sand to loamy sand on dorbank with calcrete deeper down	Peneplain	VI
Gr2	Garies	1000	Moderately deep red sand on dorbank	Wide, non-incised, gently sloping drainages	VI
Gr3	Garies Knersvlakte	1000	Moderately deep to shallow red sand to loamy sand on dorbank with calcrete deeper down	Peneplain	VI
Hu1	Hutton	3100	Deep red sand	Sand dune	VI

Soil Units	Dominant Soils		Brief Description of the Soils	Land Form	Land Capability Class
Hu2	Hutton	3100	Moderately deep red sand on rock or gravelly material	Gently sloping pediments	VI
Ms1	Mispah Hutton	1100 3100	Shallow stony to rocky sloping soils	Lower scree slopes	VII
Ms2	Mispah	1100	Dominantly shallow stony soils	Dissected Gamsberg basin	VII
R1	Rock Mispah	1100	Outcrop and rocky shallow soils	Scarps and very steep scree slopes	VIII
R2	Mispah	1100	Very shallow rocky soils and outcrop	Level to convex crest of Gamsberg	VIII

Source: SRK Consulting, 2009[6]

Land Capability

Land capability was also assessed by SRK Consulting in December 2009. Land capability is generally measured in terms of agricultural potential. SRK's findings were that the land capability in the study area (assessed using the System of Land Capability Classification for Agriculture in South Africa) ranged from low (Class VI) to very low (Class VIII, Table S1), largely as a result of the arid climate of the area and the sandy nature of soils found there. According to the Chamber of Mines land capability classification system, the affected area may only be used as a 'wilderness' area, i.e. it cannot be used for any alternative agricultural purpose.

Groundwater

Approximately 41 water sources (including boreholes, wells and springs) were identified during the hydrocensus undertaken by SRK Consulting in 2010, however, only 27 of those were operational. The baseline study confirmed that no regional aquifers have developed in the Namaqualand Metamorphic Complex. Furthermore, due to thinly developed soils, primary weathered zone aquifers are infrequent and localised.

Groundwater is mainly found within secondary fractured-rock aquifers and tends to be found along fractures within hydraulically isolated rocks of low permeability, which are commonly found in the surrounding areas. According to the baseline report, the transmissivity of the fractured aquifers is considered to be low (SRK Consulting, 2010).

The geology in the Gamsberg area is mainly comprised of dense metamorphic rocks which are characterised with low permeability, and as such, the movement of groundwater in the area is largely influenced by secondary

[6] *Key to Land Capability Classes
Class VI: Land in Class VI has permanent limitations that make it unsuited to cultivation and limit its use to natural grazing, veld re-inforcement, afforestation or wildlife
Class VII: Land in Class VII has very severe permanent limitations that render it unsuitable for cultivation or intensification and restrict its use to natural grazing, afforestation or wildlife
Class VIII: Land in Class VIII has permanent limitations that preclude its use for commercial plant production and restrict its use to wildlife, recreation, water supply or aesthetic needs

structural features. Features such as shears, thrust faults and fractures will impact on the movement of groundwater.

Groundwater resources in the Namakwa District are more abundant than surface water features. Groundwater serves as a key water source, especially for livestock farmers in the Project area.

The depth of groundwater ranges from 0 meters below ground level (mbgl) within the Gamsberg inselberg to approximately 51 mbgl in the surrounding plains.

Based on modelled groundwater contours, subsurface flows are limited to the south west and north east of the Gamsberg inselberg (ERM, 2013). The groundwater flows are consistent with the general surface topography in the area, which is indicative of an unconfined aquifer condition.

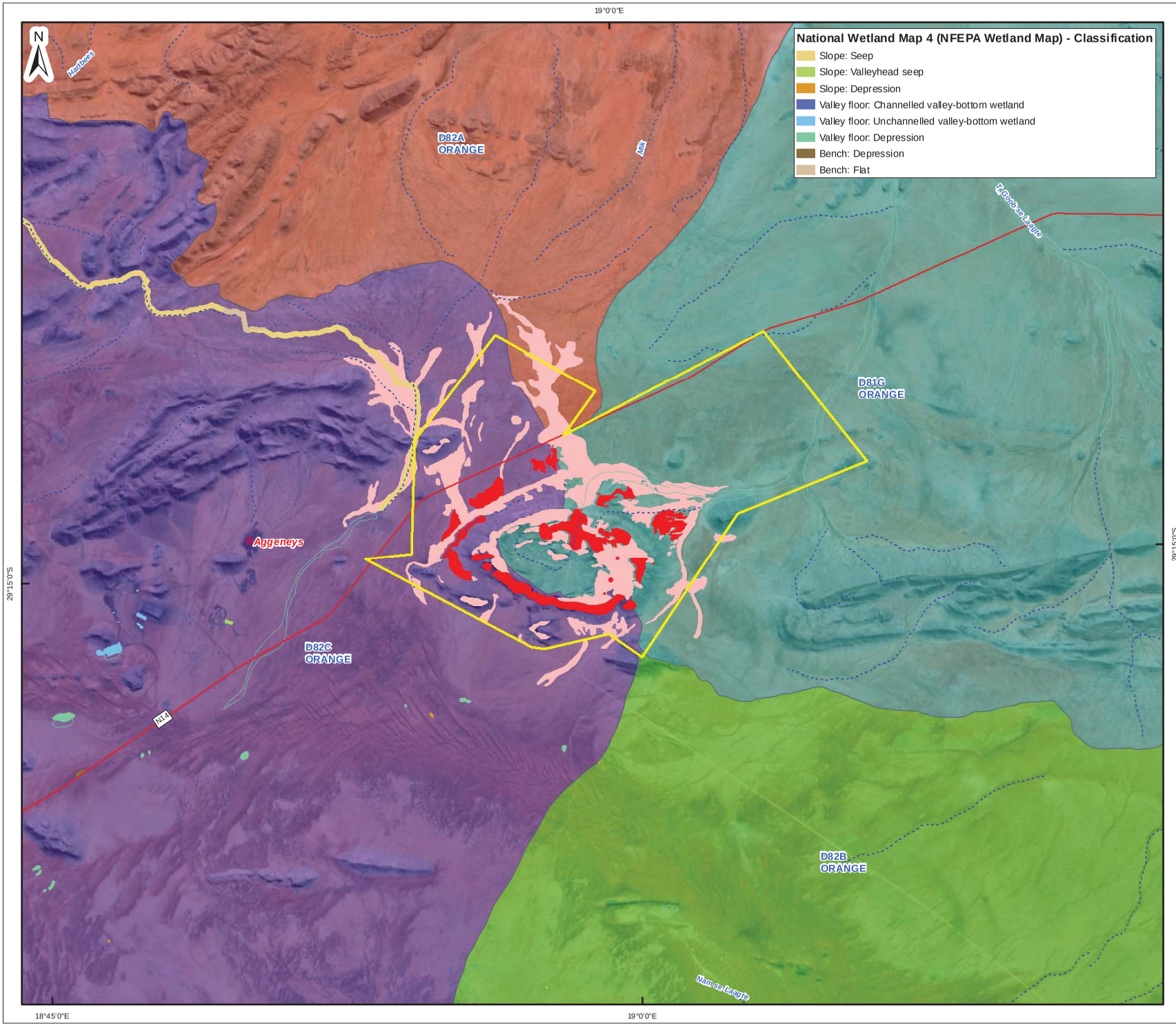
Surface Water

The Gamsberg Zinc Mine is located on the watershed between two quaternary catchments, D81G and D82C. The D81G catchment drains into the Orange River to the north and the D82C catchment is an interior drainage basin that does not drain to the sea.

Most of the water courses in the area are ephemeral but the small catchment area on top of the Gamsberg inselberg contains a spring and can experience seasonal to perennial flows.

The most significant watercourse to be considered for this scope of work is a drainage line running parallel to the N14 at the base of the northern side of the Gamsberg inselberg, and its tributaries from the north. The plant conveyor and a road are currently authorised to cross this watercourse.

The surface water in the local area is shown in Figure 12.



Legend

- Gamsberg Zinc Mine Property
- Main Roads
- Towns/Villages

ENPAT Rivers

- Perennial River
- Non-Perennial River
- Dam/Pan/Wetland

Sub-Catchments

- D81G
- D82A
- D82B
- D82C
- Botanical Sensitivity Irreplaceable
- Botanical Sensitivity Constrained

0 1 2 3 4 Kilometers

Scale: 1:150 000
Projection: Transverse Mercator
Datum: Lo 23 WGS 84

Gamsberg Smelter Project

Figure 12
Surface Water in the Local Area

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Terrestrial Biodiversity - Flora

The Gamsberg Inselberg in a Regional Context

The Gamsberg inselberg sits within what is termed the Bushmanland Inselberg Region (BIR), which includes all the large, quartzite-capped inselbergs located in the northern Bushmanland plains in South Africa. The BIR is said to cover a total area of about 6 300 km² (ERM, 2013). Based on this site, the vegetation found on the plains and along the warmer north-facing slopes is characteristic of the Nama Karoo Biome whereas that of cooler higher-elevation plains and south-facing slopes is characteristic of the Succulent Karoo Biome. The overlap of these biomes makes these inselbergs a unique feature.

The vegetation found on these inselbergs forms a distinct centre of plant endemism located within the larger Eastern Gariep Centre of Endemism (ERM, 2013). As there are a number of species identified that are considered to be endemic to the Bushmanland inselbergs and the BIR itself, the region has been termed the "Bushmanland Inselberg Centre of Endemism". A regional investigation undertaken by Dr Phillip Desmet (2000 - Referenced by ERM, 2013), confirmed that the Gamsberg inselberg is considered to be the most regionally important inselberg in the BIR in terms of its biodiversity and composition.

Terrestrial Biodiversity – Flora

The analysis in this section is based on the surveys undertaken by Phil Desmet (2010 2000 - Referenced by ERM, 2013) and the EIA written by ERM in 2013/2014 for the Gamsberg Zinc Mine. Further studies will be undertaken for this project to confirm findings.

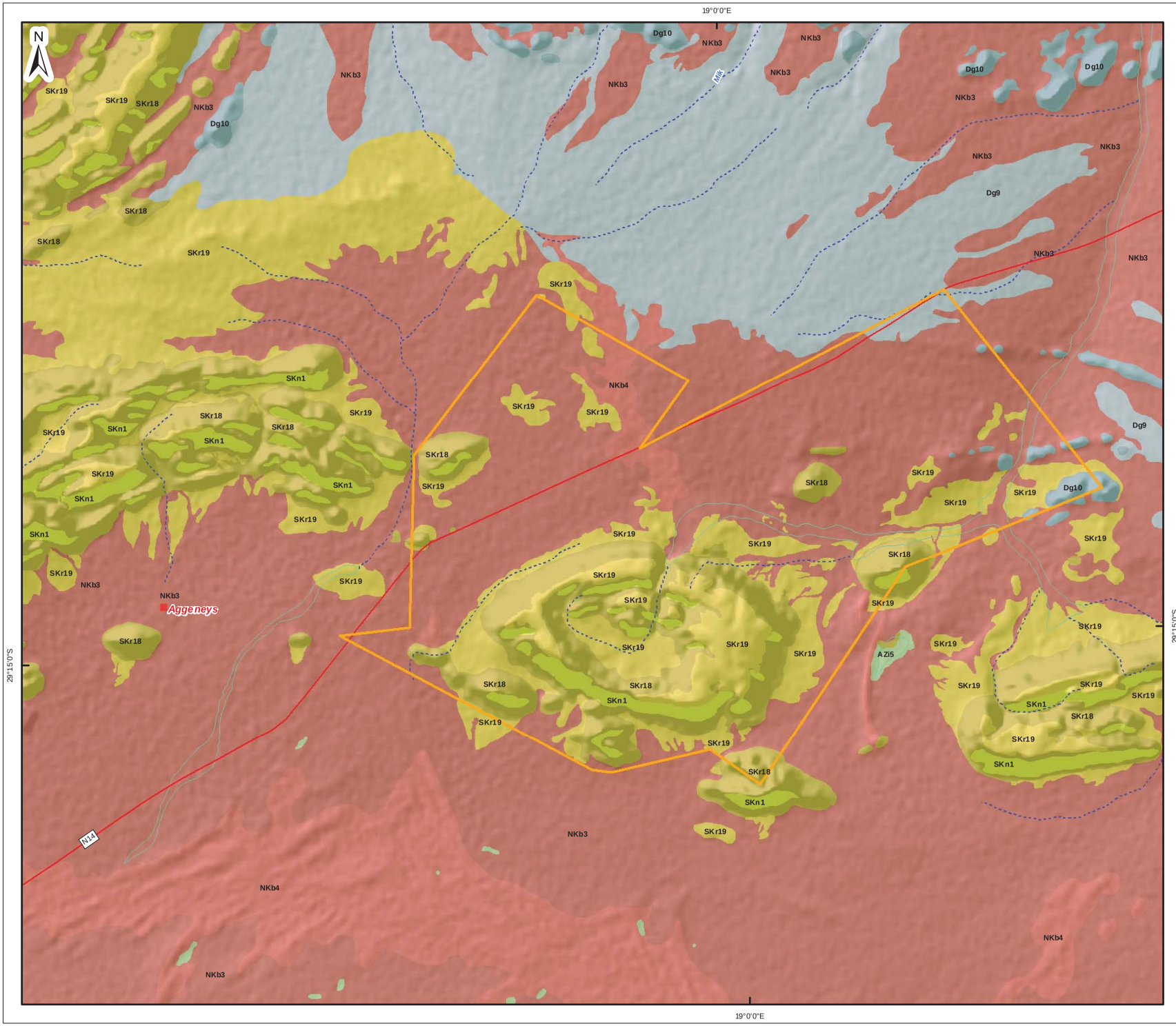
Based on previous investigations undertaken, together with the baseline study undertaken by Dr Phillip Desmet (2010), a total of 397 plant species were identified and recorded in the study area.

The Aggeneys Gravel Vygieveld (Mucina and Rutherford, 2006), covers a total area of approximately 1 556 hectares within the study area, which is approximately 9% of the regional extent of this vegetation type. This vegetation type is generally found in the Northern Cape Province, at elevations exceeding 950 m, and found along plateau summits of inselbergs and koppies. The vegetation in the region is characterised by sparse, low-growing species. The species found throughout the year are characterised by small to very small succulent plants, with a general absence of trees and grasses, except along drainage lines. Although the vegetation types can vary, Succulent Karoo vegetation is prominent in the area (ERM, 2013).

The Bushmanland Inselberg Shrubland is comprised of two habitat units, covering a total area of just over 3 000 hectares within the study area (ERM, 2013). The habitat units present withing the ERM (2013) study area contain between 3.2% and 3.8% of the regional extent of these habitat units. The Bushmanland Inselberg Shrubland is generally found at elevations varying from 850 m – 1 150 m, typically on the slopes of inselbergs and koppies, and is characterised with sparse to dense vegetation with varied composition. The vegetation is a mixture of low-growing grasses, leaf-succulent Karoo shrubs, microphyllous and spinescent karoo shrubs and succulent trees.

The Bushmanland Arid Grassland vegetation type (Mucina and Rutherford, 2006) is present in the region, and contains three specific habitat units, namely, Plains Sandy flat, Plains Sandy hummocky and Plains Gravel Calcrete, which cumulatively covers a total area of approximately 3 000 hectares (ERM, 2013). Of the three habitat units, the Plains Gravel calcrete forms the smallest area (211.5 hectares), however, equates to 23.7% of the regional extent of this vegetation type and is represented by numerous isolated patches. The remaining habitat units form less than 1% of the regional extent of their respective vegetation units. The Bushmanland Arid Grassland vegetation is the dominant vegetation on the sandy plains around the base of the Gamsberg inselberg and also extends along the plains to the north of the N14.

The Bushmanland Sandy Grassland vegetation type (Mucina and Rutherford, 2006) is comprised of a single habitat unit called the Plains Sandy mobile dunes (ERM, 2013). This habitat type covers a total area of 18.5 hectares, which equates to less than 1% of the regional extent of this vegetation type. The Bushmanland Sandy Grassland is generally found from the south of Aggeneys to the north of Pofadder, along large sand dunes present in the region.



Legend

- Gamsberg Zinc Mine Property
- Main Roads
- Towns/Villages

ENPAT Rivers

- Non-Perennial River
- Dam/Pan/Wetland

Vegetation (SANBI - 2019)

- AZi 5 Bushmanland Vloere
- Dg 10 Eastern Gariep Rocky Desert
- Dg 9 Eastern Gariep Plains Desert
- NKb 3 Bushmanland Arid Grassland
- NKb 4 Bushmanland Sandy Grassland
- SKn 1 Namaqualand Klipkoppe Shrubland
- SKr 18 Bushmanland Inselberg Shrubland
- SKr 19 Aggeneys Gravel Vygieveld

0 1 2 3 Kilometers

Scale: 1:100 000
Projection: Transverse Mercator
Datum: Lo 23 WGS 84

Gamsberg Smelter Project

Figure 13
Vegetation Types in the Local Area

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An Azonal vegetation type (ERM, 2013) was identified and is comprised of three vegetation habitat units, namely, Kloof, Wash and Temporary Rock Pools. The vegetation found in these habitats is generally comprised of surrounding vegetation as well as vegetation specific to the features (i.e. springs). The kloof on the northern portion of the Gamsberg inselberg is considered the largest in the BIR, covering a total area of 177 hectares.

With respect to vegetation types, the Kloofs contain Bushmanland Inselberg Shrubland along the north-facing slopes, Bushmanland Inselberg Succulent Shrubland along the south-facing slopes and lastly, Wash vegetation in the floor of the Kloof (ERM, 2013).

Terrestrial Biodiversity – Fauna

The terrestrial biodiversity in this section is based on the surveys undertaken by ERM in 2013/2014 for the Gamsberg Zinc Mine EIA. Further studies will be undertaken for this project to confirm findings.

Based on the field work and observations by ERM, it was confirmed that no Red Listed invertebrate species were identified in the Gamsberg region. According to ERM (2013) at least 24 scorpion species are expected to occur in the Gamsberg and surrounding areas, which are well known for exhibiting an exceptionally high diversity of this group. A total of eight species were confirmed present.

Three species of frog were recorded within the study area, namely the Paradise Toad (*Vandijkophrynus robonsoni*), Cape Sand Frog (*Tomopterna delalandii*) and Marble Rubber Frog (*Phynomantis annectens*). The Gamsberg may support a slightly greater diversity of frogs in total, with up to nine species potentially existing in the area. No Red Data species are known or expected to occur within the Smelter study area.

The Gamsberg area supports a relatively rich diversity of reptiles, given the diversity of habitats and the presence of mountainous, rocky terrain, which supports a number species that do not occur on the surrounding low-lying plains. Twenty-four species of reptile were recorded during the herpetofaunal surveys, including four snakes, 16 lizards and one tortoise. It is likely that the full species richness is closer to 40-50 species.

The bird species richness for the greater area is quite low due to the limited diversity of habitats and the arid conditions. However, the site lies within an important area for several listed species as well as many biome-restricted species. The area around Aggeneys falls within an Important Bird Area (IBA) as defined by Birdlife South Africa. This IBA, known as the Haramoep and Black Mountain Mine Nature Reserve IBA (Birdlife South Africa - Bird Area factsheet: SA 035), extends from south of the N14 near Aggeneys to the Orange River in the north.

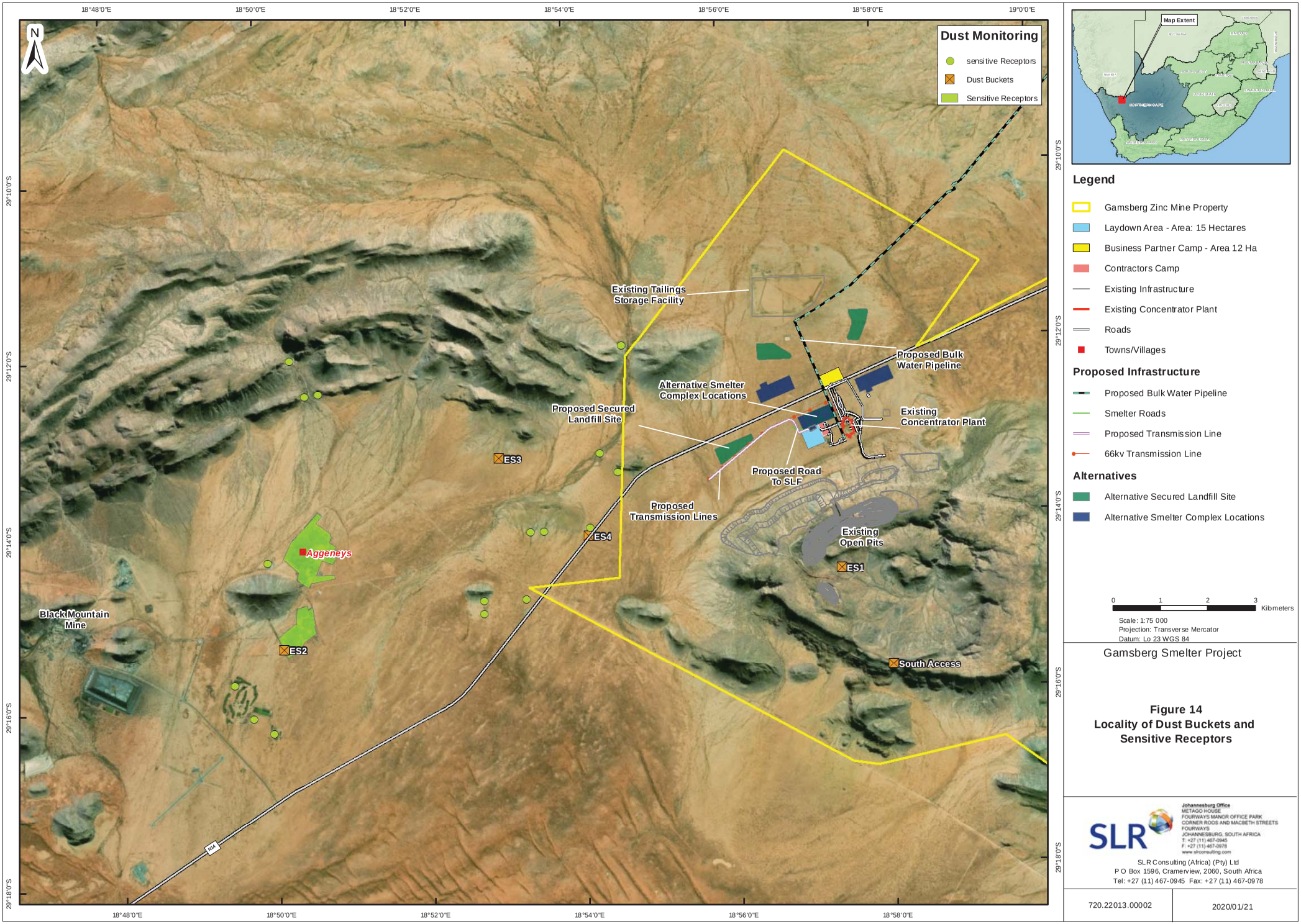
According to ERM (2013) the birds recorded in the Gamsberg area include four Red Listed and 14 range restricted bird species. The Red listed species include Martial Eagle (*Polemaetus bellicosus*) listed as Vulnerable; and Lanner Falcon (*Falco biarmicus*) and Secretary bird (*Sagittarius serpentarius*) both listed as Near Threatened. Other raptors observed include Verreaux's Eagle (*Aquila verreauxii*) which nest within the site, Jackal Buzzard (*Buteo rufofuscus*), Southern Pale Chanting Goshawk (*Melierax canorus*) and Greater Kestrel (*Falco rupicoloides*).

A total of 37 mammal species were recorded from the Gamsberg area. The results from these surveys highlighted that the Gamsberg area supports over 50% of the expected regional diversity.

According to ERM (2013) four small mammals listed as Near Threatened were recorded during the GrountTruth surveys undertaken in 2009 and 2012 as well as reports of Leopard and Brown Hyaena. Two of the mammal species recorded during the 2009 and 2012 surveys are listed as “Specially Protected” under the Northern Cape Conservation Act (2009) Schedule 1, namely African Wild Cat and Striped Polecat. Leopard as well as Riverine rabbit have recently been spotted on the Gamsberg Zinc Mine (Pers. Comm.).

Air Quality

Ambient PM_{10} sampling has been undertaken by Black Mountain Mining (Pty) Ltd at areas surrounding the Gamsberg Zinc Mine during 2018 and 2019. A summary of ambient PM_{10} concentrations measured at the Gamsberg Mining Offices, Aggeneys High school, Gamsberg construction camp and Gamsberg concentrator plant is provided in Table 28.



Gamsberg Smelter Project

Figure 14
Locality of Dust Buckets and Sensitive Receptors

SLR

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Table 28 Summary of the Ambient Particulate Measurements Within the Study Area (Units: mg/m³)

Pollutant	Availability (%)	Daily				No. of recorded hourly exceedances
		Max	99th Percentile	90th Percentile	50th Percentile	
Gamsberg Mining Offices (January - May 2018)						
PM_{10}	100	273.5	39.0	11.3	2.2	12
Gamsberg South Access (January - June 2018)						
PM_{10}	96	50.6	7.4	2.1	0.3	0
Aggeneys High School, South Village (January - September 2019)						
PM_{10}	97	564.5	23.0	9.0	2.7	5
Gamsberg Camp (January - September 2019)						
PM_{10}	98	337.0	27.8	11.5	3.5	7
Gamsberg BW (January - September 2019)						
PM_{10}	58	498.0	21.0	8.5	0.0	3

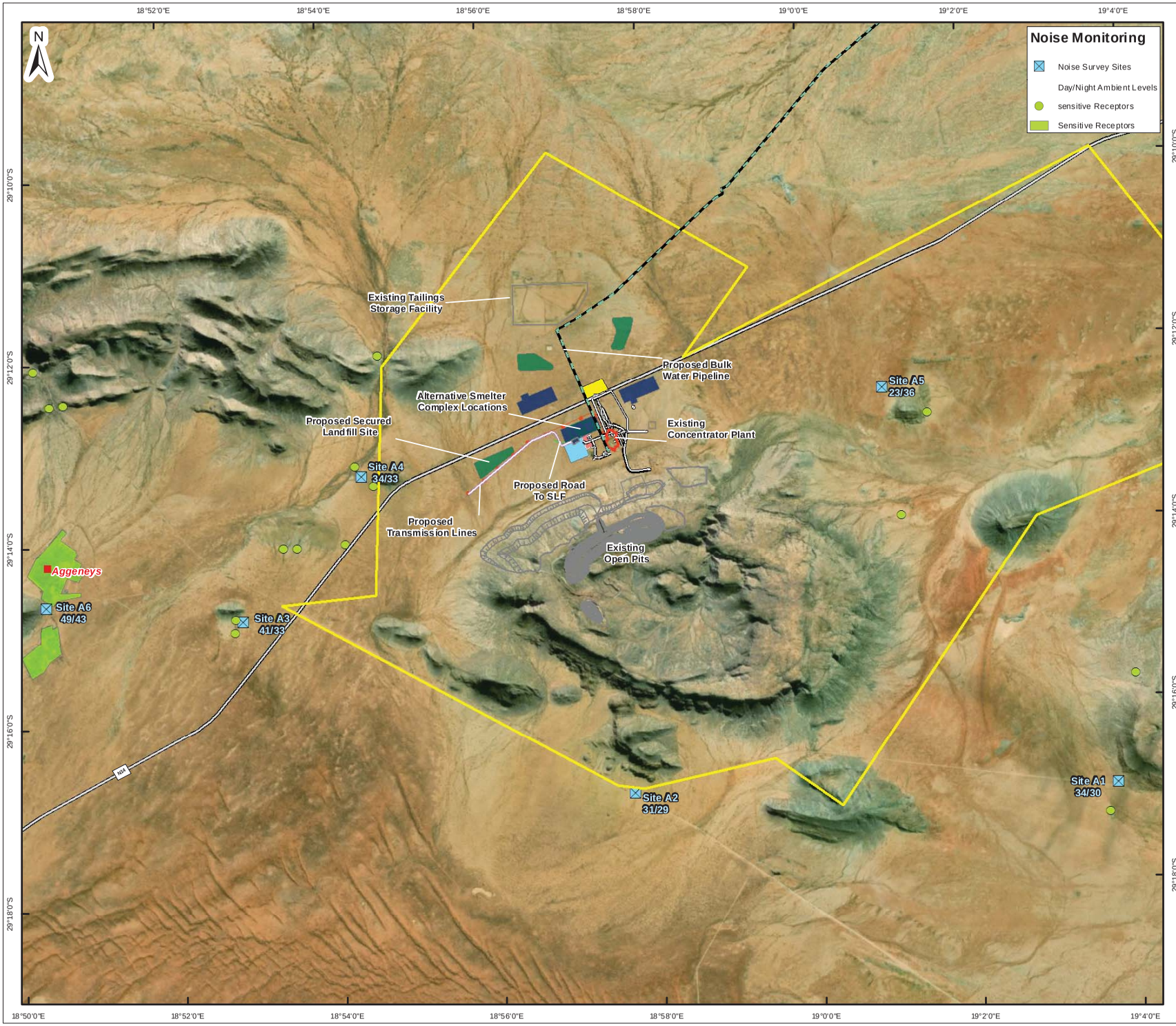
The ambient air quality surrounding the Gamsberg Zinc Mine can be summarised as follows:

- The flow field is dominated by winds from the southerly sector.
- The closest residential development to the proposed Gamsberg Smelter Project is Aggeneys (~10 km west-southwest of the Gamsberg Zinc Mine).
- Measured ambient daily PM_{10} ground level concentrations in the study area during 2018, ranged between 7.4 µg/m³ to 39 µg/m³ (99th percentile).
- The highest levels of PM_{10} were experienced at the Gamsberg Zinc Mine Offices which would be expected due to their proximity to the current mining operations (which include waste rock dumps, crushing, screening, vehicle movement, blasting etc).

Noise

The main meteorological parameters affecting the propagation of noise include wind speed, wind direction and temperature. These along with other parameters such as relative humidity, air pressure, solar radiation and cloud cover affect the stability of the atmosphere and the ability of the atmosphere to absorb sound energy (Airshed, 2019). Airshed Planning Professionals undertook a baseline noise survey around the Smelter site on 9 and 10 September 2019. The findings showed that during the day, the predominant wind direction is from the south and the north-northwest therefore, on average, noise impacts are expected to be more notable north of the project activities.

Sampling points were selected based on the proposed Gamsberg Smelter Project activities, position of sensitive receptors and previous survey sites (Figure 15). Survey results are summarised in Figure 16 (day-time results) and Figure 17 (night-time results).



Legend

- Gamsberg Zinc Mine Property
- Laydown Area - Area: 15 Hectares
- Business Partner Camp - Area 12 Ha
- Contractors Camp
- Existing Infrastructure
- Existing Concentrator Plant
- Roads
- Towns/Villages

Proposed Infrastructure

- Proposed Bulk Water Pipeline
- Smelter Roads
- Proposed Transmission Line
- 66kv Transmission Line

Alternatives

- Alternative Secured Landfill Site
- Alternative Smelter Complex Locations

0 1 2 3 Kilometers

Scale 1:75 000
Projection: Transverse Mercator
Datum: Lo 23 WGS 84

Gamsberg Smelter Project

Figure 15
Noise Survey Sites and Sensitive Receptors

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Day-time baseline noise level measurements indicate day-time ambient noise levels that are comparatively quiet with occasional noisy incidents such as vehicles and community activities (observed at Site 6). LAeq's (A-weighted equivalent sound pressure level) ranged between 23 dBA and 49 dBA which is considered typical of rural to suburban areas according to SANS 10103. Recorded LAeq's during the day were within the International Finance Corporations (IFC)[7] guidelines for residential, institutional and educational receptors (55 dBA).

Night-time baseline noise level measurements indicate night-time ambient noise levels that are generally quiet but influenced by community activities (observed at Site 6) and occasional noisy incidents such as vehicles on the roads. Mining activities were clearly audible at Site 2 and Site 5 during the night. LAeq's ranged between 29 dBA and 43 dBA which is considered typical of rural to urban areas according to SANS 10103[8]. Recorded LAeq's during the night were within IFC guidelines for residential, institutional and educational receptors (45 dBA).

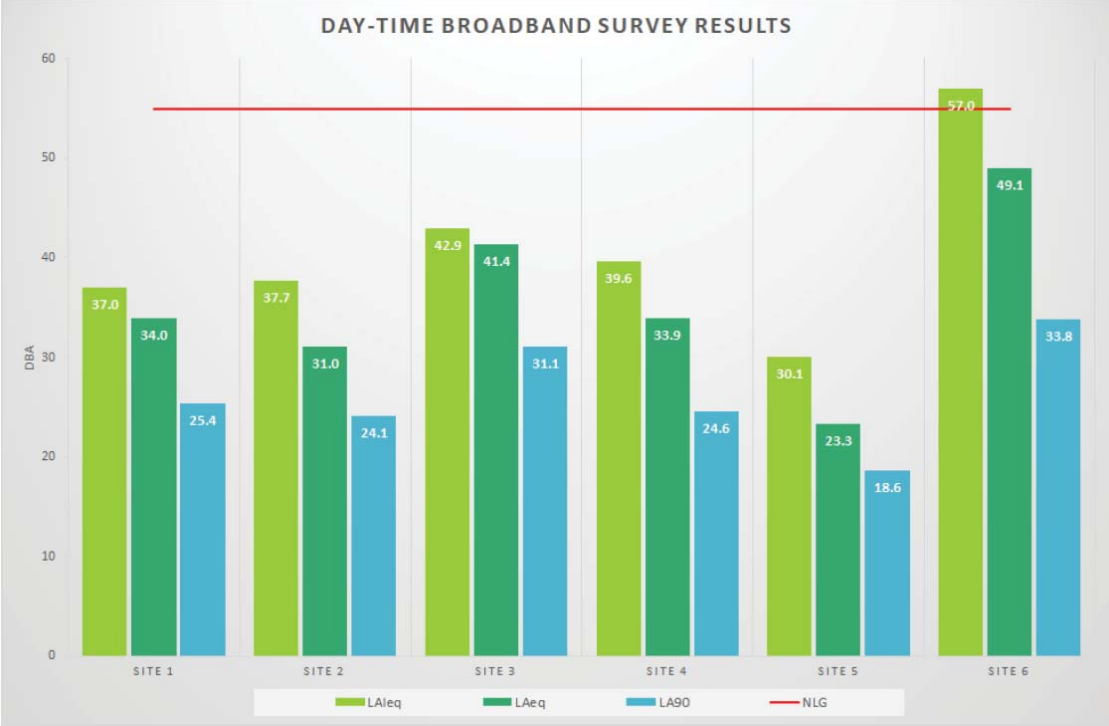


Figure 16 Day-Time Broadband Survey Results

[7] The IFC General EHS Guidelines on noise address impacts of noise beyond the property boundary of the facility under consideration and provides noise level guidelines.

[8] It is further important to note that the IFC noise level guidelines for residential, institutional and educational receptors correspond with the SANS 10103 guidelines for urban districts.

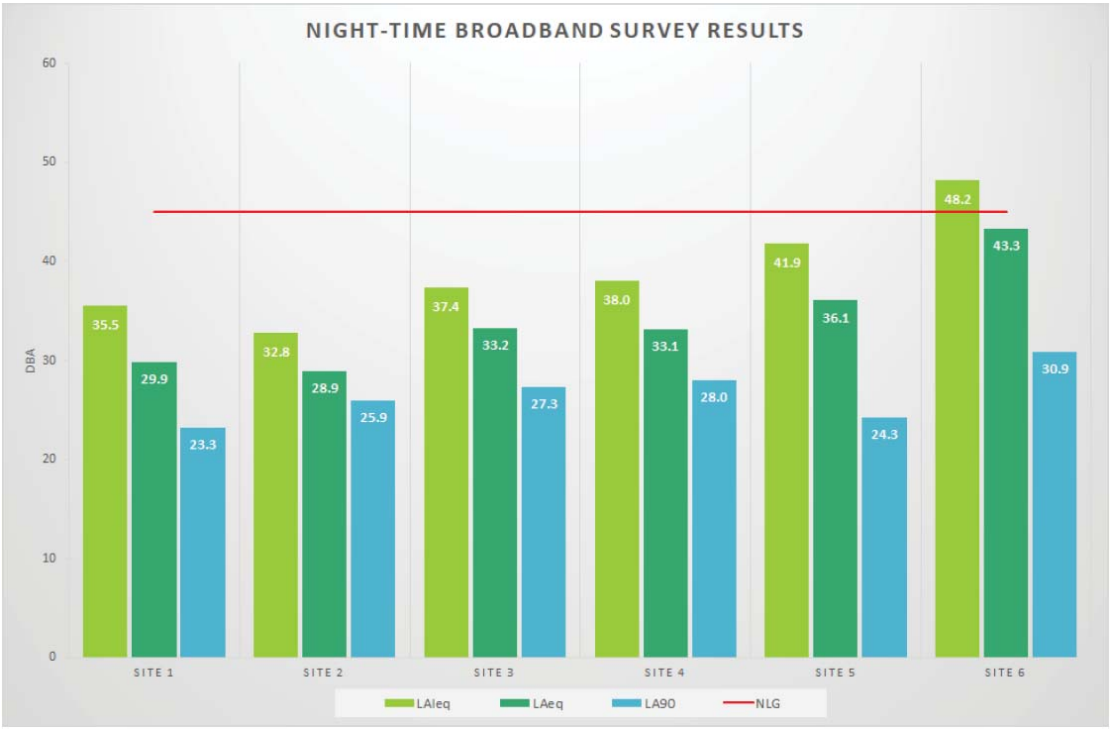


Figure 17 Night-Time Broadband Survey Results

Social

The baseline profile of the receiving socio-economic environment is presented in this Section.

Regional Study Area

The regional study area is broadly defined as the Northern Cape Province and specifically the Namakwa District municipal area (Figure 18). It is anticipated that the Smelter, in combination with the proposed expansion of the concentrator plant at the Gamsberg Zinc Mine, will contribute to economic growth and employment creation in these two areas. The social baseline for the Northern Cape and Namakwa District Municipality is described in Table 29 and Table 30 respectively. The Namakwa District Municipality is one of five district municipalities in the Northern Cape Province.

Table 29 Northern Cape Social Baseline

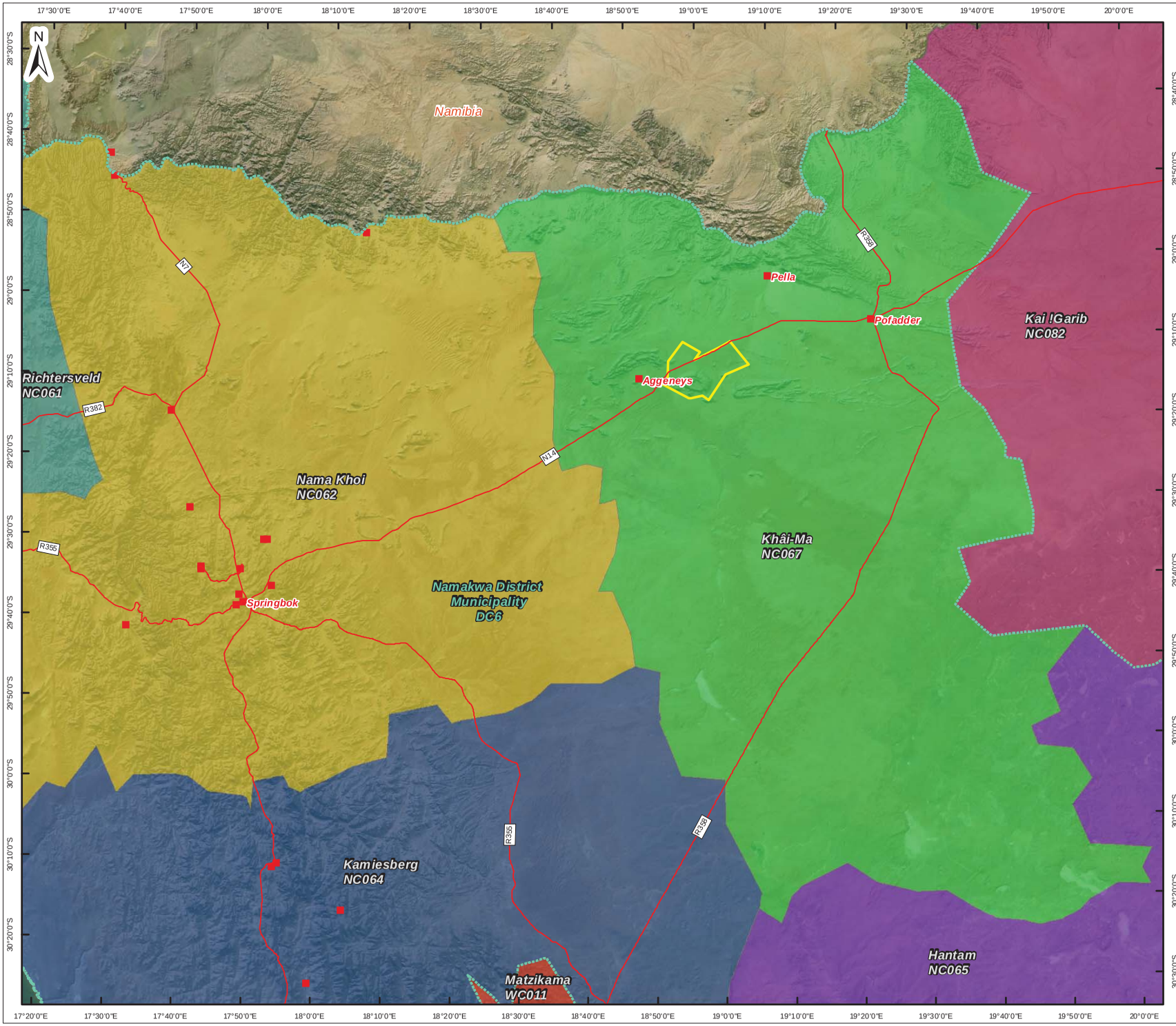
Aspect	Description
Population	Notwithstanding its large geographical area (the biggest province by land mass), the Northern Cape Province has the lowest population of all provinces (1.2 million residents), representing about 2% of the national population in 2014/2015. The age category 0-4 years constituted the largest proportion of the population, while the age cohort 70-74 had the lowest population. The total fertility rate for the Province was 2.85 births per woman between 2011 and 2016. The average life expectancy rate at birth was 59 years for males and 65 years for females. Population density was 3.26 persons per square km in 2016. Since 2006, the population has marginally increased year to year. The Province had a positive net migration of 3 311 people in the same years. Its urbanisation rate was 79.9% in 2016.

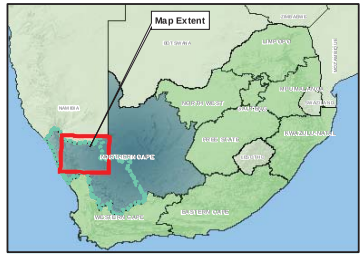
Aspect	Description
Economy	In 2016, the Province was the smallest contributor to the national GDP (2.1%). The Namakwa District Municipality, in turn, was the smallest contributor to the provincial GDB (11%). The largest industries were community services (22.5%) and mining (17.5%). The Province's economic growth rate was -2.7% in 2016. This negative economic growth can largely be attributed to contractions in the agriculture, mining, transport and electricity sectors. However, by 2018, the Northern Cape's GDP had expanded by 2.8%, the highest of all provinces. Mining and agriculture were major contributors to the expansion. In 2014, the economy (represented by agriculture, mining, manufacturing and construction) made up 34% of the Northern Cape's output. The largest economic sector was mining, at 22% of the provincial economy, followed by agriculture (7%), manufacturing (3%), and construction (2%). The Northern Cape contributed 6% of national mining.
Employment	Approximately 40% of the working age population was employed in 2015. 64 % of total employment was in the formal sector, compared to the national average of 69%. In 2014, the median formal monthly wage was R2 600 and the median wage for domestic, informal and agricultural workers was R1 400. BMM is one the largest private sector employers in the Northern Cape, employing around 1 692 people at the BBM mine, and 1 171 people at the Gamsberg Project (employees and business partner employees). Around 80% of BMM's employees are from the Northern Cape, including 60% from the Namakwa district (mainly Khâi-Ma and Nama Khoi municipal areas).

Table 30 Namakwa District Municipality Social Baseline

Aspect	Description
Population	The Namakwa District has the lowest population (115 488 in 2016), compared to other districts in the Northern Cape Province (about 10% of the total provincial population). The District's population growth rate was 0.2% in 2014. The population density for Namakwa District is 0.91 people per square kilometre (2014). The urbanisation rate for the District is approximately 91%. Among all local municipalities within the district, the Nama Khoi Local Municipality had the highest population density (3.08 people per square km, followed by Khâi-Ma municipality (1.4 people per square km). A breakdown of the population by age group shows a high and increasing number of economically active people in the Nama Khoi, Hantam and Khâi-Ma local municipalities, which underscores the need for job creation. The age cohort with the largest population size is 25-29 years. The median age in the District Municipality is 31, about 20 % higher than for the Northern Cape Province. 68 % of the population falls in the 15-64 year cohort. Afrikaans is the most dominant language (97%) spoken at home. The district population is dominated by Coloureds, with slightly more females than males. The number of households increased from 33 567 in 2004 to 37 839 in 2014. Approximately 36% of households are female-headed households. The average household size is 3.1 members and the dependency ratio (per 100 of the population between 15 and 64 years) is 47.1.
Education	Poor quality of education is reported as a major concern in the District. About 24% of the population has completed matric, 8% has completed higher education and 4.4% has no school education (2016).
Services provision	The majority of households in the District are housed in formal dwellings. About 2.3% live in informal dwellings. The majority of households have access to piped water (95%) (70.5% inside the

Aspect	Description
	dwelling). Access to sanitation has improved since the 2011 census (now at 80%). Refuse removal is around 81.7%.
Economy	The major contributions to the economy of the District is agriculture, community services and mining. The GDP growth rate for the Namakwa District was 3.7% in 2016. The Nama Khoi Municipality was the biggest contributor to the District's GDP (41%) in 2013 while Khâi-Ma municipality contributed 7% (note that this was prior to the establishment of the Gamsberg Zinc Mine). Renewable energy is increasing its contribution to the economy of the District, while tourism is also a relatively large contributor. In 2014, the mining industry in the Namakwa District was led by the Nama Khoi region (58%), followed by the Richtersveld and Khâi-Ma municipalities respectively.
Employment	The District Municipality's labour market is faced with high unemployment, with an official unemployment rate of 21.5% in 2014. The unemployment rate in the Khâi-Ma local municipality was 24.5% in the same year, and that of the Nama Khoi local municipality, 23.5%. The largest increase in the unemployment rate in the District between 2004 and 2014 was in the Khâi-Ma municipality (7.1%). As was mentioned, around 60% of the BMM/Gamsberg Zinc Mines' workforce are located in the Namakwa District area. The average annual income in the district is approximately R30,000. However, some 43% earn less than R20,000 per year.
Poverty	The district municipality had a poverty rate of 50.4 percent in 2004 and 26.2 percent in 2014.





Legend

- Gamsberg Zinc Mine Property
- Main Roads
- Towns/Villages

Local Municipality

- Hantam
- Kai !Garib
- Kamiesberg
- Khâi-Ma
- Matzikama
- Nama Khoi
- Richtersveld
- Namakwa District Municipality

0 5 10 15 20 25 Kilometers

Scale: 1:85 000
Projection: Transverse Mercator
Datum: Lo 23 WGS 84

Gamsberg Smelter Project

Figure 18
Local and District Municipalities surrounding the Gamsberg Zinc Mine

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Khâi-Ma Local Municipality

The Project is situated in the Khâi-Ma Local Municipality, which is one of six local municipalities within the Namakwa District Municipality (Figure 18).

A basic socio-economic profile of the population residing in the local study area is presented in Table 31. The information was mainly sourced from the 2011 Census Survey, the 2016 StatsSA Community Survey, the Khâi-Ma IDP review (2019), Media Monitoring Africa (2018) (via Wazimap) and the Municipalities of South Africa website (municipalities.co.za). [9]

Table 31 Khâi-Ma Municipality Social Baseline

Aspect	Description
Administration	The Khâi-Ma municipality is a low capacity municipality (Category B), divided into four wards. The Project is located in Ward 4 of the Municipality. Pofadder, Pella, Aggeneys, Witbank and Onseepkans are all located within the municipal area. Farming settlements include Dwagga, Soutpan, Vrugbaar, Raap-en-Skraap and Klein Pella. The administrative headquarters of the municipality is located in Pofadder. The Khâi-Ma municipality provides basic services to Onseepkans, Blyvooruitsig, Pofadder and Witbank. Aggeneys is a mining town where the residents are mainly employed by BMM and Gamsberg Zinc Mines and the supporting Business Partners. Vedanta/Black Mountain Mining provides basic services to the residents of Aggeneys.
Population	The Khâi-Ma Municipality had a population of 12 333 people in 2016. Population density is around one person per square km, with the majority of the population living in the rural areas (4 035 people). The total population for the municipality is 11,344 people. Aggeneys has a population of 2 053 people (666 households) and Pofadder 2 919 people (733 households). More than 71% of the population falls within the 15-64 age cohort, while 22.2% are under 15 years old. About 6% of the population is older than 64 years. The population growth rate in 2016 was 0.21% per year. The current growth rate is estimated to be 0.83%. The dependency ratio is 39.6 per 100 people within the 15-64 age cohort. The median age was 28 years in 2011. There are 4 079 households in the Khâi-Ma municipal area, with an average household size of three persons per household. Almost 34% of households are female-headed households. More than 92% of households live in formal dwellings, while 6.4% live in informal dwellings. The language most spoken at home is Afrikaans (95%), while 75% of the population is considered “Coloured.” The poverty headcount was 5.9% in 2016.
Education	Almost 3% of the population has no schooling, 22.2% has Matric and 5.2% has higher education.
Services	About 90% of households have piped water and 84% have flush or chemical toilets. Weekly refuse removal is available to 94% of households, and 87.6% has electricity. In 2016, the Khâi-Ma local municipality was the local municipality within its district which had the most access to basic services (Stats SA, 2018). However, the municipality still has trouble in delivering satisfactory services to its communities due to lack of capacity and an influx of people. The high levels of water consumption is also a big concern in this water stressed region.
Economy	The main economic sectors in the municipality are agriculture, mining, tourism, community services, and renewable energy.

[9] It was noted that various sources contain conflicting data, while data sources used ranged from 2001 to 2016. Most of the information in the IDP is outdated. For example, the role of mining and mining-related employment in the Khai Ma municipality is largely missing from the local municipal level data. Where possible, the 2016 Community Survey findings was given preference below.

Aspect	Description
Employment	Close to 55% of the working age population are employed. The average annual income was R29 400 per household in 2011, but 34% earned R20 000 or less. The annual income for individuals was R15 000, with 41% earning between R10 000 and R20 000 per annum. As was mentioned, around 80% of BMM's employees are from the Northern Cape, including 60% from the Namakwa district (mainly Khâi-Ma and Nama Khoi municipal areas).
Health care	Provincial hospitals are located in Pofadder, Springbok and Upington and well as a private hospital in Upington. The various towns in the municipal areas have functional government primary health care clinics.
Ward 4	According to the 2011 Census, the Ward had a population 3 638 people. The median age in Ward 4 was 31, while 66% of the population was between 18 and 64. Around 20% of the households were female-headed households. Employment was around 57%. For almost 80% of the population, Afrikaans is spoken most often at home. Less than 4% are living in informal dwellings. 35.7% have completed matric or higher. Aggeneys is the main town in Ward 4. Approximately 85% of the households have access to piped water, 85.2% have refuse removal and 85.9 have flush toilets. More than 90% of households have access to electricity.
Nama Khoi Local Municipality	The Nama Khoi Local Municipality is briefly discussed as it forms an important labour sending area for Black Mountain Mine and Gamsberg Zinc Mine activities. It is anticipated that the smelter project will also use this local municipality as one of its labour sending area. The Nama Khoi Local Municipality is a Category B municipality. The town of Springbok is the administrative centre and the most densely populated area, as it is the economic hub of the Namakwa District with the highest population. It is also the largest contributor to the District's GDP (41%), and made the largest contribution to employment in the District. Mining used to form the backbone of the economy. According to the 2016 Community Survey, the Khâi-Ma Municipality had a population of 46 513 people, with a population density of 2.6 people per square kilometre. For approximately 97% of the population, Afrikaans is the language most spoken at home.

Economic

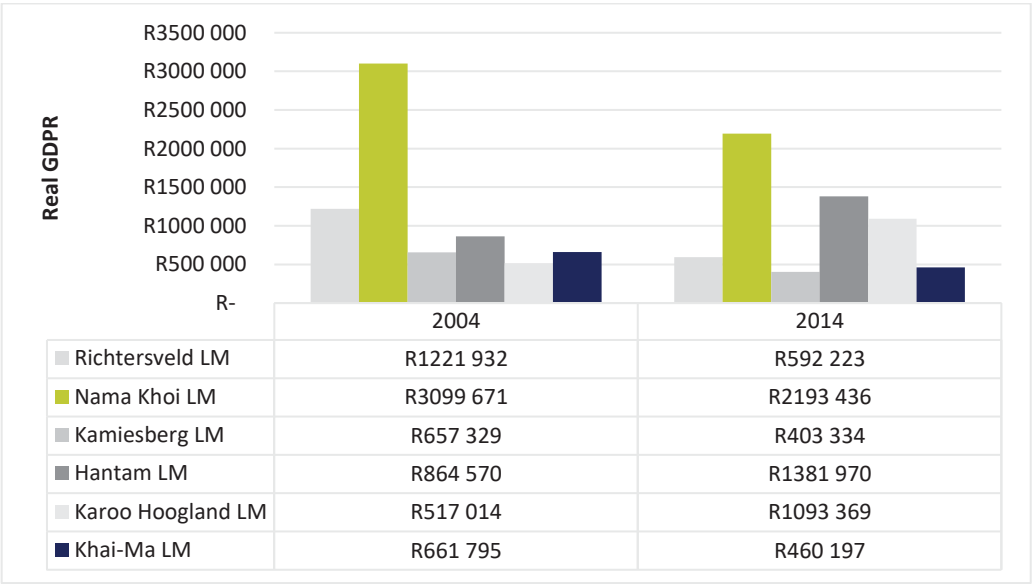
Economic Growth Trends

Growth of the Namakwa District Municipality's economy, as measured by real changes in Gross Regional Domestic Product (GRDP), was between 0.1% and 1.5% per annum between 2010 and 2013, after recovering from the 2009 recession's low point of -5.4%. The latest available data is shown in Figure 19, which shows that the Namakwa District Municipality's economy's trajectory has to an extent followed that of the Northern Cape but with more severe periods of retraction and with a downturn in 2013.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Namakwa District Municipality	5,90	-0,80	2,50	3,70	1,80	2,20	-5,40	0,10	0,50	1,50	0,60
Northern Cape Province	3,50	2,50	3,60	4,20	3,90	1,90	-3,00	2,50	2,20	1,10	1,60

Figure 19 Real GDPR Growth Rates for The Wider Study Area, 2003-2014 (Source: NDM, 2018)

Considering growth at a more local level, it is apparent that in real terms, both Khâi-Ma Local Municipality's and Nama Khoi Local Municipality's economies contracted between 2004 and 2014. Figure 20 shows that Nama Khoi Local Municipality used to be by far the largest contributor to GDPR in the Namakwa District Municipality. While the Nama Khoi Local Municipality was still the largest contributor in 2014, its share of the regional economy relative to that of other municipalities had shrunk considerably (potentially due to mine closures). This is in contrast to the economies of Hantam Local Municipality and Karoo Hoogland Local Municipality, the only two local municipalities in the district which experienced growth during the period.



	2004	2014
Richtersveld LM	R1221 932	R592 223
Nama Khoi LM	R3099 671	R2193 436
Kamiesberg LM	R657 329	R403 334
Hantam LM	R864 570	R1381 970
Karoo Hoogland LM	R517 014	R1093 369
Khai-Ma LM	R661 795	R460 197

Figure 20 Real GDPR in the Local Municipalities of The Namakwa District, 2004 And 2014 (Source: NDM, 2018)

Considering growth by sector shows that Nama Khoi Local Municipality was responsible for over half of the district economy's output in the mining sector in 2014, while Khâi-Ma Local Municipality was responsible for 13%. Nama Khoi Local Municipality contributed around 25% towards the district's manufacturing sector in 2014,

down from 34% in 2004, and Khâi-Ma Local Municipality contributed around 8% in 2014 (down from 11% in 2004). Contributions towards the district's economy in other sectors are outlined in Table 32.

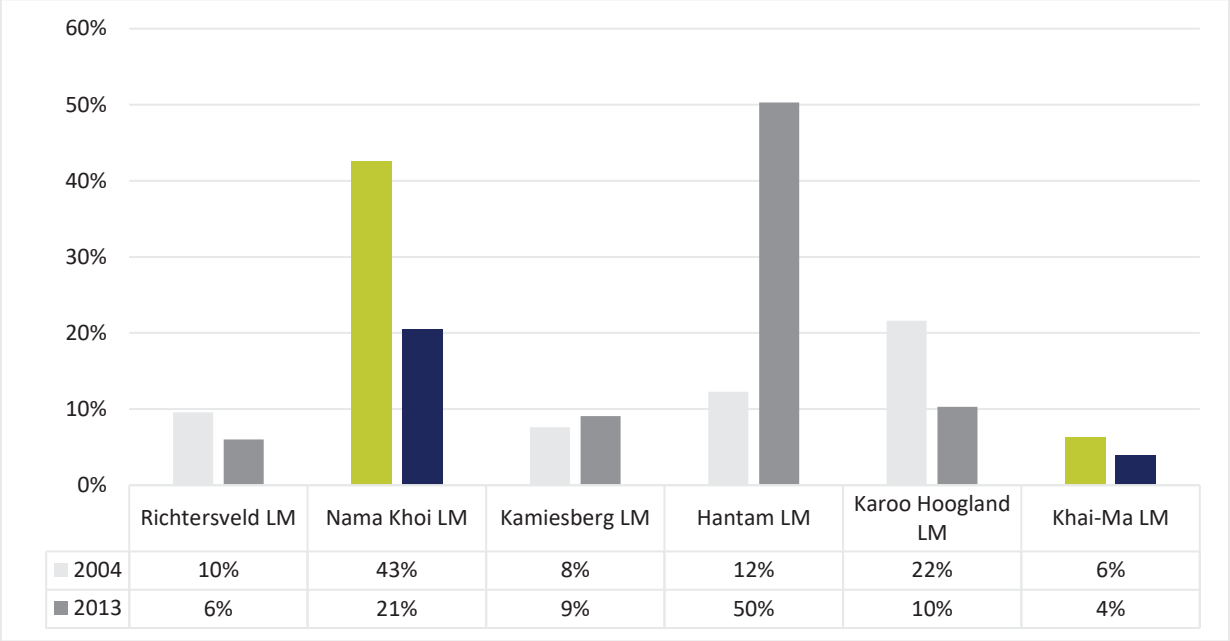
Table 32 Contribution of Khâi-Ma Local Municipality and Nama Khoi Local Municipality to District GDPR by Sector, 2004 and 2014

Sector	Year	Nama Khoi LM	Khâi-Ma LM
Agriculture	2004	6.2%	5.1%
	2014	3.4%	2.9%
Mining	2004	52.7%	11.9%
	2014	58.1%	13.1%
Manufacturing	2004	33.8%	10.9%
	2014	25.3%	8.2%
Electricity	2004	48.5%	6.8%
	2014	30.0%	4.2%
Construction	2004	38.1%	5.8%
	2014	27.8%	4.3%
Trade	2004	33.2%	4.7%
	2014	22.9%	3.4%
Transport	2004	38.2%	6.1%
	2014	26.6%	4.5%
Finance	2004	46.1%	6.5%
	2014	38.9%	5.3%
Community services	2004	35.2%	6.7%
	2014	25.2%	4.8%
Total industries	2004	44.1%	9.4%
	2014	35.8%	7.5%

Source: NDM, 2018

Given that the Standard Industrial Classification does not consider tourism explicitly, it is useful to consider tourism trends separately. Figure 21 shows the proportion of the Namakwa District's bed nights for which each local municipality was responsible in 2004 and 2013. The figure suggests that Nama Khoi Local Municipality and Khâi-Ma Local Municipality have both become less popular tourism destinations relative to the other municipalities in the district. Nama Khoi Local Municipality has gone from accounting for 43% of the district's

bed nights in 2004 to 21% in 2013, while Khâi-Ma Local Municipality has gone from 6% to 4%. The greatest increase in the proportion of bed nights has been experienced by Hantam Local Municipality, which has gone from hosting 12% of the district's bed nights in 2004 to 50% in 2013.

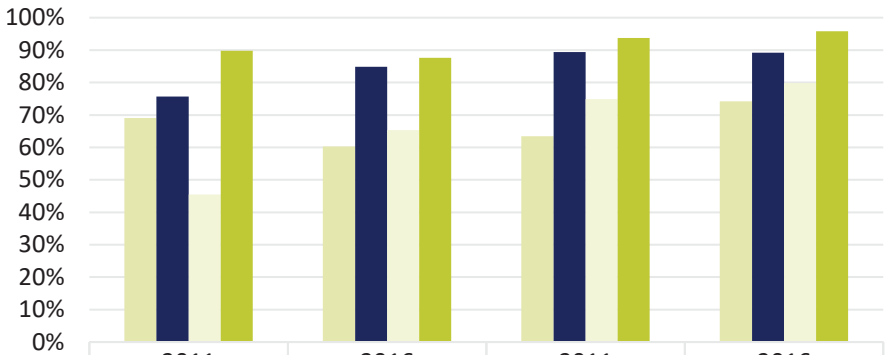


	Richtersveld LM	Nama Khoi LM	Kamiesberg LM	Hantam LM	Karoo Hoogland LM	Khai-Ma LM
2004	10%	43%	8%	12%	22%	6%
2013	6%	21%	9%	50%	10%	4%

Figure 21 Proportional Contribution of Local Municipalities to Total Tourist Bed Nights in the Namakwa District, 2004 And 2013 (Source: NDM, 2018)

Availability of Municipal Services

The two local municipalities' goals to improve access to basic services have had mixed results according to StatsSA (2012; 2017). In the case of Khâi-Ma Local Municipality, improvements have been seen in the areas of refuse removal and water supply, but fewer households have access to flushing toilets connected to sewage systems and electricity. For households living in Nama Khoi Local Municipality the trends have been somewhat more positive. A higher proportion of households have access to a flush toilet connected to sewage, piped water inside their dwellings and electricity. The proportion of households with access to weekly refuse removal remains unchanged at 89%. These trends are shown in Figure 22.



	2011	2016	2011	2016
	Khâi-Ma Local Municipality		Nama Khoi Local Municipality	
Flush toilet connected to sewerage	69%	60%	64%	74%
Weekly refuse removal	76%	85%	89%	89%
Piped water inside dwelling	46%	65%	75%	80%
Electricity for lighting	90%	88%	94%	96%

Figure 22 Access to Key Municipal Services in the Study Area, 2011 and 2016 (Source: Stats SA, 2012; Stats SA, 2017)

Future Economic Development Goals and Objectives

In terms of future economic development goals, the 2016-2017 review of the 2012-2017 IDP of the Khâi-Ma Municipality is informative. According to this plan, the Municipality "has four main economic sectors: livestock grazing, mining, agriculture and tourism. The two emerging sectors are renewable energy and conservation and ecological restoration." (K-MLM, 2016: 82-83) The IDP identifies the following Strategic Pillars:

- "Increased accessibility;
- Infrastructure investment;
- Wealth creation;
- Broadening the economic base;
- Attracting visitors and investors; and
- Conducive Local Economic Development (LED) environments".

Within the 4th Strategic Pillar of broadening the economic base, the following key priority areas are identified (K-MLM, 2016: 83):

- "Establish green business hub;
- SMME opportunities;
- Better service delivery;
- Job creation;
- Local entrepreneurship;
- Promote investment; and
- Green energy development".

The Namakwa District Municipality (NDM) IDP 2017-2022, as well as the 2018-2019 revision of the IDP, list the following as being strategic objectives for the area (NDM, 2017: 41; NDM, 2018: 53):

- "Monitor and support local municipalities to deliver basic services which include water, sanitation, housing, electricity and waste management;
- Support vulnerable groups;
- Improve administrative and financial viability and capability;
- Promote and facilitate Local Economic development;
- Enhance good governance

Promote and facilitate spatial transformation and sustainable urban development;

Improve communication and communication systems;

Establish a customer care system;

Invest in the improvement of ICT systems;

To render a municipal health services;

To coordinate the disaster management and fire management services in the district;

Implement the climate change response plan; and

Caring for the environment"

The Namakwa District Municipality Rural Development Plan lists the following development priorities within the area (DRD&LR, 2017: 54):

- "Tourism development;
- Transport strategy;
- Linkages with Namibia;
- Renewable energy generation;
- Mining development; and
- Nodal policy"

Traffic

A baseline traffic survey was undertaken by Siyazi Limpopo Consulting Services (Pty) Ltd on 10 and 11 October 2019 at various intersections in the vicinity of the Gamsberg Zinc Mine and in Springbok at the N14 and N7 intersection. The respective peak-hour flows for the traffic counts at the relevant intersections were identified as indicated in Table 33, Figure 23 and Figure 24.

Table 33 Peak Hour Periods at the Relevant Intersection

Point	Intersection	AM Peak		PM Peak	
		Time Interval	Number of Vehicles	Time Interval	Number of Vehicles
A	Road N14 and Gamsberg Zinc Mine Access Road	06:15 to 07:15	230	15:45 to 16:45	169
B	Road N14 and Loop 10 Road	06:00 to 07:00	194	15:45 to 16:45	159

Point	Intersection	AM Peak		PM Peak	
		Time Interval	Number of Vehicles	Time Interval	Number of Vehicles
C	Road N14 and Aggeneys Access Road	06:00 to 07:00	249	15:45 to 16:45	183
D	Road N14 and Road R355	07:00 to 08:00	193	16:15 to 17:15	263
E	Road R355 and Kokerboom Road	07:00 to 08:00	132	16:15 to 17:15	142
F	Kokerboom Road and Road N7 Southbound On-Ramp	07:00 to 08:00	267	15:15 to 16:15	239
G	Kokerboom Road and Road N7 Northbound On-Ramp	07:00 to 08:00	314	15:15 to 16:15	325

It is important to take note that peak periods differ between intersections due to the distance between the relevant intersections under investigations. Distances between intersections are as follows:

- Point A to Point B – 7.7km.
- Point B to Point C – 7.2km.
- Point C to Point D – 102km
- Points E, F and G are within 750m from Point D.

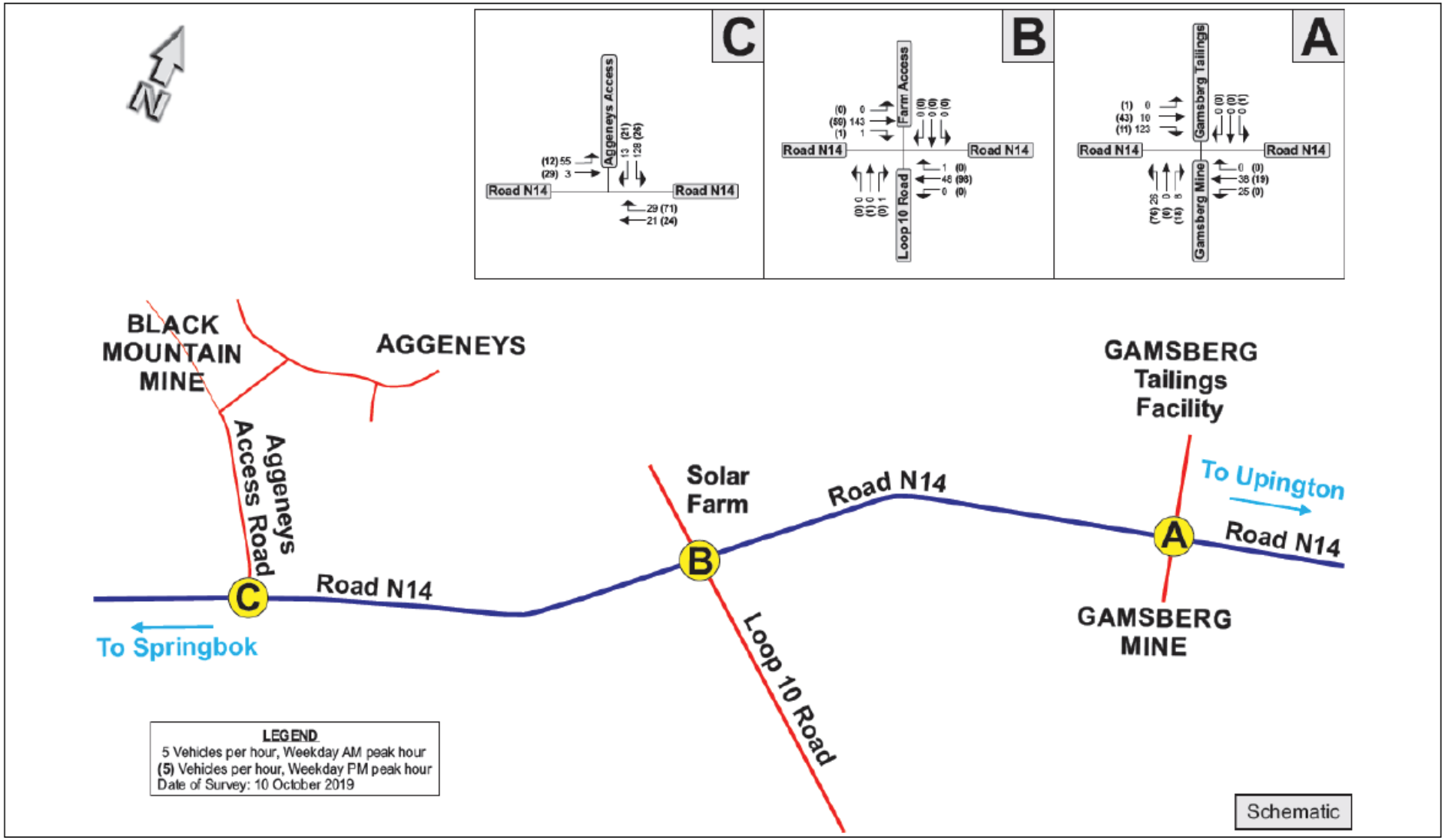


Figure 23 2019 Existing Peak Hour Traffic (Vicinity of Gamsberg Zinc Mine)

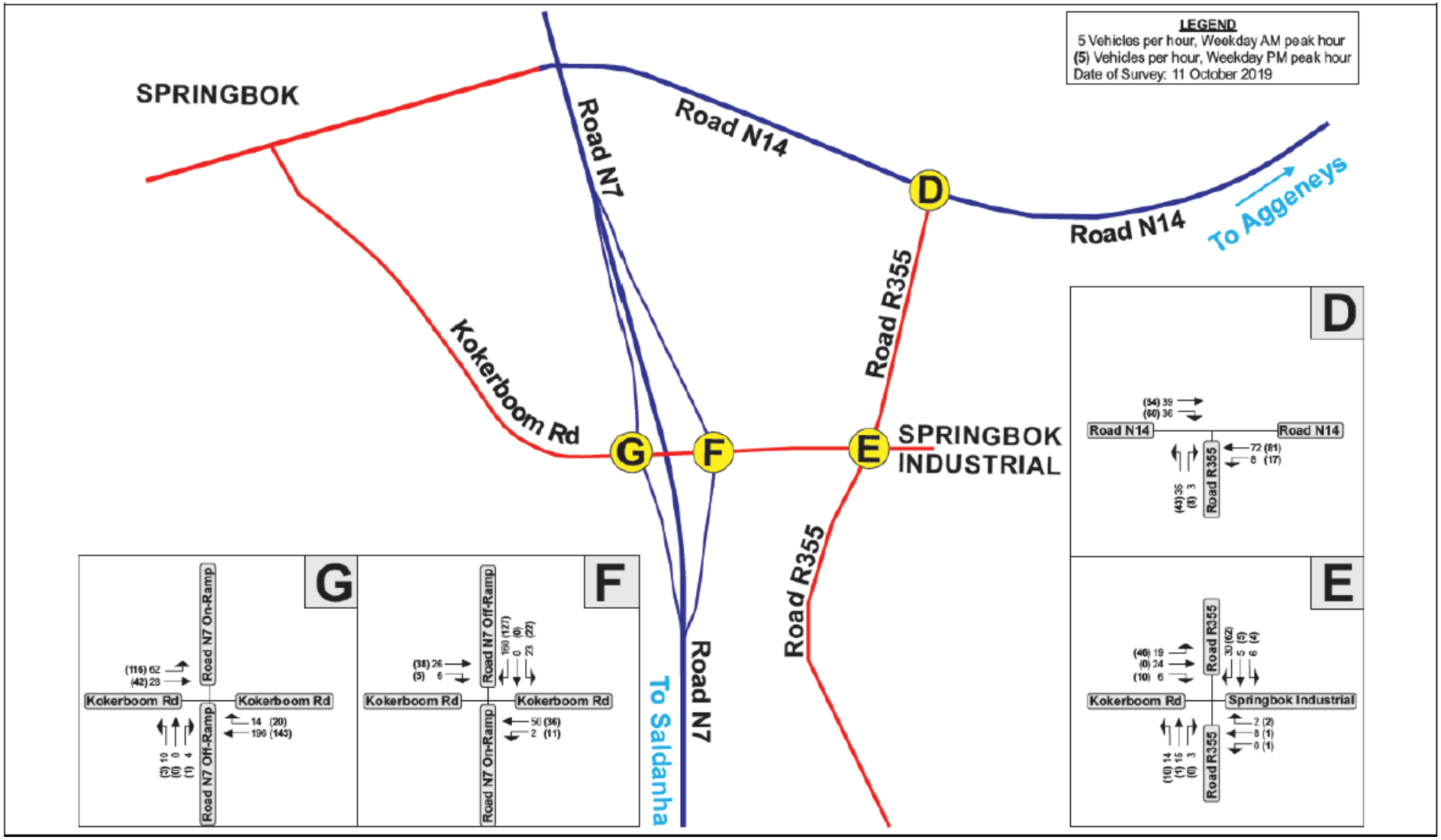


Figure 24 2019 Existing Peak Hour Traffic (Springbok)

Climate Change

The global context of climate change is discussed in relation to the impact of the project on climate change. Anthropogenic climate change as a global phenomenon is caused by the accumulated greenhouse gas emissions from global emitting sources. Recently CO_2 levels within the atmosphere surpassed 415 parts per million for the first time in recorded history. The impact of this upward trend in emissions is increasingly of concern due to the negative impacts such as extreme weather events, drought and increased rainfall variability accompanying climate change.

The receiving environment for this project, in the context of climate change, is the global atmosphere. The duration of the impact of the greenhouse gas emissions is considered as effectively permanent as the greenhouse gas emissions produced remain in the atmosphere for an extended period of time. In 2015 the world agreed in the Paris Agreement that the target to limit global warming should be a 2°C increase of average global temperature above the pre-industrial average temperature. The Intergovernmental Panel on Climate Change (IPCC) estimated in the 5th Assessment Report[10] that the global limit is to emit 2,900 gigatons of CO_2 above the pre-industrial levels by 2100. By 2012, a total of 1,890 gigatons of CO_2 has already been emitted. This leaves a remaining budget of 1,010 gigatons of CO_2 before the 2°C limit is breached.

The Paris Agreement, however, also states that the world should increase ambition and aim for a target of 1.5°C. This is in order reduce significant and far-reaching impacts associated with climate change, such as; sea rise, desertification, ocean acidification, biodiversity loss and increase in frequency and intensity of extreme weather events. The IPCC reported in 2018 an estimate of the remaining carbon budget of 580 gigatons CO_2 for a 50% probability of limiting warming to 1.5°C, and 420 gigatons CO_2 for a 66% probability (medium confidence).

The practical implication of having a carbon budget is that this is the maximum amount of emissions that can be emitted. In the context of environmental impact assessments, this constitutes a limited resource. If the limit presented by this amount is exceeded, then the planet as whole will suffer irreparable damage with dire consequences to the global society.

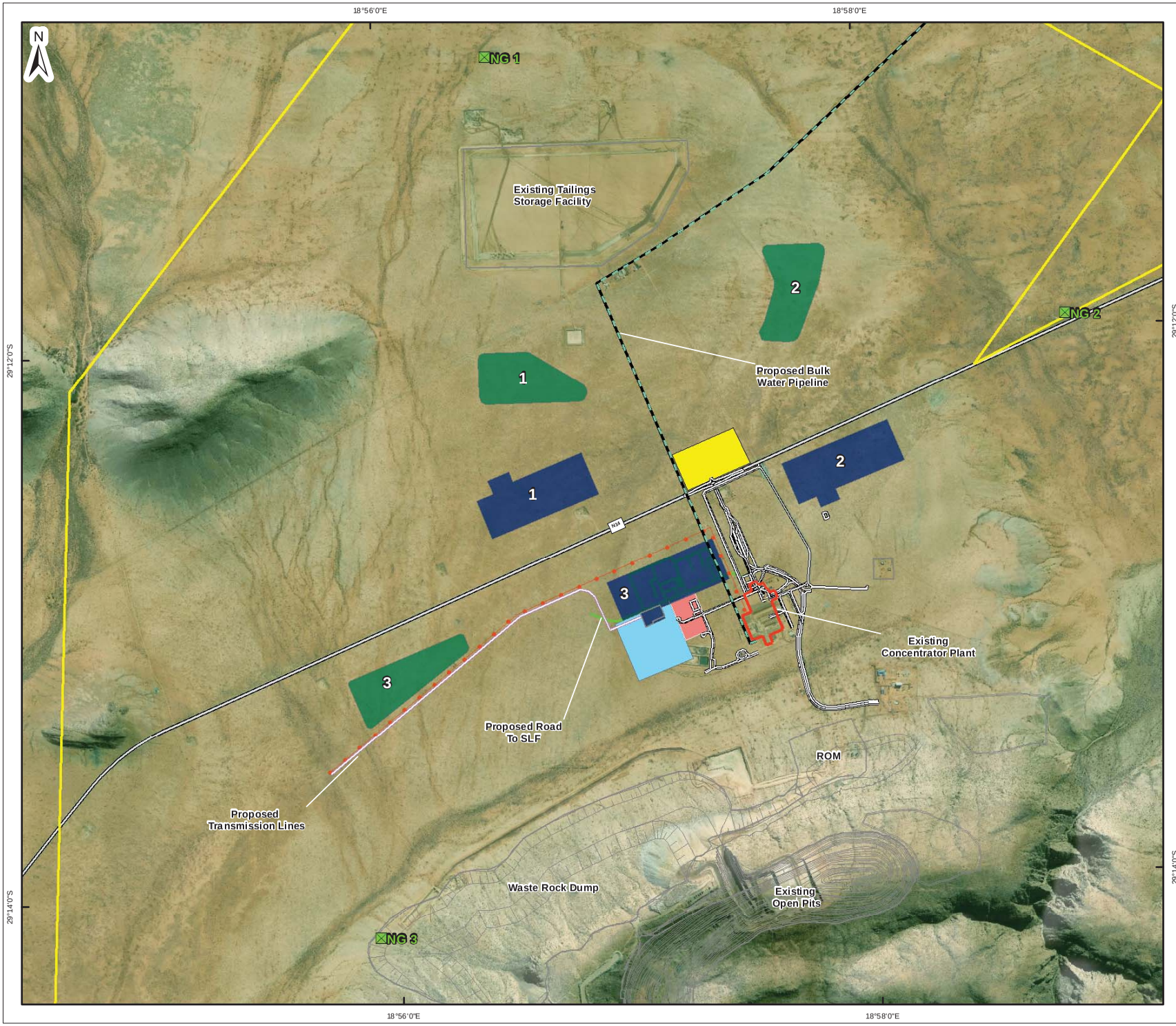
For this analysis, the 2°C increase of average global temperature above the pre-industrial average temperature target is used.

Cultural Heritage and Palaeontological Resources

A Heritage and Archaeological Impact Assessment and Paleontological Impact Assessment for the Gamsberg Zinc Mine, was undertaken by Dr David Morris (2013) and Mr John Pether (2013) respectively. These studies covered the whole of the MRA and include the proposed footprint of the smelter complex and associated infrastructure. The findings of these studies remain valid.

The three sites of archaeological importance are included in Figure 25.

[10] IPCC, 2014. Fifth Assessment Report of the IPCC, s.l.: s.n.



Legend

- Gamsberg Zinc Mine Property
- Laydown Area - Area: 15 Hectares
- Business Partner Camp - Area 12 Ha
- Contractors Camp
- Existing Infrastructure
- Existing Concentrator Plant
- Roads
- Archaeological and Paleo Findings

Proposed Infrastructure

- Proposed Bulk Water Pipeline
- Smelter Roads
- Proposed Transmission Line
- 66kv Transmission Line

Alternatives

- Alternative Secured Landfill Site
- Alternative Smelter Complex Locations

0 500 1 000 Meters

Scale: 1:25 000
Projection: Transverse Mercator
Datum: Lo 23 WGS 84

Gamsberg Smelter Project

Figure 25
Heritage Sites within the Project Area

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Heritage and Archaeology

A survey of land surfaces north of the Gamsberg Inselberg and on the northern slope of the inselberg itself on the farms Gams and Aroam revealed minimal archaeological traces. Findings included very few isolated stone flakes (Figure 25). Where erosion had cut into the surface there was no indication of any artefacts below the surface there either.

A description of the three sites of archaeological importance are included in Table 34.

Table 34 Archaeological Observations North of Gamsberg

Locality	Description	Heritage Significance
NG 1 29.18247 S 18.94130 E	Apparent stone structure: mid-twentieth century drilling site (water or mine prospecting). Cement capping has code '2293 /54'. Bottle glass and wire found in the vicinity. A similar feature occurs further north at 29.18235 S 18.94446 E (P Desmet pers comm). Ostrich eggshell fragments on nearby rise are possibly indicative of Later Stone Age activity, but no stone artefacts found.	Low
NG2 29.19924 S 18.98100 E	A series of dome-shaped bedrock outcrops around which are clustered an abundance of Ceramic Later Stone Age artefacts (stone artefacts, pottery, ostrich eggshell). Elongated grinding grooves were noted on the outcropping bedrock. These features occur on other similar sites in the wider landscape. Hollows in the bedrock occur, which hold water for a time after rains (known locally as !Gorras the Nama word for these natural reservoirs). The sites probably represent repeated short-duration encampments by transhumant herders or hunter-gatherers with pottery, probably mainly in the last millennium. Transhumant farmers of the colonial era evidently used such sites in similar manner (leaving broken glass and porcelain).	High
NG3 29.236 S 18.932 E	Isolated Earlier Stone Age (ESA) cleaver found on the plain below the inselberg, noted by P. Desmet. Such isolated finds indicate off-site activity. Small clusters of ESA artefacts have been found in the basin. This single instance lacks context and is hence of limited archaeological significance.	Low

Palaeontology

The Gamsberg Zinc Mine is situated in the northern part of the Bushmanland Plateau where inselbergs and ridges of bedrock project steeply above the sandy plains. These are rocks of the Namaqua Metamorphic Province and the specific strata comprising Gamsberg belong to a meta-volcano sedimentary succession named the Aggeneys Subgroup of the Bushmanland Group. The age of the Bushmanland Group is between 1 640 and 1 200 Ma. The mining of the zinc ore in unfossiliferous Bushmanland Group bedrock strata does not have an impact on fossil heritage.

The fossils most commonly seen in aeolianites are land snails and tortoises. Closer inspection reveals the incisors, skulls and bones of moles. Other small bones occur sparsely such as bird and micromammal bones. This is the ambient fossil content of dunes and it includes the bones of rodents, lizards, snakes, birds, ostrich eggshell and

small mammals (hares, mongooses, cats etc.). The bones of larger animals are generally very sparsely scattered. Notwithstanding, concentrations of bones are found in specific contexts.

Watercourses are present at a variety of scales, from small, ephemeral, braiding-stream courses on alluvial fans to more entrenched, integrated drainage systems. The fossil potential of small-scale systems is very low. In larger drainages fossils such as abraded bone fragments and loose teeth occur sparsely in channel lags. These drainages must have been more active during periods of wetter climate such as occurred during the Quaternary. Finds such as the snail Melanoides, clam Corbicula and freshwater oyster Etheria attest to more perennial freshwater availability in the larger, now seldom-flowing drainages. The latter will also have hosted waterhole and pan deposits in places, with improved fossil potential.

No areas of particular paleontological sensitivity are identified within the area of direct influence. Due to the sparse, very patchy distribution of fossils in the subsurface, the probability of an important fossil find is considered unlikely.

7.5.2 Current Land Uses

The current land use in the proposed Gamsberg Smelter Project area is mining. The Project is surrounded by farms used for grazing (mainly sheep) (excluding farms that form part of the Black Mountain Mining (Pty) Ltd's Biodiversity Agreement). A solar farm, two quarries and a guesthouse are located in close proximity to the Project (less than 10 km). Livestock grazing is the main land use in the surrounding rural areas.

Gamsberg Zinc Mine MRA

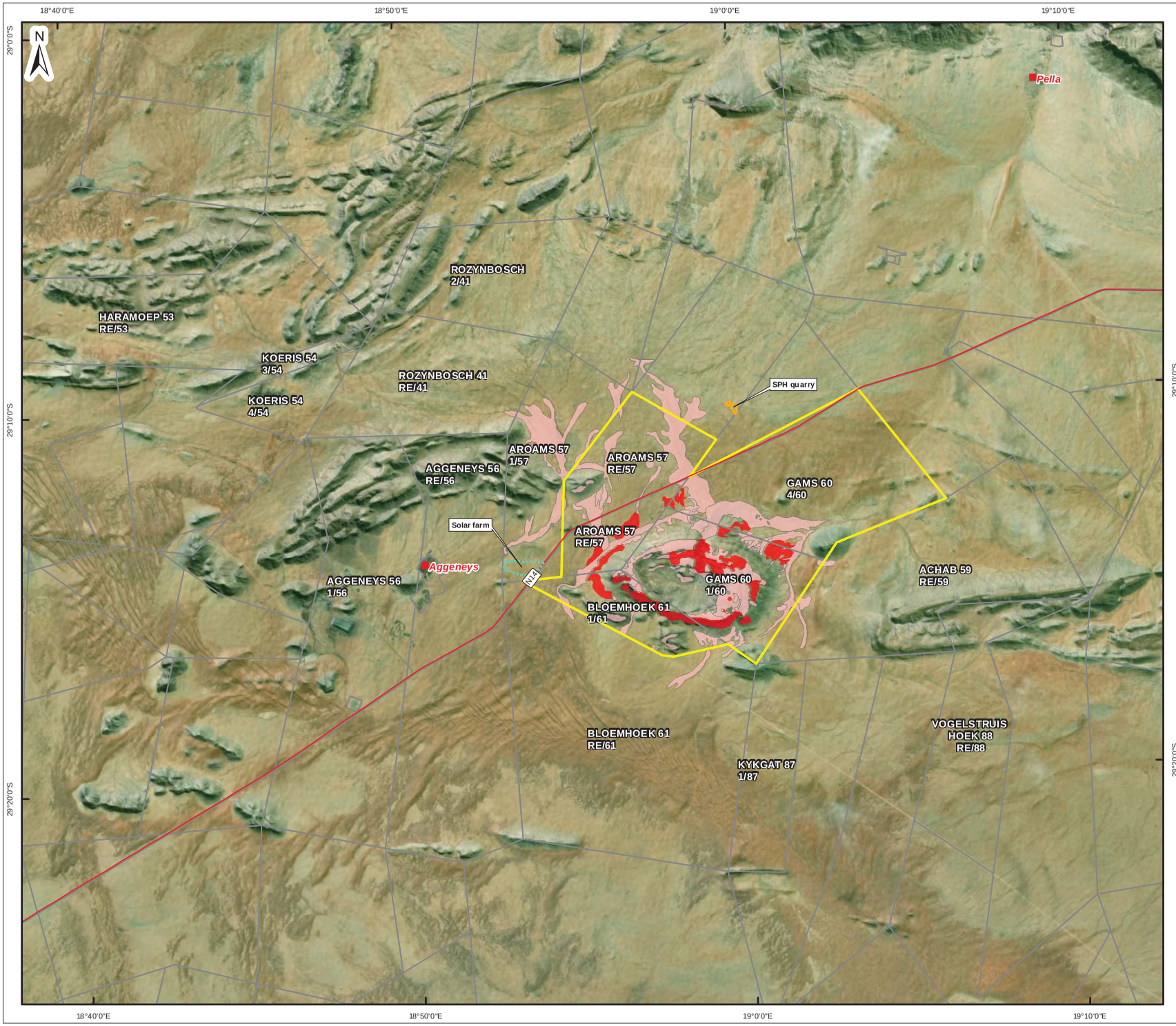
The land on which the smelter complex, secured landfill facility and associated access roads are proposed is currently part of the approved MRA for the Gamsberg Zinc Mine. Mining is currently taking place as well as the primary processing of the ore in the Phase 1 concentrator plant. The land on which the smelter and secured landfill facility is proposed is currently unused.

Surrounding Land Uses

Surrounding Farms and Landowners

The farms surrounding the Gamsberg Zinc Mine are indicated in Figure 26.

- Aroams 57 Ptn 1
- Bloemhoek 61 Rem
- Achab 59
- Kykgat 087 Ptn 1
- Gams 60 Ptn 4
- Gams 60 Rem
- Aroams 57 Ptn 2
- Aroams Rem Ptn 3



Legend

- Gamsberg Zinc Mine Property
- Farm Portion
- Main Roads
- Towns/Villages

Other Land Uses

- SPH quarry
- Solar farm

Botanical Sensitivity

- Irreplaceable
- Constrained

0 2 4 6 Kilometers

Scale: 1:180 000
Projection: Transverse Mercator
Datum: Lo 23 WGS 84

Gamsberg Smelter Project

Figure 26
Surrounding Farms and Land Uses

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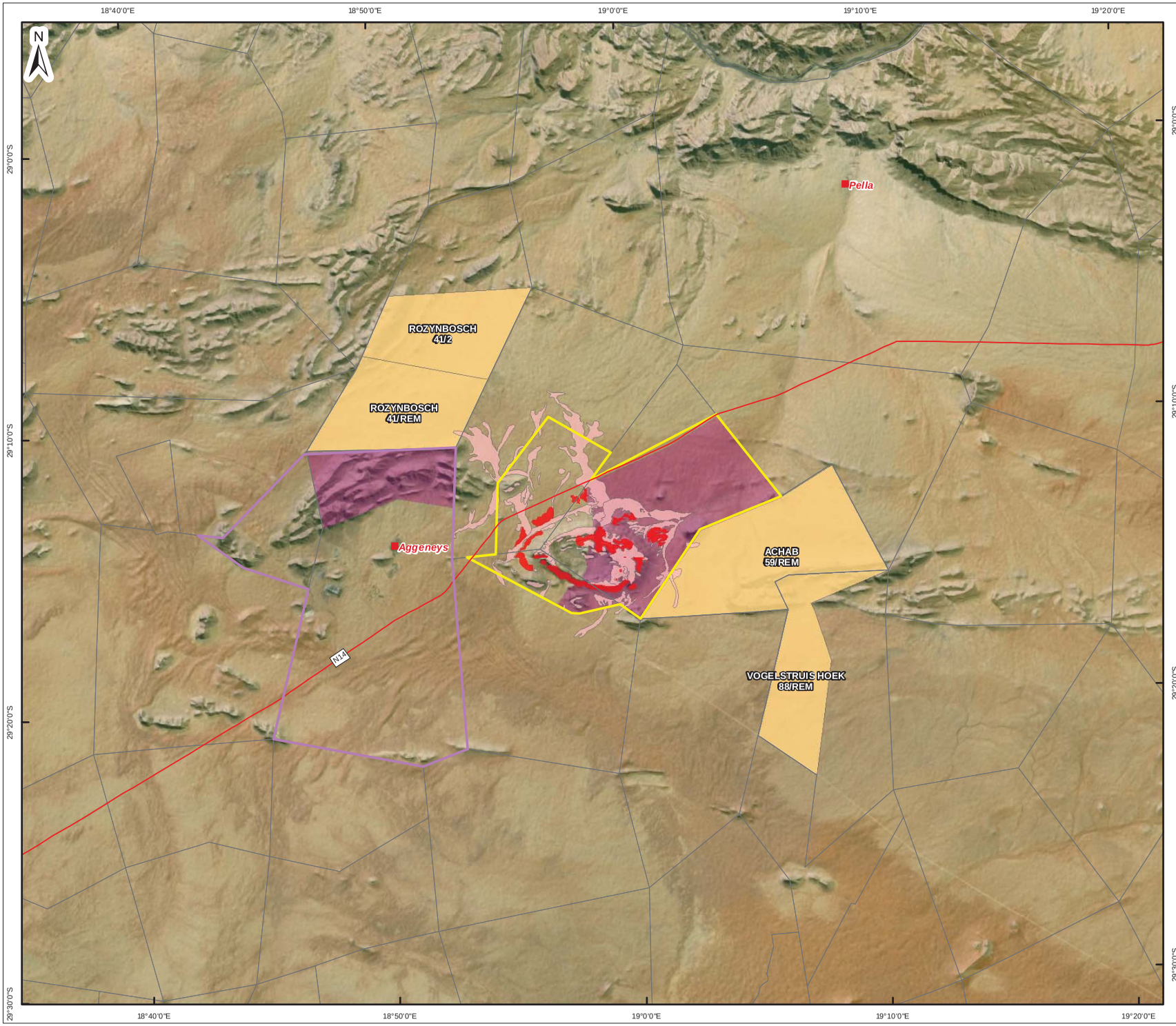
Biodiversity Offset and BMM Set-Aside Areas

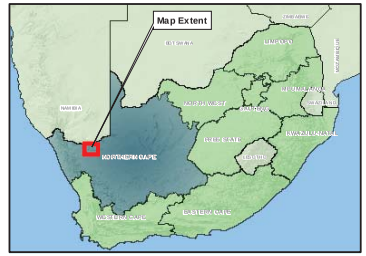
Black Mountain Mining (Pty) Ltd have entered into a Biodiversity Offset Agreement as per the Condition of the Environmental Authorisation (EA) for the Gamsberg Zinc Mine. According to Clause 6.1 of the Biodiversity Offset Agreement Black Mountain Mining (Pty) Ltd is required to secure at it sole and exclusive cost additional conservation worthy land comprising of 1) at least 7 of the 12 nearby properties or 2) 12 900 ha containing the characteristics identified in Clause 6.9 of the Biodiversity Offset Agreement.

A total of four farms (Achab 57, Ptn 2 farm Rozynebosch 41, REM of the farm Rozynebosch 41 and the REM of the farm Vogelstruishoek) were secured covering a surface area of 21 021.66 ha. The Gamsberg Nature Reserve was proclaimed on 5 August 2019 as gazetted in the Northern Cape Provincial Gazette.

Portions of the land as indicated in Figure 26, consisting of Gams 60 Ptn 1 and 4, Bloemhoek 61 Ptn 1 and Aggeneys 56 Rem and Ptn 1 have been designated as set-aside areas (Clause 5). According to the Biodiversity Offset Agreement Black Mountain Mining (Pty) Ltd acknowledge and agree that the protection of the Black Mountain Mining (Pty) Ltd properties shall be managed and implemented through the EMPr and/ or Biodiversity Management Plan.

The Offset farms that have been secured as well as the set-aside areas are illustrated in Figure 27.





Legend

- Gamsberg Zinc Mine Property
- Gamsberg Mining Right Area
- Main Roads
- Towns/Villages
- Set Aside Areas
- Offset Farms

Botanical Sensitivity

- Irreplaceable
- Constrained

0 2 4 6 Kilometers

Scale: 1:220 000
Projection: Transverse Mercator
Datum: Lo 23 WGS 84

Gamsberg Smelter Project

Figure 27
Black Mountain Mining (Pty) Ltd
Offset and Set-Aside Areas

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Black Mountain Mine

Black Mountain Mine (BMM) is approximately 15km to the south west of the Gamsberg Zinc Mine and is owned and operated by Vedanta Resources (69.6%) in partnership with Exxaro Resources (owns 24.4%) and ESOP (6%) . BMM's current operation comprises two underground shafts, Deeps and Swartberg; and a processing plant.

BMM mines zinc, lead, silver and copper, hoisting 1.7Mt of ore per year, and has a production capacity of 90 000tpa metal-in-concentrate.

The Deeps shaft produces copper, lead and zinc, with silver as a by-product. Annual production is of the order of 102ktpa of zinc-equivalent metal-in-concentrate. Production at Deeps is currently scheduled to cease in around 2021.

The Swartberg shaft produces primarily copper and lead, with silver as a by-product. Annual production is of the order of 13.5ktpa of metal-in-concentrate. Plans are well advanced to deepen Swartberg, which will increase production to 1.6Mtpa of copper and lead ore, and 60ktpa - 70ktpa of metal-in-concentrate, depending on a favourable economic assessment. Further ramp up is planned for the future, taking copper and lead ore production past the 2Mtpa mark.

Concentrate from the Black Mountain operations is transported via road transport to the Port of Saldanha.

BMM has been in operation since 1980 and was acquired by Vedanta Resources from Anglo American in 2010/2011.

Town of Aggeneys

The town of Aggeneys is situated approximately 10km to the south west of the Gamsberg Zinc Mine and is largely for housing the employees from both the Gamsberg Zinc Mine and BMM. Aggeneys town consist of 688 houses of which 167 houses where constructed for the Gamsberg Zinc Mine. Single accommodation units can accommodate 155 people. Educational facilities include two primary schools namely the government school and the Aggeneys International Academy, along with a secondary school. Medical facilities include the mine run clinic and also a smaller state clinic. Limited shops are present in town mainly anchored by the OK.

Solar PV Farm

Aggeneys 40MW Solar Generation Facility is situated on the Farm Aroams approximately 5 km to the north west of the proposed Gamsberg Smelter Project area.

Quarry

SPH Kundilla Aggregate Quarry Is situated approximately 7 km to the north east of the Gamsberg Smelter Project area.

7.6 DESCRIPTION OF SPECIFIC ENVIRONMENTAL FEATURES AND INFRASTRUCTURE ON THE SITE

The environmental features and infrastructure within the current mining area and infrastructure complexes are described above in Sections 3.2.1 and 7.5.1, respectively.

7.7 ENVIRONMENTAL AND CURRENT LAND USE MAP

Topographical information as well as land uses within and surrounding the various project footprints are illustrated in Figure 2 and Figure 26.

7.8 ENVIRONMENTAL IMPACTS IDENTIFIED

This section provides a list of potential impacts on the biophysical, heritage/cultural and socio-economic aspects that have been identified in respect of each of the main project actions/activities and processes for each of the project phases (Table 35). A discussion of each of the impacts identified is provided in Section 7.10. The preliminary ratings for consequence, probability and significance of each of the impacts in the unmitigated scenario (which assumes that no consideration is given to the prevention or reduction of biophysical and social impacts) are also provided in Table 35 in accordance with the DMR report template. In this regard it must be noted that a conservative approach has been applied to these ratings in the absence of site specific studies. Once all the site specific studies have been completed the assessment and related ratings may change. The final ratings will be included in the EIA.

Table 35 Preliminary List of Potential Impacts Identified for the Proposed Gamsberg Smelter Project

Note: The preliminary assessment ratings provided in this table are for the unmitigated scenario only which assumes that no consideration is given to the prevention or reduction of biophysical and socio-economic impacts. Furthermore, a conservative approach has been applied to these ratings in the absence of site specific studies. Once all the site specific studies have been completed the assessment and related ratings may change. Moreover, once the mitigation/management measures have been incorporated into the assessment as part of the EIA a determination of residual impact will be provided.

Potential impact	Activity	Alternative[11]	Project phases[12]	Consequence			Probability	Significance	Degree to which impact can:		
				Intensity	Duration	Extent			be reversed	cause irreplaceable loss of resources	be avoided/
Direct impact on biodiversity due to vegetation clearing.	Site preparation Earthworks Transport systems Support services General site management Rehabilitation Maintenance and aftercare	All	C, O	H	H	VH	H	H	Unlikely	Possible	Avoided as far as possible.
Impact on biodiversity due to particulate	Operation of the smelter	All	O	M	H	VH	M	H	Partially	Possible	Managed/ Mitigated

[11] The No-Go Alternative is not assessed here.
[12] C – Construction; O – Operational; D – Decommissioning; Cl - Closure

Potential impact	Activity	Alternative[11]	Project phases[12]	Consequence			Probability	Significance	Degree to which impact can:		
				Intensity	Duration	Extent			be reversed	cause irreplaceable loss of resources	be avoided/
emissions and NO_2 and NOx from the smelter.											
Negative visual impacts	All activities	All	C, O, D, Cl	M	H	M	H	M	Fully	Unlikely	Managed/ Mitigated
Loss of soil and land capability through removal, erosion and compaction	Site preparation and construction activities Transportation General site management Infrastructure complexes Power supply Residue waste management General and hazardous waste management Support facilities Rehabilitation Maintenance and aftercare	All	C, O, D, Cl	H	H	VL	M	M	Partially	Possible	Managed/ Mitigated

Potential impact	Activity	Alternative[11]	Project phases[12]	Consequence			Probability	Significance	Degree to which impact can:		
				Intensity	Duration	Extent			be reversed	cause irreplaceable loss of resources	be avoided/
Loss of soils and land capability through contamination	Site preparation and construction activities Transportation General site management Infrastructure complexes Power supply Residue waste management General and hazardous waste management Support facilities Rehabilitation Maintenance and aftercare	All	C, O, D	M	H	VL	M	L	High	Unlikely	Avoid/ Manage/ Mitigate
Groundwater contamination	Site preparation Earthworks Transport systems Mineralised waste	All	O, D, Cl	H	H	M	H	M	Low	Possible	Managed/ Mitigated

Potential impact	Activity	Alternative[11]	Project phases[12]	Consequence			Probability	Significance	Degree to which impact can:		
				Intensity	Duration	Extent			be reversed	cause irreplaceable loss of resources	be avoided/
	Support services General site management Rehabilitation Maintenance and aftercare										
Surface water contamination	Site preparation Earthworks Transport systems Mineralised waste Support services General site management Rehabilitation Maintenance and aftercare	All	C, O, D	M	H	L	M	L	Partially	Conceivable	Managed/ Mitigated
Reduced air quality due to emissions from the smelter	Transport systems Smelter operations Support services	All	O	M	H	M	H	M	Partially	Possible	Managed/ Mitigated

Potential impact	Activity	Alternative[11]	Project phases[12]	Consequence			Probability	Significance	Degree to which impact can:		
				Intensity	Duration	Extent			be reversed	cause irreplaceable loss of resources	be avoided/
Climate change	All activities	All	C, O, D, Cl	M	H	VH	M	M	Partially	Possible	Managed/ Mitigated
Increase in disturbing noise levels	Site preparation Earthworks Smelter operations Transport systems Mineralised waste management Support services General site management Rehabilitation Maintenance and aftercare	All	C, O, D	M	H	M	H	M	Fully	Unlikely	Can be managed/mitigated to acceptable levels
Impact on existing roads and traffic due to project related traffic	Transport systems	All	C, O, D	M	H	VH	M	M	Fully	Unlikely	Can be managed/mitigated to acceptable levels
Loss of or damage to	Site preparation Earthworks	All	C	L	L	VL	VL	VL	Low	Possible	Can be avoided

Potential impact	Activity	Alternative[11]	Project phases[12]	Consequence			Probability	Significance	Degree to which impact can:		
				Intensity	Duration	Extent			be reversed	cause irreplaceable loss of resources	be avoided/
heritage and/or palaeontological resources	Transport systems Support services										
Positive socio-economic impacts	Site preparation Earthworks Transport systems Mineralised waste management Support services General site management Rehabilitation Maintenance and aftercare	All	C, O, D	M+	H	H	M	M+	Partially	N/A	Can be managed to enhance positive impact

7.9 METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

The method used for the assessment of impacts is set out in TABLE 36. This assessment methodology enables the assessment of environmental impacts including: cumulative impacts, the intensity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated.

TABLE 36 SLR EIA Methodology

PART A: DEFINITIONS AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of intensity, spatial extent and duration**
Criteria for ranking of the INTENSITY of environmental impacts	**VH**	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VL	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.
	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	**VL**	Very short, always less than a year. Quickly reversible
	L	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	M	Medium-term, 5 to 10 years.
	H	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	VH	Very long, permanent, +20 years (Irreversible. Beyond closure)
Criteria for ranking the EXTENT of impacts	**VL**	A part of the site/property.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours
	H	Local area, extending far beyond site boundary.
	VH	Regional/National

PART B: DETERMINING CONSEQUENCE							
INTENSITY = VL							
DURATION	Very long	VH	Low	Low	Medium	Medium	High
	Long term	H	Low	Low	Low	Medium	Medium
	Medium term	M	Very Low	Low	Low	Low	Medium
	Short term	L	Very low	Very Low	Low	Low	Low
	Very short	VL	Very low	Very Low	Very Low	Low	Low
INTENSITY = L							
DURATION	Very long	VH	Medium	Medium	Medium	High	High
	Long term	H	Low	Medium	Medium	Medium	High
	Medium term	M	Low	Low	Medium	Medium	Medium
	Short term	L	Low	Low	Low	Medium	Medium
	Very short	VL	Very low	Low	Low	Low	Medium
INTENSITY = M							
DURATION	Very long	VH	Medium	High	High	High	Very High
	Long term	H	Medium	Medium	Medium	High	High
	Medium term	M	Medium	Medium	Medium	High	High
	Short term	L	Low	Medium	Medium	Medium	High
	Very short	VL	Low	Low	Low	Medium	Medium
INTENSITY = H							
DURATION	Very long	VH	High	High	High	Very High	Very High
	Long term	H	Medium	High	High	High	Very High
	Medium term	M	Medium	Medium	High	High	High
	Short term	L	Medium	Medium	Medium	High	High
	Very short	VL	Low	Medium	Medium	Medium	High
INTENSITY = VH							
DURATION	Very long	VH	High	High	Very High	Very High	Very High
	Long term	H	High	High	High	Very High	Very High
	Medium term	M	Medium	High	High	High	Very High
	Short term	L	Medium	Medium	High	High	High
	Very short	VL	Low	Medium	Medium	High	High

VL	L	M	H	VH
A part of the site/ property	Whole site	Beyond the site, affecting neighbours	Extending far beyond site but localised	Regional/ National
EXTENT				

PART C: DETERMINING SIGNIFICANCE							
PROBABILITY (of exposure to impacts)	Definite/ Continuous	VH	Very Low	Low	Medium	High	Very High
	Probable	H	Very Low	Low	Medium	High	Very High
	Possible/ frequent	M	Very Low	Very Low	Low	Medium	High
	Conceivable	L	Insignificant	Very Low	Low	Medium	High
	Unlikely/ improbable	VL	Insignificant	Insignificant	Very Low	Low	Medium
			VL	L	M	H	VVH
			CONSEQUENCE				

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
Very High	Potential fatal flaw unless mitigated to lower significance.
High	It must have an influence on the decision. Substantial mitigation will be required.
Medium	It should have an influence on the decision. Mitigation will be required.
Low	Unlikely that it will have a real influence on the decision. Limited mitigation is likely required.
Very Low	It will not have an influence on the decision. Does not require any mitigation
Insignificant	Inconsequential, not requiring any consideration.

***VH = very high, H = high, M= medium, L= low and VL= very low and + denotes a positive impact.**

7.10 POSITIVE AND NEGATIVE IMPACTS OF THE PROPOSED ACTIVITY AND ALTERNATIVES

7.10.1 Geology

No geological impacts such as sterilisation of mineral resources are expected as the proposed Gamsberg Smelter Project is being planned in a manner whereby the smelter complex and secured landfill facility would not be constructed in areas which could potentially be resource areas. There will be some excavations for foundations for the smelter complex but these are not expected to have an impact on the local geology.

7.10.2 Topography

No physical topographic impacts are expected as the smelter complex and secured landfill facility would be constructed on the flat areas surrounding the Gamsberg Inselberg. Existing mining activities have significantly altered the original topography along the slopes of the inselberg, where waste rock has been dumped and will continue to be dumped for the life of mine.

7.10.3 Biodiversity

Physical loss and/or general disturbance of terrestrial biodiversity

Clearing of 22 ha of land for the smelter complex and 21 ha for the secured landfill facility may impact on certain sensitive vegetation and flora. However, the sites of these facilities were selected specifically in areas mapped as low sensitivity and have avoided areas identified as irreplaceable and/ or constrained during previous vegetation and sensitivity mapping studies. The dominant habitat unit of the Project footprint is Flat Sandy Plains within the Bushmanland Arid Grassland vegetation type which has the largest extent in the Bushmanland Inselberg region with 148 000 ha. The only sensitive vegetation type that will be affected by the Project is a 'wash'(i.e. seasonal stream course), which has been assessed and mapped as 'constrained' in terms of sensitivity, of which approximately 150 m length strip will need to be crossed by the road connecting the Smelter Complex and the secured landfill facility (Figure 2). The botanical survey for the EIA will verify the presence of threatened or range restricted flora to determine the sensitivity of the biodiversity in and around the smelter complex and associated facilities to determine the significance of the potential loss of biodiversity and to identify suitable mitigation measures.

Based on current knowledge of the vegetation type in the smelter complex and secured landfill facility sites, the loss of the Flat Sandy Plains vegetation and small strip of wash habitat is expected to be of low to moderate significance as long as construction activities and the final developed impacts remain within the defined area for this infrastructure. The footprint and vegetation type impacted by the smelter complex and secured landfill facility falls within the area that was included in the existing Gamsberg Zinc Mine Biodiversity Offset agreement between Black Mountain Mining (Pty) Ltd and DENC. As a result, and due to the avoidance of the most sensitive

vegetation zones, it is unlikely that an additional offset will be required but this will be confirmed during the flora and fauna assessment.

The additional work required to address this issue is described in Section 8.3 of this Scoping Report.

Impact on sensitive biodiversity due to reduced air quality

The smelter complex and secured landfill facility are located approximately 400 m and 250 m, respectively, from portions of the Calcrete Gravel Plains habitat within the Bushmanland Arid Grassland vegetation type as identified by ERM, 2013. The Calcrete Gravel Plains habitat has been assessed as irreplaceable and 1 732 ha has been mapped in the Bushmanland Inselberg Region, all of which occurs around the Gamsberg inselberg. This habitat type is considered potentially the most sensitive to air quality impacts of the project and will be given closest consideration in the flora and fauna study.

Increased emissions of particulate matter (PM), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2) and Nitrogen Oxide (NOx), and possible, but limited, fall out of heavy metals such as Lead (Pb) and Zinc (Zn), during operation of the smelter may impact on the sensitive flora in the vicinity. However, there is limited understanding of the tolerance of the region's succulent flora to increased dust and the air emissions and a precautionary approach needs to be taken to ensure that indirect vegetation impacts associated with air quality impacts are minimised and monitoring is undertaken to allow for adaptive management to be applied. Based on current understanding it is expected that the impacts of additional PM and increased ground level concentrations of SO_2, NO_2 and NOx, and fall out of Pb and Zn from the Smelter Project will affect a smaller area than the modelled dust deposition zones for the mining activities of 50 mg/m^2/day and 20 mg/m^2/day, which were used as the basis for the determination of the magnitude and extent of the existing Gamsberg Zinc Mine Offset. Air quality impacts from the smelter complex and secured landfill facility are expected to stay within critical or threshold values available for other vegetation types from the public literature, and may have a localised adverse effect on flora around the facilities, if at all. It is expected that the dust from the mine itself will have a more significant long-term impact than the air quality impacts of the Smelter Project. Nonetheless, on a precautionary basis, any negative impacts of air quality on irreplaceable Calcrete Gravel Plain habitat is expected to be of low intensity but of regional extent due to the high conservation importance of this habitat and overall significance is likely to be moderate with mitigation and high without mitigation. Potential air quality impacts will be evaluated by modelling air dispersion and fall out in the context of the sensitive vegetation types for the EIA. Given the expected localised extent of air quality impacts and overlap with the Gamsberg mine dust deposition zone, it is expected that the potentially impacted area falls largely or entirely within the area that falls under the Gamsberg Zinc Mine Biodiversity Offset agreement between BMM and DENC. As a result, it is unlikely that an additional offset will be required but this will be further investigated and confirmed during the EIA.

The additional work required to address this issue is described in Section 8.3 of this Scoping Report.

7.10.4 Visual

Negative visual impacts

Visual impacts on the receiving environment may be caused by activities and infrastructure associated with the smelter complex and the secured landfill facility as well as night-time illumination at the mine. The project activities would be visible to varying degrees from visual receptors in the surrounding areas, in particular from N14 road users.

In the absence of mitigation measures that provide for rehabilitation and possible visual screening of facilities, the intensity in the unmitigated scenario would be expected to be medium due to the visual impact of the mine and associated facilities in the background. Potential impacts would extend beyond the project area boundary to the visual receptors and be medium term in nature. The related unmitigated significance would be medium. Even with mitigation, during the operational phase, activities would remain visible from the more sensitive

viewpoints. At closure, when rehabilitation is completed in a manner that supports the post-closure land use, the significance would be reduced to minor.

The additional work required to address this issue is described in Section 8.3 of this Scoping Report.

7.10.5 Soils and Land Capability

Loss of soil and land capability through removal, erosion and compaction

Topsoil is generally a resource of high value containing a gene bank of vegetation seeds and other organisms. Soil resources can be lost through removal, erosion and compaction which can result in a loss of soil functionality as an ecological driver. The conservation of topsoil, soil management practises and the related rehabilitation strategy and initiatives is highly important in achieving a sustainable post-closure land use. A number of activities/infrastructure, particularly during the construction/ clearing phase, have the potential to result in the loss of soils and related land capability, regardless of the alternatives that are selected.

In the absence of soil conservation and management measures and a rehabilitation plan that supports the post closure land use, the intensity of potential impacts is expected to be high due to the sensitive nature of the project area. Without mitigation the loss of soil and related land capability would definitely occur and would extend beyond the life of the Project but would be localised to within the project area boundary. Due to the sensitivity of the soils the unmitigated scenario is expected to be medium. This impact significance could be reduced to low with the implementation of mitigation measures focused on minimising impacts during operations and remedying any negative impacts at closure.

Loss of soil and land capability through contamination

Contamination from both the smelter complex and the secured landfill facility have the potential to result in the loss of or damage to soil resources. Contamination of soil resources would result in a decrease in the rehabilitation and post-closure land use potential. Contaminants could include construction related consumables, fuels, hydrocarbons and hazardous wastes. There are a number of likely contamination sources in all phases that have the potential to contaminate soil resources for all alternatives that are being considered.

In the absence of pollution containment and spill management measures the intensity of potential impacts is expected to be medium. With a medium probability the overall significance is expected to be low. In the mitigated scenario that focuses on avoiding impacts through containment of potential contamination at source and implementation of spill management procedures, the significance could be reduced to low as the intensity, duration, extent and probability would all reduce.

7.10.6 Groundwater

Reduced groundwater quality due to contamination

There is the potential for contamination due to both the smelter complex operations as well as from the secured landfill facility. Potential contaminants from the project are expected to include construction related consumables, fuels, hydrocarbons, residues and hazardous wastes. A waste classification of the Jarofix and ETP cake and any other waste to be stored in the secured landfill site will be undertaken for the EIA as well as to inform the final design of the secured landfill facility and liner requirements.

In the absence of mitigation, however, the intensity of unmitigated impacts would be high, particularly for the secured landfill facility. Potential health impacts could occur where these water resources are used by third party users for extended periods of time. Impacts could extend beyond the site boundary to these water users and could extend beyond closure. In time, reduced water quality could be reversed, however, at this stage, the related time period is not known. The related unmitigated significance is, therefore, high. Important to note is

that the use or potential contamination of water resources is regulated through Water Use Licensing requirements of the DWS as the custodian of water resources in South Africa. Where the project plan takes into account the findings of specialist studies, applies the necessary mitigation to avoid, minimises or remedy impacts in line with the mitigation hierarchy and operates under a water use license, the significance of potential impacts can be reduced.

The additional work required to address this issue is described in Section 8.3 of this Scoping Report.

7.10.7 Surface Water

Reduced water quality due to contamination

During all phases of the project there is the potential for spills or leaks to impact surface water where there is runoff. However, due to the extremely low rainfall in the area this is likely to be minimal unless there is a major leak/spill from a wastewater storage or pollution control dam's area.

In the absence of mitigation, the intensity of unmitigated impacts is expected to be medium. The duration will extend from the start of construction to the completion of decommissioning and until the site is completely rehabilitated. The probability of contamination in the unmitigated case is expected to be medium and thus has an overall low significance. Where the project plan takes into account the findings of specialist studies, applies the necessary mitigation to avoid, minimise or remedy impacts in line with the mitigation hierarchy and operates under a water use license, the significance of potential impacts can be reduced.

The additional work required to address this issue is described in Section 8.3 of this Scoping Report.

7.10.8 Air Quality

Reduced air quality due to atmospheric emissions

Emissions from the Smelter can have a negative impact on ambient air quality and surrounding land uses during the operational phase, regardless of the alternatives that are selected. Emission sources during other phases would include land clearing activities for construction, materials handling, wind erosion of disturbed areas, vehicle movement along unpaved roads and exhaust emissions. The main contaminants would include particulate matter, SO_2 and NO_x.

In the absence of mitigation measures that focus on the control of emissions at source and a rehabilitation plan that allows for rehabilitation and supports the post closure land use, the intensity is expected to be medium. Where third parties are exposed to project-related emissions negative impacts could result in health impacts and cause a nuisance impact. Air pollution impacts would extend beyond the site boundary. The significance is thus determined to be medium. With mitigation that focuses on controlling emissions sources, the significance could be reduced to medium as the intensity, duration, extent and probability would reduce.

The impact of reduced air quality on biodiversity is discussed in Section 7.10.3.

The additional work required to address this issue is described in Section 8.3 of this Scoping Report.

7.10.9 Noise

Increase in noise levels

Smelter projects in general have the potential to contribute to an increase in ambient noise levels during the construction, operational and decommissioning phases. For this project ambient noise levels would be related to the Gamsberg zinc mining activities, traffic from the N14 and some community noise. Project-related noise sources would include construction related activities, emergency power supply, operation and movement of

machinery and equipment (including reverse beepers) and transport of product and by-product off site. Potential receptors within the project area include individual homesteads and residential areas (i.e. Aggeneys), the closest of which is more than 4 km away.

In the absence of mitigation measures that consider potential receptor sites in relation to project activities the intensity is expected to be medium due to the distance of receptors from the Project area. Noise pollution impacts would extend beyond the site boundary and would occur until decommissioning is complete. The related unmitigated significance would be medium. With mitigation that focuses on minimising impacts through the application of noise control measures, the significance could be reduced to low as the intensity, duration and probability would reduce.

The additional work required to address this issue is described in Section 8.3 of this Scoping Report.

7.10.10 Traffic

Impact on roads due to project related traffic

During the construction and operational phases of the Project there would be a significant increase in traffic, for example bringing construction materials to the site or taking product and by-product away from the site for export during operations. This would result in an inconvenience to current road users, potentially higher accident rates (for people and animals), decreased road service levels and/or increased road damage. This in turn can put pressure on the relevant roads authority to increase the maintenance programmes and/or upgrade the roads. The proposed Gamsberg Smelter Project would require the use of several roads in the region; the N14, N7 and R399.

In the absence of project related activities, traffic volumes along the N14, N7 and R399 are generally moderate . Regardless of the alternatives that are selected, the project would contribute to traffic volumes on public roads. Traffic impacts are expected from construction through to the end of the decommissioning phase.

In the absence of mitigation measures that take into account other road uses, project-related use of public roads could result in a high intensity impact. Any serious injury or death is a long-term impact that would extend to the communities to which injured people/animals belong. The related unmitigated significance is medium. With mitigation that focuses on ensuring adequate capacity on the road network and safety measures for other road users, the significance could reduce to medium as the intensity, duration and frequency of potential accidents is expected to reduce.

The additional work required to address this issue is described in Section 8.3 of this Scoping Report.

7.10.11 Heritage/ Cultural Resources

Loss of or damage to heritage and/or paleontological resources

The placement of infrastructure and mining activities in general, in all phases prior to closure, have the potential to remove, damage or destroy heritage/cultural and palaeontological resources, either directly or indirectly, and result in the loss of the resource for future generations.

However, as in Section 7.5.1, no cultural or heritage resources were identified by Morris (2013) and Pether (2013) in the study area. As such no impact is assumed and no further studies have been commissioned.

7.10.12 Socio-economic Impacts

Positive and negative impacts during the construction phase

Positive Impacts:

- Employment creation during construction;
- Multiplier effects on local economy;
- Contribution to the local economy through employment and economic stimulus;
- Contribution to district and national revenue base and economic development;
- Enhanced quality of life for project beneficiaries as result of improved socio-economic conditions;
- Positive impacts associated with project activities and expenditure on key indicators including employment and household incomes;
- Impact on key macroeconomic indicators such as foreign exchange receipts; and
- Impacts on municipal service and finances.

In the absence of enhancement measures the unmitigated intensity could be a medium positive. The related unmitigated significance would also be a medium positive. Where the project planning takes into account the findings of the specialist studies enhancement measures could increase the positive impacts.

Negative Impacts:

- Disruption of movement patterns (people and animals);
- Influx related impacts (e.g. increased pressure on local services, establishment and/or growth of informal settlements, social pathologies);
- Negative impacts related to the presence of construction workforce (increase in social pathologies, and animosity between newcomers and incumbent population);
- Community health, safety and security (air, noise, dust pollution, increased traffic volumes) at the smelter site;
- Impacts on surrounding land users (health and safety, mobility, economic viability of farming activities);
- Increased pressure on Aggeneys and Pofadder services and facilities due to accommodation of permanent workforce;
- Safety risk due to increased traffic volumes;
- Deterioration of local and national roads;
- Pressure on the local and district municipalities to take over the administration and services delivery of the mine town (Aggeneys);
- Impacts related to retrenchment and loss of mine houses;
- Potential lack of economic diversity;
- Impacts associated with environmental impacts that cannot be mitigated and have economic implications such as for the tourism sector, other businesses or residents of the area; and
- Opportunity costs associated with the change in land use.

In the absence of mitigation measures the unmitigated intensity could be a low negative. The related unmitigated significance would also be a low negative. Where the project planning takes into account the findings of specialist studies and applies the necessary mitigation to avoid, minimise or remedy impacts in line with the mitigation hierarchy, the significance of potential negative impacts can be reduced.

The additional work required to address this issue is described in Section 8.3 of this Scoping Report.

7.11 THE POSSIBLE MITIGATION MEASURES AND THE LEVEL OF RESIDUAL RISK

Table 37 provides a list of the impacts identified by the EAP or raised by interested and affected parties, as well as the possible management and mitigation measures. The level of residual risk after management or mitigation is also estimated. This will be refined during the EIA phase with specialist input as appropriate.

Table 37 Possible Mitigation Measures and Anticipated Level of Residual Risk

Potential impact	Activity	Possible mitigation	Potential for residual risk
Negative visual impacts	Presence of smelter complex and secured landfill facility	- Limit the extent of disturbed areas. - Supress dust when required. - Effective waste management. - Implement effective use of lighting which reduces light spill. - Effective rehabilitation to achieve post closure land use. - The use of berms where appropriate.	Low
Loss of soil and land capability through removal, erosion and compaction	Site preparation and construction activities Transportation General site management Rehabilitation Maintenance and aftercare	- Limit site clearance to what is absolutely necessary for the immediate smelter complex and secured landfill area. - Strip, handle, stockpile and re-use soil resources in line with site specific soil conservation and management plan.	Low

Potential impact	Activity	Possible mitigation	Potential for residual risk
Loss of soil and land capability through contamination	Site preparation and construction activities Infrastructure complexes Transportation Power supply Residue waste management General and hazardous waste management Support facilities General site management Demolition Rehabilitation Maintenance and aftercare	- Basic infrastructure design that is adequate to contain polluting substances including lining of the secured landfill site. - Training of workers to prevent pollution. - Equipment and vehicle maintenance. - Fast and effective clean-up of spills. - Effective waste management. - In case of major spillage incidents an emergency response procedure must be implemented.	Low

Potential impact	Activity	Possible mitigation	Potential for residual risk
Physical loss and/or general disturbance of terrestrial biodiversity	Site preparation and construction activities Infrastructure complexes Transportation Power supply Residue waste management General and hazardous waste management Support facilities General site management Demolition Rehabilitation Maintenance and aftercare	- Avoid constrained and sensitive areas by placing infrastructure away from these areas; - Implement setback lines for sensitive biodiversity areas - Fence in construction areas to restrict access to sensitive areas - Limit site clearance to what is absolutely necessary. - Undertake pre-construction surveys of the development footprints for species suitable for search and rescue operations. - Obtain relevant permits prior to removal of protected species. - Implementation of an alien invasive species management programme. - Limit emissions (dust, light, noise). - Training of employees on the value of biodiversity. - Zero tolerance for harming and harvesting fauna and flora. - Effective waste management and pollution prevention. - Implementation of a biodiversity action plan to ensure that the undeveloped/disturbed areas within the property are properly conserved and maintained. - Effective rehabilitation to achieve post closure land use.	High
Impact on terrestrial biodiversity due to reduced air quality from the Smelter operations	Construction activities and Smelter operation	- Limit disturbed areas. - Supress dust effectively. - Maintain equipment, including abatement equipment and vehicles in good working order. - Monitor pollutants of concern and implement additional mitigation as required. - Effective rehabilitation to achieve post closure land use.	Medium
Reduction in surface water quality affecting third party users	Site preparation and construction activities Infrastructure complexes Water supply and management	- Design and implement contamination containment measures.	Low

Potential impact	Activity	Possible mitigation	Potential for residual risk
	Residue waste management General and hazardous waste management Support facilities General site management Rehabilitation Maintenance and aftercare	- Mine infrastructure will be constructed and operated so as to comply with the National Water Act No. 36 of 1998 and Regulation 704 (4 June 1999): o Clean and dirty water systems will be separate. o Clean run-off will be diverted away from the site. o Dirty water will be contained. - Conduct surface water monitoring and implement remedial actions as required. - Effective equipment and vehicle maintenance. - Fast and effective clean-up of spills. - Effective waste management. - Education and training of employees and business partners. - Apply and operate in line with a water use license. - Effective rehabilitation to achieve post closure land use.	
Reduction in groundwater quality affecting third party users	Site preparation and construction activities Infrastructure complexes Water supply and management Residue waste management General and hazardous waste management General site management Rehabilitation Maintenance and aftercare	- Mine infrastructure will be constructed and operated so as to comply with the National Water Act No. 36 of 1998 and Regulation 704 (4 June 1999). - Design and implement contamination containment measures. - Infrastructure that has the potential to pollute groundwater will be identified and included into a groundwater pollution management plan which will be implemented as part of the operational phase through post-closure as required. - Conduct groundwater monitoring and implement remedial actions as required. This includes compensation for mine related loss of third party water supply. - Apply and operate in line with a water use license. - Effective equipment and vehicle maintenance. - Fast and effective clean-up of spills. - Effective waste management.	Low

Potential impact	Activity	Possible mitigation	Potential for residual risk
		- Education and training of workers. - Effective rehabilitation to achieve post closure land use.	
Decrease in air quality from project emissions	Construction activities and Smelter operation	- Limit disturbed areas. - Supress dust effectively. - Maintain equipment and vehicles in good working order. - Monitor pollutants of concern and implement additional mitigation as required. - Effective rehabilitation to achieve post closure land use.	Low
Climate change	Smelter operation Use of machinery during the construction and decommissioning phases	- Limit greenhouse gas and other emissions	Low
Increase in noise levels	Construction activities and Smelter operation	- Maintain vehicles and equipment in good working order. - Conduct noise monitoring in response to noise complaints.	Low
Effect on roads due to project related traffic	Site preparation and construction activities Transportation of finished product and waste products General site management	- Construct safe access points/intersections. - Educate employees (Business Partner and permanent) about road safety. - Enforce strict vehicle speeds. - Enforce strict rules with regard to taking regular breaks during long trips. - If a person or animal is injured by transport activities an emergency response procedure must be implemented.	Medium
Loss of or damage to heritage and/or palaeontological resources	Site preparation and construction activities General site management Demolition Rehabilitation	- Plan project to avoid any resources of significant importance. - Training of employees and business partners regarding the heritage and cultural sites that may be encountered and about the need to conserve these.	Low

Potential impact	Activity	Possible mitigation	Potential for residual risk
		- Fence off and limit access to the heritage and cultural sites in the MRA that could be indirectly disturbed by the smelter activities. - In the event that resources are identified, a chance find procedure should be implemented.	
Positive and negative socio-economic impacts	Construction and operation of the smelter complex	- Develop and implement procedures for recruiting, training and procurement that align with good industry practise. - Employ local people and procure goods and services locally as far as practically possible. - Effective communication to manage expectations with regard to employment and other opportunities. - Ensure that closure planning considerations address the re-skilling of employees for the downscaling, early closure and long-term closure scenarios.	Medium positive Low Negative

7.12 THE OUTCOME OF THE SITE SELECTION MATRIX

Three site options were considered for both the smelter complex and the secured landfill facility (Section 7.2.2). Based on the outcome of the site selection matrix (Table 21 and Table 22), the preferred design or layout is Site 3 for both the smelter complex and the secured landfill facility.

7.13 MOTIVATION WHERE NO ALTERNATIVES WERE CONSIDERED

Not applicable.

7.14 THE PREFERRED ALTERNATIVES

Refer to Section 7.1.

8. PLAN OF STUDY FOR THE ENVIRONMENTAL IMPACT ASSESSMENT

The main objectives of the EIA phase are to:

- Assess the potential impacts associated with the preferred project alternatives as per the terms of reference for the assessment that are set out in the Scoping Report.
- Identify and describe procedures and measures that would enhance potential positive impacts and avoid, minimize, remedy or compensate potential negative impacts.
- Liaise with relevant government departments on issues relating to the proposed development to ensure compliance with existing guidelines and regulations.
- Undertake consultation with I&APs and provide them with an opportunity to review and comment on the outcomes of the EIA process and acceptability of mitigation measures.
- Develop an EMPr and a conceptual closure/decommissioning plan.
- Provide measures for ongoing monitoring (including environmental audits) to ensure that the project plan and proposed mitigation measures are implemented as outlined in the detailed EIA report.

This chapter describes the nature and extent of further investigations to be conducted in the EIA, and sets out the proposed approach to the EIA phase.

8.1 ALTERNATIVES TO BE CONSIDERED

The alternatives considered and the preferred site layout alternatives are provided in Section 7.1.

8.2 ASPECTS TO BE ASSESSED BY THE EAP

Aspects to be assessed include those listed in Section 8.3 where specific specialist input is required as well as aspects where specialist investigations are not required as outlined below.

8.2.1 Geology

No specialist investigation is proposed for assessing the impacts on geology due to the surface nature of the project. A geophysical survey will, however, be carried out to determine any geological faults which could be affected by the Gamsberg Smelter Project. This information will be used in the groundwater assessment.

8.2.2 Topography

It is proposed that no specialist investigation is required in this regard. The assessment and detailed mitigation measures will be provided in the EIA by SLR with input from the project team visual specialist.

8.2.3 Soils

It is proposed that no specialist investigation is required in this regard. The assessment and detailed mitigation measures will be provided in the EIA by SLR with input from the SRK baseline studies (2009). It has been assumed that the findings of these studies remain valid.

8.2.4 Cultural Heritage and Palaeontological Resources

A Heritage and Archaeological Impact Assessment was undertaken by Dr David Morris (2013) and Mr John Pether (2013) was appointed to undertake a desktop Paleontological Impact Assessment. These studies covered the entire MRA for the original Gamsberg Zinc Mine EIA (2013) which was approved by the DENC in 2013 (see EA dated 12 August 2013). It has been assumed that the findings of these studies remain valid.

8.3 ASPECTS TO BE ASSESSED BY SPECIALISTS

The aspects to be assessed by the various specialists are included in Table 38. Each specialist study will undertake the following steps:

- Identify specific issues of concern through an understanding of the project and the sensitivity of the affected environment as well as review of all issues raised by stakeholders;
- Interact with other specialists, where required, to ensure the integration of issues of concern and appropriate assessment;
- Define relevant laws and regulations that apply to the specific specialist study;
- Define the baseline environment through review of available information from past studies and additional field studies, where required;
- Assess the direct, indirect and cumulative impacts;
- Provide mitigation measures to reduce impacts to an acceptable level i.e. residual impact. Where necessary provide recommendations to address residual impacts i.e. biodiversity offsets; and
- Where required, provide detailed monitoring plans.

Table 38 Plan of Study: Aspects to be Assessed by Specialists

Specialist Study	Plan of Study
Groundwater	The groundwater specialist study will be conducted by SLR and will focus on the following: • Review all existing hydrogeological data: this includes monitoring data and baseline hydrogeology (water levels and water quality); review previous studies that were undertaken for the Gamsberg Zinc Mine, including the groundwater model report and all groundwater monitoring data; examine new infrastructure map and determine possible source term sites;

Specialist Study	Plan of Study
	extract all pertinent data and compile the Conceptual Hydrogeological Model. • Groundwater numerical modelling: Based on the source term derived from the geochemical study, the existing groundwater numerical model will be updated; Model results will inform the EIA and WULA regarding whether or not there is any potential of groundwater contamination. • The groundwater study will include a geochemical and waste assessment to inform the contamination potential of any residues/discards generated by the project. The waste assessment will be undertaken in terms of the National Norms and Standards (Regulation 635 and 656 of 2013).
Surface Water	The surface water specialist study will be conducted by SLR and will focus on the following: Baseline: • Review of topographical data, existing site layout, future site layout, geotechnical/ground conditions information etc; and • Climate characterisation including rainfall, evaporation and design storm intensities. Storm water Management: • Clean and dirty water classification; • Catchment delineation in terms of GN 704 (clean and dirty water); and • Develop layout for storm water management infrastructure including routing of channels and culverts, site of silt traps and PCDs to inform impact assessment. Floodline Review: • Review of current floodlines to ensure that they conform to the requirements of this study. Water Quality (WQ) Review: • Review of current WQ to ensure that they conform to the requirements of this study. Water Balance: • Collate and review input from project team including inflows, TSF water balance, process plant water balance, storm water management, water quality etc. to inform the impact assessment. Impact Assessment: • Qualitative assessment of the impacts of the project and summary of mitigation measures, including any cumulative impacts.
Terrestrial Biodiversity	The terrestrial biodiversity specialist study will be conducted by Simon Todd (Independent Consultant) and will focus on the following:

Specialist Study	Plan of Study
	• Develop sensitivity maps based on detailed survey work undertaken for the Gamsberg Zinc Mine EIA and use this to assess alternative sites for the site of the smelter and associated infrastructure (i.e. avoidance); • Compile a detailed baseline study based on the information gathered during the Gamsberg Zinc Mine EIA as well as targeted field work to specific areas of concern to determine status of these habitats post mine commissioning and operation over the past 5 years; • Work closely with the air quality specialist to understand levels of dust fallout from the smelter construction and operations as well as concentrations of pollutants in the atmosphere that may have an impact on the sensitive habitat i.e. identify possible thresholds (critical levels) for certain pollutants; and • Develop an appreciation for the offset agreement for the Gamsberg Zinc Mine that was entered into between Gamsberg Zinc Mine and DENC and identify if additional offsets may be required after the mitigation hierarchy has been applied and residual impacts assessed • Develop a framework Biodiversity Management and Monitoring Plan that is aligned with the existing plans at the Gamsberg Zinc Mine.
Air Quality	The air quality specialist study will be conducted by Airshed Planning Professionals and will focus on the following: • Compilation of an emissions inventory comprising the identification and quantification of potential sources of emissions due to the proposed Gamsberg Smelter Project; • Dispersion simulations of all potential pollutants from the operational plant for applicable averaging periods, including the cumulative impact of existing ambient baseline conditions; • Assessment of potential for human health impacts; and • Assessment of the potential biodiversity impacts - this will require close collaboration with the biodiversity specialist to identify appropriate thresholds for various plant species.
Noise	The noise specialist study will be conducted by Airshed Planning Professionals and will focus on the following: • Noise emissions from the project's operational phases will be estimated. The propagation of noise from the project will be calculated according to SANS 10357:2004, 'The calculation of sound propagation by the Concawe method'. The Concawe method makes use of the International Organisation for Standardization's (ISO) air absorption parameters and equations for noise attenuation as well as the factors for barriers and ground effects. In addition to the ISO method, the Concawe method facilitates the calculation of sound propagation under a variety of meteorological conditions. Data representative of conditions in the study area and obtained from the air quality study will be applied in the calculations.

Specialist Study	Plan of Study
	• Noise impacts will be calculated both in terms of total ambient noise levels as a result of the project as well as the effective change in ambient noise levels. Impacts will be calculated and assessed according to local SABS guidelines.
Visual	The visual specialist study will be conducted by Visual Resource Management Africa cc and will focus on the following: • Characterisation of the baseline environment by considering the natural and cultural landscape, scenic resources, sense of place and visual receptors; • Compilation of a viewshed analysis; • Assessment of potential impacts associated with each of the project phases; and • Development of mitigation measures.
Traffic	The traffic specialist study will be conducted by Siyazi and will focus on the following: • Conduct detailed trip generation and distribution calculations; • Conduct detailed intersection performance evaluations using micro simulation software (Sidra); • Provide basic intersection geometric layout input; and • Prepare a report containing findings and recommendations (Traffic Impact Assessment).

Climate Change	The climate change specialist study will be conducted by Promethium Carbon and will focus on the following:
	• Description of the receiving environment;
	• Calculate carbon footprint of the project ;
	• Analysis of the project GHG emissions:
	  • identify and further detail the upstream and downstream sources of greenhouse gas emissions (Scope 3 emissions);
	  • where information is not available in this regard, develop a set of assumptions to inform the upstream and downstream greenhouse gas emissions;
	• Analysis of project alternatives and mitigation measures in place;
	• Climate change impact assessment:
	  • impact of the project GHG emissions (carbon dioxide, methane and nitrous oxide) on climate change;
	  • comparison of impacts against project alternatives;
	• Climate change vulnerability of the project:
	  • Potential impact of climate change on the project in terms of available climate data;

Specialist Study	Plan of Study
	• Potential climate change impacts for the region of operation in terms of project risks, the social context, project value chain and broader environmental risks; and • Recommendations on emission management during construction and operations.
Social	The social specialist study will be conducted by Nic Boersema (Independent Consultant) and will focus on the following: • Interact closely with the noise, visual, economics and air quality specialist to better understand the outputs of these studies and how these may impact surrounding communities; • Refine the Project's Area of Influence (AoI) and scope of the SIA, if necessary; • Address issues that have been raised during the EIA process; • Address and assess alternatives to the proposed activity; • Identify, describe and assess positive, negative and cumulative impacts (pre- and post-mitigation); and • Formulate impact enhancement, avoidance, management and mitigation measures for incorporation into the management plan. The preparation of the Social Impact Assessment (SIA) will be based on: • Information obtained from primary and secondary data gathering; • Feedback from stakeholders via the public participation process; • Consideration and understanding of planned project activities for all project phases; • Input from other project specialist studies (e.g. noise, visual, air quality, traffic) and the project management team; • Review of impacts of similar projects; and • Professional experience/ judgement of the social specialists and the project team. Impact identification will consider positive and negative impacts, as well as cumulative impacts. They will also include perceived risks, as determined through, amongst others, data gathering and the public participation process.
Economic	The economic specialist study will be conducted by Independent Economic Researchers and will focus on the following: • Broad level review of the need and financial viability/risks associated with the project; • Compatibility with key national, local and provincial economic and associated spatial development plans and relevant strategies; • Positive impacts associated with project activities and expenditure on key indicators including employment and household incomes; • Impact on key macroeconomic indicators such as foreign exchange receipts;

Specialist Study	Plan of Study
	• Impacts on municipal service and finances; • Impacts associated with environmental impacts that cannot be mitigated and have economic implications such as for the tourism sector, other businesses or residents of the area; and • Opportunity costs associated with the change in land use.
Mine Closure Update	The mine closure update will be conducted by SLR and will focus on the following: • Update the environmental risk assessment to include the smelter complex and secured landfill facility; • Review the existing mine closure strategy, objectives, schedules and motivations; • Assess the long-term/latent impacts and mitigation measures (from latest specialist studies) associated with the Project; • Update rates, quantification and closure liability assessment to include the smelter complex and secured landfill facility; • Identify knowledge gaps (for future closure plan updates); • Review proposed monitoring, auditing and reporting procedures; • Incorporate new stakeholder comments applicable to closure and the smelter complex and secured landfill facility; and • Generate an addendum closure report for the smelter complex and secured landfill facility (to be integrated with existing mine closure report).

8.4 METHOD OF ASSESSING THE ENVIRONMENTAL ASPECTS

Refer to Section 7.9.

8.5 METHOD OF ASSESSING IMPACT SIGNIFICANCE

Refer to Section 7.9.

8.6 CONSULTATION WITH THE COMPETENT AUTHORITY

The final EIA report including comments received during the I&AP review process will be prepared and submitted to the DMR for their review and decision-making. A site visit and meeting will be held, if requested.

8.7 THE PUBLIC PARTICIPATION PROCESS IN THE EIA

8.7.1 Notification of Interested and Affected Parties

I&APs will be notified via email, post, bulk SMS and community structures.

8.7.2 Details of the engagement process to be followed

The PPP in the EIA phase will include:

- Placement of full hard copy EIA reports at public review venues;
- Providing an electronic copy of the EIA report on the SLR website;
- Distribution of a Non-Technical Summary to I&APs in both English and Afrikaans;
- I&APs will be provided with a 30-day review period in line with the EIA Regulations;
- I&APs will be informed and given feedback during the EIA phase;
- Collect and respond to issues in an Issues and Response table;
- Submit final EIA report including the Issues and Response table to DMR; and
- Notify I&APs on the project I&AP database of the decision taken by DMR and applicable appeals processes.

8.7.3 Information to be provided to Registered Interested and Affected Parties

The following information will be included in the EIA report and made available for public review:

- Detailed description of the proposed Gamsberg Smelter Project;
- A site layout;
- Details of the Listed Activities requested for authorisation in terms of NEMA, NEM:WA, NWA and NEM:AQA;
- Scale and extent of activities requested for authorisation in terms of NEMA, NEM:WA, NWA and NEM:AQA;
- The duration of the activity;
- An assessment of the biophysical and socio-economic impacts identified during the EIA process, with input from I&APs, regulatory authorities and specialists;
- Detailed management measures to reduce and control environmental and socio-economic impacts; and
- Copies of the specialist reports undertaken for the proposed Gamsberg Smelter Project.

As part of the review of the EIA report an Executive Summary of the EIA report would be provided to I&APs in both English and Afrikaans.

Once the DMR has issued a decision on the application, SLR would, on behalf of the applicant, inform registered I&APs of the decision and the opportunity for appeal.

8.8 TASKS TO BE UNDERTAKEN DURING THE EIA

A description of the tasks that would be undertaken during the EIA phase is provided in TABLE 39. A preliminary schedule for the EIA phase that aligns with regulatory timeframes is included.

TABLE 39 EIA Tasks and Timing

Phase	EAP activity	Opportunities for Consultation and Participation		Schedule*
		Competent Authorities	I&APs	
Specialist Studies	EAP to manage specialist activities and receive inputs for EIA. Specialists to be kept informed of issues raised throughout the EIA process.	-	-	September 2019 to February 2020
EIA Phase	Compile EIA report	-	-	March to May 2020

Phase	EAP activity	Opportunities for Consultation and Participation		Schedule*
		Competent Authorities	I&APs	
	Distribute EIA for review	Provide copy to DMR for records	Review of EIA (30 days), Comments to EAP	June to July 2020
	I&AP consultations	-	Consultation with I&APs	
	Collate and respond to comments and finalise EIA report	-	-	July to August 2020 2020
	Submit EIA to DMR			August 2020
Competent authority review and decision-making	EIA report to DMR (106 days from acceptance of Scoping Report).	DMR Acknowledge Receipt of EIA (10 days).	Notify I&APs of final report submission	August to November 2020
		DMR Review (107 days)		
		Environmental Authorisation Granted / Refused	-	November 2020
Decision	Notify registered I&APs of decision (within 14 days of date of decision)	-	-	November to December 2020
Appeal Phase	EAP to provide information on appeal process as and when required.	Consultation during processing of appeal if relevant.	Submit appeal in terms of National Appeal Regulations, 2014	120 day process

8.9 MEASURES TO AVOID, REVERSE, MITIGATE, OR MANAGE IDENTIFIED IMPACTS

See Table 37. It should be noted that this table has been compiled with the information available at present and will be refined during the EIA phase.

9. OTHER INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

No additional requests for information have been received to date.

10.OTHER MATTERS REQUIRED IN TERMS OF SECTIONS 24(4)(A) AND (B) OF THE ACT

No other matters are required in terms of Section 24(4)(A) and (B) of the act.

11.UNDERTAKING BY THE EAP

I, Katherine de Courcy Hamilton, the Environmental Assessment Practitioner responsible for compiling this report, undertake that:

- the information provided herein is correct;
- the comments and inputs from stakeholders and I&APs have been correctly recorded;
- information and responses provided to stakeholders and I&APs by the EAP is correct to the best of SLR's knowledge at the time of compiling the report; and
- the level of agreement with I&APs and stakeholders has been correctly recorded and reported.

Kate Hamilton **(Report Author)**	**Kate Hamilton** **(Project Manager)**	**Stuart Heather-Clark** **(Reviewer)**

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