ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT FOR THE DEVELOPMENT OF THE PROPOSED SIYANDA FERROCHROME SMELTER

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(FOR REGULATORY AUTHORITY AND PUBLIC REVIEW)

SUBMITTED FOR ENVIRONMENTAL AUTHORISTAION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107 OF 1998) AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT (ACT 59 OF 2008)

NAME OF APPLICANT: Siyanda Chrome Smelting Company (SCSC) (Pty) Ltd

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Applicant	Siyanda Chrome Smelting Company (SCSC) (Pty) Ltd
Consultant	SLR Consulting (Africa) (Pty) Ltd
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Project Manager	Caitlin Hird
Report Author	Caitlin Hird
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EXECUTIVE SUMMARY

INTRODUCTION TO THE PROPOSED PROJECT

Siyanda Chrome Smelting Company (Pty) Ltd (SCSC) is a South African company, the majority shareholding of which is held by Siyanda Resources (Pty) Ltd (SR). SR is a diversified mining investment company with a long history in the production and sale of UG2 chrome ore, through its subsidiary Siyanda Chrome Investments (Proprietary) Limited (SCI). SCI is Anglo American Platinum Limited's joint venture partner in Masa Chrome Company (Pty) Ltd (Masa) situated at the Union Section Mine.

SCSC is proposing to construct a new ferrochrome (FeCr) smelter on portion 3 of the farm Grootkuil 409 KQ located adjacent to the existing Union Section Mine approximately 8 km north-west of Northam in the Thabazimbi Local Municipality, Limpopo Province. Refer to Figure 1 and Figure 2 for the regional and local settings respectively.

SCSC is proposing to process UG2 chrome concentrate from surrounding platinum mines and in broad terms, the project will comprise a railway siding, a raw materials offloading area, two 70 MW DC ferrochrome furnaces, crushing and screening plant, a slag dump, baghouse slurry facility and related facilities such as material stockpiles, workshops, stores and various support infrastructure and services including powerlines, access and internal roads and pipelines.

The EIA process comprises two phases: a scoping phase and an environmental impact assessment phase combined with the environmental management programme (EIA and EMP) phase. This report describes the EIA and EMP phase for the proposed project.

SLR Consulting (Africa) (Pty) Ltd (SLR), an independent firm of environmental consultants, has been appointed by SCSC to undertake the environmental assessment process for the proposed project.

LEGAL FRAMEWORK

Prior to the commencement of the proposed project, environmental authorisation is required from various government departments. These include:

- Environmental authorisation from the Department of Environmental Affairs (DEA) in terms of National Environmental Management Act No.107 of 1998 (NEMA). The proposed project incorporates several listed environmental activities. The applicable list of activities is provided in Section 4 and a copy of the integrated application submitted to the DEA is included in Appendix D. The EIA regulations being followed for this project are Regulation 982 of 04 December 2014.

- A waste management license from the DEA in terms of the National Environmental Management: Waste Act No. 59 of 2008 (NEM:WA). This has been applied for as part of the integrated application for environmental authorisation as described above. The applicable list of activities as currently set out in the legislation is provided in Section 4. A copy of the integrated application submitted to the DEA is included in Appendix D.
- A Water Use License (WUL) from the Department of Water and Sanitation (DWS) in terms of the National Water Act No. 36 of 1998 (NWA). The applicable water uses in terms of Section 21 of the NWA may include (a), (b), (c), (g), (i) and (f). A letter of intent outlining SCSC's intention to submit a WULA has been submitted to DWS. A copy fo this letter is included in Appendix D.
- An Air Emissions License (AEL) in terms of the National Environmental Management: Air Quality Act 39 of 2004 (NEM:AQA) which will be issued by the DEA. This applies to activities which could result in emissions which could have a detrimental impact as listed in terms of Notice 964 of 2012 (23 November 2012) in terms of Section 21 of NEM:AQA.

OTHER APPROVALS / PERMITS

Other approvals/permits needed for the proposed project are listed below. In this regard, there are other approvals that are required prior to construction and/or commissioning of the project. This list does not cover occupational health and safety legislation requirements.

- Prior to removing or damaging any protected plant species, the necessary permits will be obtained from DWS in terms of the National Forests Act, 84 of 1998.
- Prior to storage, handling, transportation and disposal of explosives the relevant licenses and written permissions are required in terms of the Explosives Act, 25 of 1956, as amended.
- The proposed project will require a re-zoning application process to be undertaken in which the project area will be re-zoned from agriculture to industry. This re-zoning application process will be handled by PlanWize Town and Regional planners and is not being done as part of the EIA process.
- New/existing level crossing and permission from Transnet required in support of the project's proposed access road.

STAKEHOLDER ENGAGEMENT

The stakeholder engagement process commenced prior to scoping and has continued throughout the environmental assessment process. As part of this process, authorities and interested and affected parties (IAPs) were given the opportunity to attend public meetings, submit questions and comments to the project team, and review the background information document, scoping report and now the EIA and EMP report. All comments that have been submitted to date by the authorities and IAPs have been included and addressed in the EIA and EMP report. Further comments arising from the EIA and EMP report review process will be handled in a similar manner.

IMPACTS AND MITIGATION MEASURES

This report provides an assessment of the potential impacts of the proposed project and provides measures to prevent or mitigate the impacts.

The potential impacts associated with the proposed project activities and infrastructure can be categorised into those that have low, medium and high significance in the unmitigated scenario. All three categories of impacts require a measure of mitigation which, if successfully implemented will reduce the significance of the impacts and the related residual risk.

The table below provides a summary of the potential impacts in no particular order of importance.

Table A – Potential impact summary

Aspect	Potential impact	Impact discussion	Significance without mitigation	Significance with mitigation
Geology	Loss and sterilisation of mineral resources	Mineral resources can be sterilised and/or lost through the placement of infrastructure and activities in close proximity to mineral resources, by preventing access to potential mining areas, and through the disposal of mineral resources onto mineralised waste facilities. Cross discipline planning to avoid mineral sterilisation can help to mitigate the unacceptable sterilisation of resources, without compromising safety requirements.	H	L
Topography	Hazardous excavations and infrastructure that can be harmful to people and animals	Hazardous excavations and infrastructure include all structures into or off which third parties and animals can fall and be harmed. Related mitigation measures focus on infrastructure safety as well as on limiting access to third parties and animals.	H	L
Soil and land capability	Loss of soil resources and land capability through contamination	Soil is a valuable resource that supports a variety of ecological functions and is the key to re-establishing post closure land capability. Soil and related land capability can be compromised through pollution and through physical disturbance through compaction, removal and erosion. Related mitigation measures focus on pollution prevention, implementing soil conservation procedures and limiting site clearance to what is absolutely necessary.	H	L
	Loss of soil resources and land capability through physical disturbance		H	L
Biodiversity	Physical destruction of biodiversity	Areas of high ecological sensitivity are functioning biodiversity areas with species diversity and associated intrinsic value. In addition, some of these areas host protected species. The linking areas have value because of the role they play in allowing the migration or movement of flora and fauna between the areas which is a key function for the broader ecosystem. Development of the project has the potential to impact on biodiversity both through physical destruction (mainly during infrastructure establishment and project development) and on-going physical disturbance during all project phases. Related mitigation measures focus on limiting the project footprint area and operation controls to limit on-going disturbance.	H	M
	General disturbance of biodiversity		H	L
Surface water	Alteration of surface water drainage patterns	Rainfall and surface water run-off are collected in all areas that have been designed with water containment infrastructure. The collected run-off will therefore be lost to the catchment and can result in the alteration of drainage patterns and reduction to downstream surface water users. Related mitigation measures focus on minimising the footprint areas associated with containing rainfall and runoff and diverting clean run-off away from the project site	H	M (L at closure)
	Contamination of	The proposed project has the potential to contaminate surface water resources. Related	H	L

Aspect	Potential impact	Impact discussion	Significance without mitigation	Significance with mitigation
	surface water resources	mitigation measures focus on pollution prevention, monitoring and risk based response to identified pollution occurrences.		
Groundwater	Reducing groundwater levels and availability	The abstraction of water from the borehole for the use as potable and process water has the potential to cause a lowering of groundwater levels. Lowering of groundwater levels has the potential to impact on third party boreholes that may be utilised for domestic and livestock watering. Related mitigation measures focus on monitoring and risk based response to identified groundwater reduction impacts.	L	L
	Contamination of groundwater resources	The nature of the proposed project is such that it presents a potential for the contamination of groundwater resources that in some cases may be used by third parties for domestic and livestock watering purposes. Related mitigation measures focus on pollution prevention, monitoring and risk based response to identified contamination occurrences.	M	L
Air	Air pollution	The main contaminants associated with the proposed project include: inhalable particulate matter less than 10 microns in size (PM_{10}), larger total suspended particulates (TSP) as well as $PM_{2.5}$ (particulate matter less than 2.5 microns in size), Cr6+ (chrome 6), SO_2 (sulphur dioxide) and NO_x (mono-nitrogen oxides). At certain concentrations, contaminants can have health and/or nuisance impacts. Related mitigation measures focus on pollution prevention, monitoring and risk based response to identified pollution occurrences.	H	M
Noise	Increase in disturbing noise levels	Noise pollution (disturbance and nuisance) will have different impacts on different receptors because some are more sensitive to noise and others are not. Related mitigation measures focus on noise pollution prevention and monitoring when required.	M	L
Blasting	Blasting impacts	Blast related impacts to third parties and property can be caused by fly rock, vibrations and air blast. Related mitigation measures focus on blast controls, monitoring and risk based response to identified blast impact occurrences.	M	L
Traffic	Disturbance of roads by project related traffic	The proposed project will result in an increase in traffic volumes along the D869 and R510. Potential traffic safety risks include: pedestrian accidents and vehicle accidents. Related mitigation measures focus on road and pedestrian safety.	H	M
Visual	Negative visual impacts	Visual impacts are assessed by considering changes to the visual landscape. Project infrastructure and activities will change this landscape and the changes will have different impacts that will vary between the different viewpoints and the associated visual receptors. Related mitigation measures focus on landscaping interventions particularly during the decommissioning and rehabilitation stages.	H	M (L at closure)
Heritage, cultural and paleontological resources	Destruction of heritage, cultural and palaeontological resources	No cultural and heritage resources have been identified in the proposed project area and it is not expected that there is any potential for paleontological resources exist. The proposed project does however have the potential to damage heritage/cultural resources if found by change. Related mitigation measures focus on avoidance and preservation as a first priority.	M	L

Aspect	Potential impact	Impact discussion	Significance without mitigation	Significance with mitigation
Socio-economic	Inward migration impacts	SCSC's net contribution to the local, regional and national economy is positive and significant. Part of this contribution is through employment, procurement, investment, tax contributions, and foreign exchange earnings. The objective of the related mitigation measures is to enhance the positive economic impacts and limit the negative economic impacts. Part of this objective is to enhance the contribution to the local economy in particular.	H	M
	Economic impact	Mineral beneficiation projects tend to bring with them an expectation of employment in all project phases prior to closure. This expectation can lead to the influx of job seekers to an area which could cause: an increase of people moving through the area, pressure on the capacity of existing communities and possibly also the development of informal settlements. In general, both increased movement of poor people into an area and informal settlements are associated with poor standards of living which can promote disease, crime and a general threat to the safety and security of an area. Linked to this influx of people is the potential inability of receiving areas to supply basic services such as water, food, electricity, health, education and sanitation. Related mitigation measures focus on cooperation with the local municipal authorities, skills development, employment, procurement and social development.	H+	H+
Land use	Change in land use	The area where the smelter complex is to be developed is owned by SCSC and therefore no on-site third party land use is expected to be physically impacted. Notwithstanding this, the current zoning requires amendment. The linear infrastructure required for the project (access road and powerline) will as far as possible follows existing servitudes/disturbance corridors and it is therefore expected that impacts on third-party land uses will be limited. Other land uses surrounding the proposed project area include: mining, agriculture (cropping, livestock grazing and game farming), residential areas and infrastructure (existing road network and Eskom lines). Related mitigation measures focus on mitigation of potential environmental and socio-economic impacts described above and measures to promote the continuation of surrounding land uses.	H	M (L at closure)

ENVIRONMENTAL STATEMENT

The assessment of the proposed project presents the potential for significant negative impacts to occur (in the unmitigated scenario in particular) on the bio-physical, cultural and socio-economic environments both on the project area and in the surrounding area. With mitigation these potential impacts can be prevented or reduced to acceptable levels.

It follows that provided the EMP is effectively implemented there is no environmental, social or economic reason why the project should not proceed.

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ACRONYMS AND ABBREVIATIONS

Acronyms / Abbreviations	Definition
ABA	Acid Base Accounting
AP	Acid Potential
BID	Background information document
BIF	Banded Iron Formation
BPDM	Bojanala Platinum District Municipality
CBA	Critical biodiversity area
C	Carbon
CO	Carbon monoxide
CO_2	Carbon dioxide
DAFF	Department of Agriculture, Forestry and Fisheries
DPWRT	Department of Public Works, Roads and Transport
DRDLR	Department of Rural Development and Land Reform
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental impact assessment
EMP	Environmental management programme
IAPs	Interested and/or affected parties
IUCN	International Union for Conservation of Nature
IFC	International Finance Corporation
mcm	million cubic meters
MKLM	Moses Kotane Local Municipality
NEMA	National Environmental Management Act No.107 of 1998
NEM:AQA	National Environmental Management: Air Quality Act 39 of 2004 (NEM:AQA).
NEM:BA	National Environmental Management: Biodiversity Act No. 10 of 2004
NEM:WA	National Environmental Management: Waste Management Act No. 59 of 2008
NFEPA	National Freshwater Ecosystem Priority Areas 2011
NPAES	National Protected Areas Expansion Strategy 2008
NWA	National Water Act No. 36 of 1998
NO	Nitrogen oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of nitrogen
$PM_{2.5}$	Inhalable particulate matter
PM_{10}	Thoracic particulate matter
SAHRA	South African Heritage Resources Agency
SANBI	South African National Botanical Institute
SANS	South African National Standards
SCC	Species of Conservational Concern
SCSC	Siyanda Chrome Smelting Company
SLR	SLR Consulting (Africa) (Pty) Ltd
SO_2	Sulphur dioxide
TLM	Thabazimbi Local Municipality
TSP	Total suspended particles
VOCs	Volatile organic compounds
WDM	Waterberg District Municipality

Acronyms / Abbreviations	Definition
WR2005	Water Resources of South Africa, 2005
XRD	X-Ray Diffraction

PART A – ENVIRONMENTAL IMPACT ASSESSMENT REPORT

ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT FOR THE DEVELOPMENT OF THE PROPOSED SIYANDA FERROCHROME SMELTER

1 INTRODUCTION

INTRODUCTION TO THE PROPOSED PROJECT

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OTHER APPROVALS / PERMITS

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- New/existing level crossing and permission from Transnet required in support of the project's proposed access road.

EIA AND EMP PHASE OBJECTIVES

The objectives of the environmental assessment process are as follows:

- The identification of policies and legislation that is relevant to the proposed project.
- To describe the need and desirability of the proposed project.
- To describe the proposed project including alternatives that are being considered.
- To provide an assessment of the environmental and social impacts taking into account all project alternatives.

- To identify measures to avoid, manage or mitigate identified impacts including the residual risks that need to be managed and monitored.

FIGURE 1: REGIONAL SETTING

FIGURE 2: LOCAL SETTING

2 DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

2.1 DETAILS OF THE EAP WHO PREPARED THE REPORT

The details of the environmental assessment practitioners (EAPs) that were involved in the preparation of this EIA and EMP report are provided in Table 1 below.

TABLE 1: DETAILS OF THE EAPS

DETAILS	PROJECT MANAGER AND AUTHOR	REVIEWER
Name of the practitioner	Caitlin Hird	Brandon Stobart
Tel No.:	011 467 0945	011 467 0945
Fax No.:	011 467 0978	011 467 0978
E-mail address	chird@slrconsulting.com	-

Neither SLR nor any of the specialists involved in the environmental assessment process have any interest in the project other than fair payment for consulting services rendered as part of the environmental assessment process.

2.2 EXPERTISE OF THE EAP

Caitlin Hird has approximately six years of relevant experience (Curriculum Vitae attached in Appendix B). Brandon Stobart has over 17 years of relevant experience (Curriculum Vitae attached in Appendix B) and is registered as an environmental assessment practitioner (EAP) with the interim certification board. The proof of this registration is attached in Appendix A. Both Caitlin Hird and Brandon Stobart have been involved in several impact assessments for large scale developments in Southern Africa.

3 LOCATION OF THE ACTIVITY

A description of the property on which the proposed project is located is provided in Table 2. It should be noted that the table below presents property description details only of the preferred alternatives for the location of the smelter, access road and powerline routing.

TABLE 2: DESCRIPTION OF THE PROPERTY

Farm Name(s)	Portion 3 of the farm Grootkuil 409 KQ (smelter infrastructure, access road corridor and powerline). Portion 4 & 5 of the farm Grootkuil 409 KQ owned by Anglo and Portion 0 & 10 of the farm Wildebeeslaagte 411 KQ (powerline). Portion 1,3, and 11 of the farm Kameelhoek 408 KQ, Portion 7 of the farm Nooitgedacht 406 KQ, Portion 2 of the farm Zwartklip 405 KQ and Portion 2 of the farm Grootkuil 409 KQ (access road corridor). For a list of landowners of the above farm portions refer to Table 49.
Application area (Ha)	It is expected that approximately 140 ha will be disturbed by the proposed project infrastructure. It should be noted that the majority of the proposed smelter complex infrastructure area has been previously disturbed due to cropping and other agricultural activities.
Magisterial district	Northam Sub-district of the Thabazimbi Magisterial District.
Local municipality	Thabazimbi Local Municipality in the Waterberg District Municipality
Distance and direction from nearest town	The preferred project area is located approximately 8 km north-west of the town Northam
21 digit Surveyor General Code for each farm portion associated with the preferred alternatives	<u>Smelter Complex</u> Portion 3 of the farm Grootkuil 409 KQ: T0KQ00000000040900003 <u>Powerline</u> Portion 4 of the farm Grootkuil 409 KQ: T0KQ00000000040900004 Portion 5 of the farm Grootkuil 409 KQ: T0KQ00000000040900005 Portion 0 of the farm Wildebeeslaagte 411 KQ: T0KQ00000000041100000 Portion 10 of the farm Wildebeeslaagte 411 KQ: T0KQ00000000041100010 <u>Access Road Corridor</u> Portion 1 of the farm Kameelhoek 408 KQ: T0KQ00000000040800001 Portion 3 of the farm Kameelhoek 408 KQ: T0KQ00000000040800003 Portion 11 of the farm Kameelhoek 408 KQ: T0KQ0000000004080011 Portion 7 of the farm Nooitgedacht 406 KQ: T0KQ00000000040600007 Portion 2 of the farm Zwartklip 405 KQ: T0KQ00000000040500002 Portion 2 of the farm Grootkuil 409 KQ: T0KQ0000000040900002

Co-ordinates (Points A, B, C and D illustrated on Figure 2)	**Point A:** 24° 55' 22.39'' S and 27° 12' 28.77'' E (start point of access road corridor) **Point B:** 24° 55' 9.77'' S and 27° 10' 27.56'' E (western corner of preferred smelter infrastructure area) **Point C:** 24° 55' 41.11'' S and 27° 10' 34.58'' E (southern corner of preferred smelter infrastructure area) **Point D:** 24° 55' 28.94'' S and 27° 11' 39.22'' E (eastern corner of preferred smelter infrastructure area) **Point E:** 24° 57' 55.96'' S and 27° 13' 40.15'' E (start point of powerline) Figure 2 provides the co-ordinates of the start points, mid points and end points of all preferred linear infrastructure routes proposed as part of the project. Figure 25 provides the co-ordinates of the start points, mid points and end points of all linear infrastructure route alternatives proposed as part of the project. In addition, Figure 25 also illustrates the distances (lengths) of each alternative for routing of linear infrastructure.

4 DESCRIPTION OF THE SCOPE OF THE PROPOSED ACTIVITY

4.1 LISTED AND SPECIFIED ACTIVITIES TRIGGERED AND BEING APPLIED FOR

The listed and specified activities triggered and being applied for are listed in Table 3 below and are illustrated in Figure 3 (where relevant).

TABLE 3: DESCRIPTION OF THE LISTED ACTIVITIES APPLIED FOR AS PART OF THE PROPOSED PROJECT

ACTIVITY NUMBER	LISTED ACTIVITY	RELEVANCE OF LISTED ACTIVITY TO PROJECT
NEMA LISTING NOTICE 1 GNR.983		
9	The development of infrastructure exceeding 1000 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 (b) where such development will occur within an urban area.	It is expected that the proposed on-site water/stormwater transportation infrastructure (pipelines etc.) will be approximately 5000 m in length (in total) with an internal diameter of more than 0.36 m and a peak throughput of more than 120 litres per second This applies potentially to transportation of incoming water and to the transportation of water between the various on-site dams (for stormwater, process water, return water etc.)
10	The development and related operation of infrastructure exceeding 1000 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 bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes inside a road reserve; or (b) where such development will occur within an urban area.	It is expected that the proposed infrastructure for the transportation of sewage, effluent, process water, waste water or return water will be approximately 5000 m in length (in total) with an internal diameter of more than 0.36 m and a peak throughput of more than 120 litres per second. The proposed project includes options for the treatment of sewage and the handling of related effluent, baghouse slurry disposal and return water management, process/dirty run-off water management etc.
11	The development of facilities or infrastructure for the transmission and distribution of electricity- (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or (ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more.	It is expected that the powerline to be constructed for the purposes of the project will be a 275 kV line. The powerline will originate from the existing Spitzkop substation to the south-east of the project area. Since it is not clear whether the project area can be classified as an industrial complex, Activity 9 of Listing Notice 2 has also been applied for.

ACTIVITY NUMBER	LISTED ACTIVITY	RELEVANCE OF LISTED ACTIVITY TO PROJECT
14	The development of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres but not exceeding 500 cubic metres.	Storage of dangerous goods on site (such as diesel, lubricants, propane gas etc.) is likely to be 400m^3 at most. The threshold of 500 m^3 will therefore not be exceeded.
24	The development of - (i) a road 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) a road with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres; but excluding - (a) roads which are identified and included in activity 27 in Listing Notice 2 of 2014; or (b) roads where the entire road falls within an urban area.	It is expected that the project will require the development of roads with a width of approximately 10 metres. This includes both the access road as well as internal haul roads.
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 2000 cubic metres but less than 15000 cubic metres	It is expected that treatment of effluent, waste water or sewage may be required for the project. The potential volumes for treatment are as follows: • Water from pollution control dam (requiring treatment prior to re-use or discharge) is estimated to be 580 m3/day. • Water from the sewage treatment plant potentially requiring treatment is estimated to be 35 m^3/day. • The total volume of baghouse slurry potentially requiring treatment is estimated to be 426 m^3/day. Although when taken together the above volumes only equal a total of 1041 m^3 (which is less than the required threshold of 2000 m^3 for this activity), this activity has been included as a contingency for periods of sustained heavy rainfall where the total volume of water (from the pollution control dam) requiring treatment may be in excess of the anticipated 580 m3/day.
27	The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation , except where such clearance of indigenous vegetation is required for - (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan .	Siyanda is applying for approval of multiple project components in this single application including the main smelter complex, powerline, road and railway siding etc (for which a total of 34 ha of indigenous vegetation will need to be cleared). It is however understood from correspondence with the DEA that the powerline, road and railway siding are deemed by the DEA to be separate linear infrastructure and are therefore not included in the calculation of the total

ACTIVITY NUMBER	LISTED ACTIVITY	RELEVANCE OF LISTED ACTIVITY TO PROJECT
		area of indigenous vegetation to be cleared for the project infrastructure. Activity 15 of Listing Notice 2 is therefore not included in the application. It follows that excluding linear infrastructure, a total of 7 ha of indigenous vegetation will need to be cleared for the project.
28	Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 01 April 1998 and where such development: (i) will occur inside an urban area, where the total land to be developed is bigger than 5 hectares; or (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare; excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.	The total area to be disturbed/developed is approximately 140 ha in size. Part of the proposed project area was used for cropping activities and part of it was used for grazing up until 2015. These farming activities have however ceased since Siyanda purchased the land.
56	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 km – (i) where the existing reserve is wider than 13.5 metres; or (ii) where no reserve exists, where the existing road is wider than 8 metres; excluding where widening or lengthening occur inside urban areas.	The proposed project may require the widening of existing roads by 6 metres or more and/or the lengthening of existing roads by 3 km. This is relevant both for the proposed access road as well as for the internal haul roads. Some roads which require lengthening or wideing are already wider than 8 m.
64	The expansion of railway lines, stations or shunting yards where there will be an increased development footprint.	The existing railway line between Union Section Mine and the Kilkenny siding may need to be expanded in order to cater for the proposed project's railway siding.
NEMA LISTING NOTICE 2: GNR.984		
2	The development and related operation of facilities or infrastructure for the generation of electricity from a non-renewable resource where the electricity output is 20 megawatts or more.	It is expected that CO gas from furnace off-gas may be used to power the pre-heaters. It is anticipated that approximately 35 MW of energy will be generated in this way.

ACTIVITY NUMBER	LISTED ACTIVITY	RELEVANCE OF LISTED ACTIVITY TO PROJECT
6	The development of facilities or infrastructure for any process or activity which requires a permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, excluding i) activities which are identified and included in Listing Notice 1 of 2014; (ii) activities which are included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies; or (iii) the development of facilities or infrastructure for the treatment of effluent, wastewater or sewage where such facilities have a daily throughput capacity of 2000 cubic metres or less.	The proposed project requires an Air Emissions License (AEL) in terms of the National Environmental Management: Air Quality Act 39 of 2004 (NEM: AQA) for the ferrochrome smelter process. It is understood that the AEL will be licensed by the DEA.
9	The development of facilities or infrastructure for the transmission or distribution of electricity with a capacity of 275 kilovolts of more, outside an urban area or industrial complex	It is expected that the powerline to be constructed for the purposes of the project will be a 275 kV line. The powerline will originate from the existing Spitzkop substation to the south-east of the project area. Since it is not clear whether the project area can be classified as an industrial complex, Activity 11 of Listing Notice 1 has also been applied for.
12	The development of railway lines, stations or shunting yards excluding - (i) railway lines, shunting yards and railway stations in industrial complexes or zones; (ii) underground railway lines in a mining area; or (iii) additional railway lines within the railway line reserve.	The proposed project will require the construction and operation of a railway siding which will join onto the main Union Section railway line. This railway siding will be used to transport incoming chrome concentrate and raw materials and to dispatch product to market. Although part of the siding will be situated within the proposed industrial site, part of it will traverse open land between the project area and the existing Union Section railway line.
16	The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 metres or higher or where the highwater mark of the dam covers an area of 10 hectares or more.	The proposed project will require dams for storage of clean and/or dirty water. This includes dams for containment of stormwater, potable water, process water, return water etc. It is not expected that the dams will cover an area of more than 10 ha, however the dam walls may be higher than 5 m.
28	Commencing of an activity, which requires an atmospheric emission license in terms of section 21 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004), excluding – (i) listed activities which are identified and included in Listing Notice 1 of 2014 (ii) activities which are included in the list of waste management activities published in terms of Section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 0f 2008), in which case the National Environmental Management Waste Act, 2008 applies. (iii) the development of infrastructure or facilities for the treatment of effluent, waste water or sewage where such facilities have a daily throughput capacity of 200 m^3 or less.	The proposed project requires an Air Emissions License (AEL) in terms of the National Environmental Management: Air Quality Act 39 of 2004 (NEM: AQA) for the ferrochrome smelter process. It is understood that the AEL will be licensed by the DEA. The AEL will be submitted once a record of decision (on the EIA) from the DEA has been received.

ACTIVITY NUMBER	LISTED ACTIVITY	RELEVANCE OF LISTED ACTIVITY TO PROJECT
NEMA LISTING NOTICE 3: GNR. 985		
2	The development of reservoirs for bulk water supply with a capacity of more than 250 cubic metres. In an estuary ; ii. In a protected area identified in terms of NEMPAA , excluding conservancies; iii. Outside urban areas , in: (aa) National Protected Area Expansion Strategy Focus areas; (bb) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority ; (cc) Sites or areas identified in terms of an International Convention; (dd) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (ee) Core areas in biosphere reserves; (ff) 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 area of a biosphere reserve; or (gg) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined; or iv. In urban areas : (aa) Areas zoned for use as public open space; (bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority , or zoned for a conservation purpose; or (cc) Areas seawards of the development setback line or within urban protected areas.	It is expected that reservoirs for bulk water supply with a capacity of 350 m^3 will be developed as part of the proposed project. This includes reservoirs for the storage of potable water. According to the Limpopo Conservation Plan version 2, the western portion of the Siyanda property falls within an area with No Natural Habitat Remaining (NNR). An area identified as an Other Natural Area (ONA) and a small portion identified as an Ecological Support Area 1 (ESA1) is also present within the western portion of the Siyanda property. The central and eastern portions of the Siyanda property, as well as the proposed powerline alignment is located within a Critical Biodiversity Area 1 (CBA 1).
4	The development of a road wider than 4 metres with a reserve less than 13,5 metres (i) in an estuary (ii) outside urban areas in: (aa) a protected area identified in terms of NEMPAA, excluding disturbed areas (bb) National Protected Area Expansion Strategy Focus Area (cc) Sensitive areas as identified in an Environmental Management Framework as contemplated in chapter 5 of the Act as adopted by the competent authority (dd) Sites or areas identified in terms of an International Convention	The proposed project will require the development of roads up to 10 metres in width (this includes both the access road as well as internal haul roads). According to the Limpopo Conservation Plan version 2, the western portion of the Siyanda property falls within an area with No Natural Habitat Remaining (NNR). An area identified as an Other Natural Area (ONA) and a small portion identified as an Ecological Support Area 1 (ESA1) is also present within the western portion of the Siyanda property. The central and eastern portions of the Siyanda property, as well as the proposed powerline alignment is located within

ACTIVITY NUMBER	LISTED ACTIVITY	RELEVANCE OF LISTED ACTIVITY TO PROJECT
	(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans (ff) Core areas in biosphere reserves (gg) Areas within 10 km of national parks or world heritage sites or 5 km from any other protected area in terms of NEMPAA or from the core areas of biosphere reserve, excluding disturbed areas; or (hh) Areas seawards of the development setback line or within 1 kilometre from the high water mark of the sea if no such development setback line is determined; or (iii) in urban areas; (aa) Areas zoned for use as public space (bb) Areas zoned for conservation use in Spatial Development Frameworks (SDFs) adopted by the competent authority or zoned for conservation for a conservation purpose; or (cc) Seawards of the development setback line or within urban protected areas.	a Critical Biodiversity Area 1 (CBA 1).
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. 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; iii. Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuary, whichever distance is the greater, excluding where such removal will occur behind the development setback line on even in urban areas; or iv. On land, where, at the time of the coming into effect of this Notice or thereafter such land was zoned open space, conservation or had an equivalent zoning.	The proposed project will require approxiately 7 ha of indigenous vegetation to be cleared in areas where project infrastructure will be developed. It should be noted that this excludes the clearance of vegetation for linear infrastructure. According to the Limpopo Conservation Plan version 2, the western portion of the Siyanda property falls within an area with No Natural Habitat Remaining (NNR). An area identified as an Other Natural Area (ONA) and a small portion identified as an Ecological Support Area 1 (ESA1) is also present within the western portion of the Siyanda property. The central and eastern portions of the Siyanda property, as well as the proposed powerline alignment is located within a Critical Biodiversity Area 1 (CBA 1).
14	The development of - (i) canals exceeding 10 square metres in size ; (ii) channels exceeding 10 square metres in size; CO bridges exceeding 10 square metres in size; (iv) dams, where the dam , including infrastructure and water surface area exceeds 10 square metres in size; (v) weirs, where the weir, including infrastructure and water surface area exceeds 10 square metres in size;	The project will require infrastructure as per the list alongside (this includes but is not limited to channels for conveyance of stormwater, dams etc.). It is expected that a small section of the PCD (greater than 10 m^2) will be developed within 32 m of a watercourse (even though the PCD will be kept outside of the relevant floodlines). According to the Limpopo Conservation Plan version 2, the western portion of the Siyanda property falls within an area with No Natural Habitat Remaining

ACTIVITY NUMBER	LISTED ACTIVITY	RELEVANCE OF LISTED ACTIVITY TO PROJECT
	(vi) bulk storm water outlet structures exceeding 10 square metres in size; (vii) marinas exceeding 10 square metres in size; (viii) jetties exceeding 10 square metres in size; (ix) slipways exceeding 10 square metres in size; (x) buildings exceeding 10 square metres in size; (xi) boardwalks exceeding 10 square metres in size; or (xii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs - (a) within a watercourse ; (b) in front of a development setback ; or (c) if no development setback has been adopted, within 32 metres of a watercourse , measured from the edge of a watercourse ; excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour. In an estuary ; ii. Outside urban areas , in: (aa) A protected area identified in terms of NEMPAA , excluding conservancies; (bb) National Protected Area Expansion Strategy Focus areas; (cc) World Heritage Sites; (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority ; (ee) Sites or areas identified in terms of an International Convention; (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (gg) Core areas in biosphere reserves; (hh) 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 area of a biosphere reserve; (ii) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined; or iii. In urban areas : (aa) Areas zoned for use as public open space; (bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority , zoned for a conservation	(NNR). An area identified as an Other Natural Area (ONA) and a small portion identified as an Ecological Support Area 1 (ESA1) is also present within the western portion of the Siyanda property. The central and eastern portions of the Siyanda property, as well as the proposed powerline alignment is located within a Critical Biodiversity Area 1 (CBA1)

ACTIVITY NUMBER	LISTED ACTIVITY	RELEVANCE OF LISTED ACTIVITY TO PROJECT
	purpose; or (cc) Areas seawards of the development setback line.	
18	The widening of a road by more than 4 metres or the lengthening of a road by more than 1 kilometre. (i) in an estuary (ii) outside urban areas in: (aa) a protected area identified in terms of NEMPAA, excluding disturbed areas (bb) National Protected Area Expansion Strategy Focus Area (cc) Sensitive areas as identified in an Environmental Management Framework as contemplated in chapter 5 of the Act as adopted by the competent authority (dd) Sites or areas identified in terms of an International Convention (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans (ff) Core areas in biosphere reserves (gg) Areas within 10 km of national parks or world heritage sites or 5 km from any other protected area in terms of NEMPAA or from the core areas of biosphere reserve, excluding disturbed areas; or (hh) Areas seawards of the development setback line or within 1 kilometre from the high water mark of the sea if no such development setback line is determined (ii) Areas on the watercourse side of a development setback line or within 100 m of the edge of a watercourse where no such setback line has been determined; or (iii) in urban areas; (aa) Areas zoned for use as public space; or (bb) Areas zoned for conservation use in Spatial Development Frameworks (SDFs) adopted by the competent authority or zoned for conservation for a conservation purpose.	The proposed project may require the widening of existing roads by 6 metres or more and/or the lengthening of existing roads by 3 km (this includes both the proposed access road as well as the internal haul roads). According to the Limpopo Conservation Plan version 2, the western portion of the Siyanda property falls within an area with No Natural Habitat Remaining (NNR). An area identified as an Other Natural Area (ONA) and a small portion identified as an Ecological Support Area 1 (ESA1) is also present within the western portion of the Siyanda property. The central and eastern portions of the Siyanda property, as well as the proposed powerline alignment is located within a Critical Biodiversity Area 1 (CBA
NEM:WA LISTED ACTIVITIES GNR 921		
Category B 4 (2)	The reuse or recycling of hazardous waste in excess of 1 ton per day, excluding reuse or recycling that takes place as an integral part of an internal manufacturing process within the same premises.	The proposed project is investigating plans for reuse, recycling or recovery of mineralised slag and/or baghouse dust. If a third party market for resale/re-use is secured, a third party's offtake could be up to 500 tons/day. This will however depend on demand.
Category B 4(4)	The treatment of hazardous waste in excess of 1 ton per day calculated as a monthly average using any form of treatment of effluent, waste water or	The proposed project may require that baghouse slurry and/or sewage be treated prior to disposal. If this is required it is expected that approximately 10

ACTIVITY NUMBER	LISTED ACTIVITY	RELEVANCE OF LISTED ACTIVITY TO PROJECT
	sewage.	tons of waste would be treated per day.
Category B 4(7)	The disposal of any quantities of hazardous waste to land	The proposed project will require the disposal of potentially hazardous waste to land (slag and baghouse slurry). The facilities for disposal will be installed with an appropriate liner system as per the outcomes of the waste type assessment.
Category B 4(10)	The construction of a facility for a waste management activity listed in Category B of this schedule	The proposed project will require the construction of facilities for waste disposal (slag dump, baghouse slurry facility, and/or sewage effluent facility).

FIGURE 3: CONCEPTUAL INFRASTRUCTURE PLAN

4.2 DESCRIPTION OF THE ASSOCIATED STRUCTURES AND INFRASTRUCTURE RELATED TO THE DEVELOPMENT

Information provided in the following section was provided to SLR by the SCSC project team.

SCSC is proposing to process UG2 chrome concentrate from surrounding platinum mines and in broad terms, the project will comprise a railway siding, a raw materials offloading area, two 70 MW DC ferrochrome furnaces, crushing and screening plant, a slag dump, baghouse slurry facility, and related facilities such as material stockpiles, workshops, stores and various support infrastructure and services including powerlines, access and internal roads and pipelines.

Further detail is provided in the sections below.

4.2.1 CONSTRUCTION PHASE

CONSTRUCTION PHASE ACTIVITIES

The key construction activities associated with the proposed project include:

- Site establishment of temporary offices, portable toilets, contractor lay down area, temporary workshop and wash bay and temporary non-mineralised waste storage facilities.
- Clearing of vegetation in accordance with the relevant vegetation management procedures.
- Stripping and stockpiling of soil resources and earthworks in accordance with the relevant soil conservation procedures.
- Sourcing of material for construction.
- Establishment of stormwater management facilities.
- Preparing stockpile areas.
- Construction of a crushing, screening and loading area.
- Establishment of sewage treatment plant.
- Construction of administrative block.
- Installation of potable and process water dam (PWD) and the fire water tank.
- Establishment of access control facilities.

CONSTRUCTION PHASE FACILITIES

The construction phase facilities include:

- Contractor's laydown areas.
- Workshop/maintenance area for servicing and maintaining equipment and vehicles.
- Temporary waste collection and storage area.
- Store for the storing and handling of fuel, lubricants, solvents, paints and construction substances.
- Parking area for cars and equipment.

- Mobile site offices.
- Portable ablution facilities.
- Change houses.
- Soil stockpile.
- Water management infrastructure.
- Security and access control.
- Main access road.

Construction facilities will either be removed at the end of the construction phase or incorporated into the layout of the operational smelter.

WATER SUPPLY AND MANAGEMENT FOR THE CONSTRUCTION PHASE

Stormwater control for construction

Storm water measures outlined in Section 4.2.2 will be established at the start of the respective construction phase.

Potable water

During the construction phase, potable water will be made available from the municipal scheme via a pipeline. During the construction phase it is anticipated that approximately $60m^3$ of water will be used on a daily basis. A service agreement (with the municipality) will be provided once a supply agreement has been concluded.

TRANSPORTATION (ROUTES AND MECHANISMS) FOR THE CONSTRUCTION PHASE

Access to the proposed site

It is expected that for the construction phase, access to site will be via the planned access road (see Figure 2 and Figure 3). It is planned that this road will be constructed at the beginning of the construction phase in order to provide site access for construction phase traffic. Given that access road alternative 1 (Figure 25) is an already existing dirt access road traversing the Siyanda property, this may be used in addition to the main access road during the construction phase as a temporary backup option.

Transportation of workers and supplies to site

During the construction of the proposed project there will be workers travelling to and from site, vehicles supplying input materials and machinery, and vehicles removing waste material. Table 4 below provides a conceptual indication of the traffic associated with the construction phase. Figure 4 presents the intersection upgrade proposed at the entrance to the project area in order to cater for additional traffic volumes associated with the project (Siyazi, February 2016).

TABLE 4: CONSTRUCTION PHASE TRAFFIC: MATERIALS AND STAFF

Item	Trips to and from site per day	Transportation routes

Item	Trips to and from site per day	Transportation routes
Heavy vehicles delivering consumables and construction materials	14 trucks per day (28 trips per day)	Traffic will make use of the existing D869 (Brits Road) between Dwaalboom and Brits as well as the R510 road between Rustenburg and Thabazimbi
Construction employees transported by private vehicles	Approximately 23 vehicles per day (23 trips per day)	
Construction employees transported by taxis/busses	Approximately 56 vehicles per day (112 trips per day)	

Pipelines

A series of pipelines will be established as part of the construction phase for the conveyance of potable water, process water and sewage effluent. Pipelines will be installed to convey all process and potable water within the water reticulation system. All water reticulation piping will be HDPE standard and will vary in size (30 mm to 150 mm) across the proposed project area. Pipelines with a minimum diameter of 200 mm will be installed to convey sewage effluent from the change houses and the administrative block to the septic tank system, or alternatively to the sewage treatment plant should this be constructed on site (Figure 3).

Conveyors

During the construction phase conveyors will be established within the smelter complex area to convey raw materials between the various storage bunkers and proportioning bins, and thereafter to the driers, preheaters and furnaces. The conveyors will range in width from 600 mm to 1200 mm. All the conveyors will be equipped with apron slabs to collect spillage.

FIGURE 4: PROPOSED INTERSECTION UPGRADE (SIYAZI, FEBRUARY 2016)

POWER SUPPLY AND USE FOR THE CONSTRUCTION PHASE

During the construction phase, generators will be used as the primary power supply. A total of 1 MVA will be required during the construction phase. During the construction phase power will be required for drilling, welding and construction lighting.

NON-MINERALISED WASTE MANAGEMENT FOR THE CONSTRUCTION PHASE

Domestic and industrial waste

Facilities for the temporary storage of non-mineralised waste associated with the project will be provided. The types of waste that could be generated during the construction phase include hazardous industrial waste (such as packaging for hazardous materials, used oil, lubricants), general industrial waste (such as scrap metal, contaminated wood and building rubble), and domestic waste (such as packaging and food waste). These wastes will be temporarily handled and stored on site before being removed for recycling by suppliers and approved waste handling companies, reuse by scrap dealers or final disposal at a permitted waste disposal facility such as the Northam refuse disposal site.

Sewage

Construction workers will make use of portable toilets that will be serviced on a regular basis. The sewage will be removed off-site by a certified contractor and disposed of at the licensed facility in Northam. Should the municipal sewage treatment plant still be experiencing capacity issues, then sewage will be treated on site in a sewage treatment plant, the location of which is illustrated in Figure 3. In the event of sewage being treated within the on site treatment plant, treated sewage effluent will be re-used within the process and sewage sludge will be removed off-site and disposed of at the sewage treatment facility in Thabazimbi. A decision on whether the on-site sewage treatment plant will be developed or not will be made pre-construction phase.

EMPLOYMENT AND HOUSING FOR THE CONSTRUCTION PHASE

The proposed project will create approximately 700 jobs during the construction phase. No construction workers will be housed on-site. Construction workers will be accommodated in nearby towns and communities.

OPERATING HOURS FOR THE CONSTRUCTION PHASE

It is anticipated that the construction phase will consist of one shift per day from 07h00 to 17h00 from Monday to Sunday. In cases where emergency action is required and/or critical activities are required, motivation will be made for the extension of these hours within the provisions of the regulations

SECURITY AND ACCESS CONTROL

A fence will be established around the perimeter of the proposed project area. Security will be provided at the entrance to the smelter complex area. The positon of the security office(s) is illustrated in Figure 3.

CONSTRUCTION PHASE TIMING

It is envisaged that construction phase activities will commence during the second quarter of 2017 (approval dependent) and will continue for a period of approximately 24 months.

4.2.2 OPERATIONS PHASE

SURFACE INFRASTRUCTURE

Operational phase surface infrastructure is listed below and is illustrated in Figure 3**.**

- Furnaces
- Crushing and screening plant
- Ingot cooling pad
- Service yard
- Operational store
- Instrumentation workshop
- Mechanical workshop
- Electrical workshop
- Diesel workshop
- Diesel, lubricants and propane gas storage
- Refractory and general store
- Laboratory
- Slag dump
- Baghouse slurry facility
- Pollution Control Dam (PCD)
- Substation
- Filter Yard
- Stormwater management infrastructure
- Emergency fire water tank
- Process Water Dam (PWD)
- Potable water reservoir/tank
- Change house
- Clinic
- HR/SHEQ office
- Main entrance/security
- Raw materials offloading area
- Railway siding
- Access road
- Internal roads
- Powerline

- Conveyors
- Pipelines
- Cooling water tank (and pumps)
- Topsoil stockpiles/berm
- Sewage treatment/containment facility (will be required on-site in the event that the Northam sewage treatment plant is not operational – decision to be made pre-construction phase).

SMELTING METHOD – DC FURNACES

The proposed project will comprise two 70MW DC furnaces which will be used to process approximately 850 000 tons per annum of UG2 chrome concentrate from nearby chrome recovery plants. Table 5 below summarises the activities associated with the smelting process. The proposed infrastructure layout is provided in Figure 3 and a basic conceptual flow diagram is illustrated in Figure 5.

TABLE 5: SUMMARY OF SMELTING ACTIVITIES

ACTIVITY	DESCRIPTION
Transportation of raw materials to site	Raw materials (chrome concentrate, flux/reductant) will be transported to site via a combination of rail and road and temporarily stored in bunkers prior to use. Dust generated during materials handling will move through a gas cleaning system afterwhich clean gas will be emitted to the atmosphere. Baghouse dust will be returned to the raw materials system for processing.
Drying	In order to eliminate moisture in the raw materials (that is a source of electrical energy consumption in the furnaces and is also detrimental to the effective use of burnt lime), the chrome concentrate and flux/reductant will move through driers prior to being fed into proportioning bins in preparation for furnace feeding. Dust generated during the drying process will move through a gas cleaning system afterwhich clean gas will be emitted to the atmosphere. Baghouse dust will be returned to the raw materials system for processing.
Pre-heating	Smelter feed material will be pre-heated prior to smelting. Baghouse dust will be collected and disposed onto baghouse slurry facilityor re-circulated into the smelting process (depending on particulate size).
Smelting	Two 70MW DC furnaces will be used to smelt raw materials (chrome concentrate and flux and reductant). Off-gas generated by the furnaces will be used as a fuel source for pre heating (and potentially other processes) and remaining off-gas will be flared. Baghouse dust will be collected and disposed onto the baghouse slurry facility. It is expected that the furnaces will process approximately 850 000 tons per annum of UG2 chrome concentrate.
Furnace cooling	Water will be used as a cooling medium to extract heat from the equipment in the high temperature areas. Hot water (as a result of the cooling process) will be cooled by means of a fan filter and once cooled will be re-circulated back to the furnaces for cooling. The cooling system will be a closed water circuit.
Tapping of metal	Metal will be tapped from the furnaces using moulds built from alloy fines. Taphole fume extraction will take place during the tapping process and the dust will be collected and disposed onto the baghouse slurry facility
Crushing and screening	The tapped metal will then move through a crushing and screening

ACTIVITY	DESCRIPTION
	plant where it will be broken into sizeable ingots (of approx.6 tons) and allowed to cool.
Transportation of product	Product will be loaded at the railway siding and dispatched to market via train. It is anticipated that approximately 500 000 tons/annum will be despatched to market
Tapping of slag and containment of baghouse dust (and disposal onto slag dump and baghouse slurry facility)	Slag will be tapped from the furnaces via a slag launder into slag pots. Molten slag will be transported in pots to a slag dump area, where the pot will be emptied and returned to the furnaces for the next slag tap. Taphole fume extraction will take place during the tapping process and the the dust will be collected and disposed onto the baghouse slurry facility.
Dust suppression	Dust suppression will be utilised at all material handling transfer points, as required.

FIGURE 5: CONCEPTUAL PROCESS FLOW DIAGRAMME

TOPSOIL STOCKPILES AND BERM

A designated topsoil stockpile area of approximately 6.7 ha (with a capacity of approximately 320 000m^3) will be established along the western boundary of the smelter complex (Figure 3). This stockpile will also be used as a noise and visual screening berm between the proposed project and the exisiting Union Section Mine and associated Swartklip Mine Village. All topsoil will be used as part of con-current rehabilitation.

WATER SUPPLY AND USE FOR THE OPERATIONAL PHASE

Potable Water

It is expected that approximately 86m^3 of potable water will be required on a daily basis. Potable water will be made available from the municipal supply scheme and pumped to the potable water tank with a capacity of 300 m^3 (Figure 3). SCSC is also investigating the use of water from on-site boreholes for potable water, however this will only be in emergency cases when municipal water is not available. A service agreement (with the municipality) will be provided once a supply agreement has been concluded.

Process water

It is expected that approximately 133m^3 of process water will be utilised on a daily basis during the operational phase. As with potable water, process water will be sourced from the municipal supply scheme and pumped to the Process Water Dam (PWD) illustrated in Figure 3. The PWD will have a footprint of approximately 0.6 ha and a capacity of 20 000 m^3. SCSC is investigating the use of on-site borehole water as process water for emergency back up purposes when municipal water is not available. A service agreement (with the municipality) will be provided once a water supply agreement has been concluded.

As a preference, process water will be treated and re-used within the processing circuit so as to limit the total demand from the municipal supply scheme. This will be particularly relevant in the wet season when the project will have excess water (Figure 8) for use within the process. In the event that the municipal sewage plant is not operational and SCSC treats sewage within its own on site sewage treatment plant, treated sewage effluent may also be used as process water, thereby further reducing the total demand from the municipal supply scheme.

Fire water

A fire water network will be installed as part of the proposed project which will feed water to hose reels at designated points within the plant area, administrative block, stores, workshops, washbays, and change house. Fire water will be sourced from the municipal supply scheme and pumped to the fire water tank illustrated in Figure 3. In addition to this, SCSC is also investigating the use of on-site borehole water as fire water however this will only be in the case of emergencies when municipal water is not available. A service agreement (with the municipality) will be provided once a supply agreement has been concluded.

Water treatment plant

Provision has been made for an on site reverse osmosis (RO) water treatment plant in the event that excess water in the SCSC circuit requires treatment prior to use and/or discharge. Hydrological modelling predicts that the total volume of water requiring treatment is in the order of 17 429 m^3/month (in the wet season only) and a plant with capacity of 15m^3/hour will be required in order to treat this volume. The waste stream (brine) emanating from this treatment plant will be disposed of at the Holfontein hazardous waste disposal facility, or on the baghouse slurry facility (pending approval by regulatory authorities).

STORMWATER MANAGEMENT SYSTEM FOR THE OPERATIONAL PHASE

Information provided in this section was sourced from the surface water management plan developed for the proposed project by SLR (SLR, September 2016) and included in the hydrology assessment (Appendix G).

Water management facilities for the control of stormwater and for pollution prevention will be designed to meet the requirements of Regulation 704 (4 June 1999) for water management on mines. Even though the SCSC project is not a mine, these design principles are considered to be good industry practice and are therefore being applied. The five main principles of Regulation 704 that are applicable to the stormwater management of the proposed project include:

- *Condition 4* which defines the area in which, mine workings or associated structures may be located, with reference to a watercourse and associated flooding. Any residue deposit, dam, reservoir together with any associated structure or any other facility should be situated outside the 1:100 year flood-line. Any underground or opencast mining, prospecting or any other operation or activity should be situated or undertaken outside of the 1:50 year flood-line. Where the flood-line is less than 100 metres away from the watercourse, then a minimum watercourse buffer distance of 100 metres is required for infrastructure and activities.
- *Condition 5* which indicates that no residue or substance which causes or is likely to cause pollution of a water resource may be used in the construction of any dams, impoundments or embankments or any other infrastructure which may cause pollution of a water resource.
- *Condition 6* which describes the capacity requirements of clean and dirty water systems. Clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated to ensure conveyance of flows of a 1:50 year recurrence event. Clean and dirty water systems should not spill into each other more frequently than once in 50 years. Any dirty water dams should have a minimum freeboard of 0.8m above full supply level.
- *Condition 7* which describes the measures which must be taken to protect water resources. All dirty water or substances which may cause pollution should be prevented from entering a water resource (by spillage, seepage, erosion etc.) and ensure that water used in any process is recycled as far as practicable.
- *Condition 10* which describes the requirements for operations involving extraction of material from the channel of a watercourse. Measures should be taken to prevent impacts on the stability of the

watercourse, prevent scour and erosion resulting from operations, prevent damage to in-stream habitat through erosion, sedimentation, alteration of vegetation and flow characteristics, construct treatment facilities to treat water before returning it to the watercourse, and implement control measures to prevent pollution by oil, grease, fuel and chemicals.

The key aspects of the proposed conceptual stormwater management plan are listed below (relevant figures are included in Figure 6 and Figure 7):

- Clean stormwater will be diverted around dirty catchments and allowed to flow towards the watercourse located south-east of the site.
- The topsoil stockpile will be revegetated and any runoff will be collected in toe paddocks and allowed to evaporate or infiltrate.
- Dirty stormwater from the plant area (material transfer/storage/processing areas, furnace, service yard, and workshops) and waste facilities (slag dump and bag house dust facility) will be collected by perimeter drains and passed through a silt trap before being conveyed into the pollution control dam (PCD).
- Stormwater collecting in the PCD will be pumped to the PWD during and after rainfall events to supply the plant's water requirements.

In order to accommodate the design flows associated with the conceptual stormwater management plan, the recommended channel sizes (for conveyance of stormwater) are presented in Table 6 below. Figure 6 presents a cross-section through a typical channel.

TABLE 6: STORMWATER DIVERSION CHANNEL SIZING (SLR, SEPTEMBER 2016)

Catchment	Total Flow	Drainage Channel	Design Flow		Channel dimension (refer to Fig 5-2)					S	n	A	P	R	V	Q
					b1	d1	b2	d2	b3							
	m^3/s		%	m^3/s	m	m	m	m	m	m/m		m^2	m	m	m/s	m^3/s
Cleanwater Catchment	5.91	CW1	50%	3.0	1.2	0.8	1.2	0.8	1.0	0.008	0.025	1.8	3.9	0.5	2.1	3.8
		CW2	27%	1.6	0.9	0.6	0.9	0.6	1.0	0.008	0.025	1.1	3.2	0.4	1.9	2.1
		CW3	23%	1.4	0.8	0.5	0.8	0.5	1.0	0.009	0.025	0.9	2.8	0.3	1.7	1.5
Plant	5.06	DW1	50%	2.5	1.1	0.7	1.1	0.7	1.0	0.009	0.025	1.4	3.5	0.4	2.1	3.0
		DW2	50%	2.5	1.1	0.7	1.1	0.7	1.0	0.007	0.025	1.4	3.5	0.4	1.9	2.7
All	8.04	DW3*	N/A	8.0	2.0	1.3	2.0	1.3	1.0	0.005	0.025	3.8	5.7	0.7	2.2	8.6
Slag Dump	3.08	DW4	50%	1.4	0.8	0.5	0.8	0.5	1.0	0.009	0.025	0.9	2.8	0.3	1.8	1.5
Bag House Dust Facility	2.87	DW5	50%	1.4	0.8	0.5	0.8	0.5	1.0	0.009	0.025	0.9	2.8	0.3	1.7	1.5
		DW6	50%	1.4	0.8	0.5	0.8	0.5	1.0	0.009	0.025	0.9	2.8	0.3	1.7	1.5

**DW3 channel sized to convey 100% of the flow from Plant, 50% from the Slag Dump and 50% from the Bag House Dust Facility*

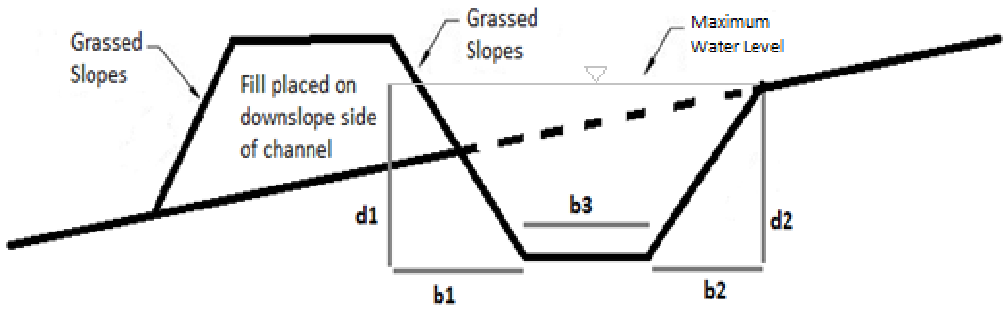

FIGURE 6: CROSS SECTION THROUGH A TYPICAL STORMWATER DIVERSION CHANNEL (SLR, SEPTEMBER 2016)

<u>Containment of dirty water</u>

The proposed PCD (and silt trap for silt reclamation) is proposed to the east of the baghouse slurry facility (Figure 7), which is the lowest point thereby ensuring gravity drainage of runoff from all dirty water catchments identified. The PCD will be lined with A Class A barrier system (for a Type 1 waste) to prevent seepage of dirty water, which otherwise might pollute local surface and groundwater resources. The PCD will feature an engineered spillway to convey design exceedance events through the PCD to the environment without causing erosion of the dam walls, which may compromise the structural integrity of the PCD. It is recommended that operation of the PCD ensures that water levels are maintained at a sufficient level to accommodate the 1:50 year 24 hour runoff volumes plus a 0.8 m freeboard (i.e. stormwater should be pumped out of the PCD during and after rainfall events, to ensure that sufficient capacity is maintained within the PCD).

GN 704 requires that dirty water containment facilities are designed, constructed, maintained and operated so that they are not likely to spill into a clean water environment more than once in 50 years. In this regard, the following design standards are applied:

- The silt trap is sized to accommodate runoff generated by the plant, slag dump and bag house dust facilities during a 1:2 year 24 hour duration event.
- The PCD is sized to accommodate runoff generated from a 1:50 year design rainfall (24 hour) event **and** the highest monthly rainfall (January) **less** the corresponding monthly evaporation (January) taking place over the surface area of the dam.

The recommended capacity requirements (based on conceptual level design) for the silt trap and PCD are presented in Table 7 below.

TABLE 7: DETAILS OF THE PCD AND SILT TRAP (SLR, SEPTEMBER 2016)

Facility	1:2yr Storm Runoff (m^3)	1:50yr Storm Runoff (m^3)	Wet Month Runoff (m^3)	Wet Month Evaporation (m^3)	Design Capacity (m^3)	PCD Footprint (m^2)
Silt Trap	13 547	N/A	N/A	N/A	13 547	2 000
PCD	N/A	46 098	23 000	2 880	66 219	17 000

FIGURE 7: CONCEPTUAL STORMWATER MANAGEMENT PLAN (SLR, SEPTEMBER 2016)

WATER BALANCE

Information in this section was sourced from the hydrology study (SLR, September 2016) undertaken for the proposed project and included in Appendix G.

A site wide water balance model has been prepared to understand flows within the SCSC project operational water circuit during wet and dry seasons. The wet and dry season water balances are illustrated in Figure 8 and Figure 9 respectively. The dry season water balance indicates that there will be no excess water in the system. The wet season water balance however indicates that during the rainy season the site will be water positive (a surplus of 17 429 m^3/month) and that surplus water may need to be discharged into the environment if it cannot all be used in the water circuit instead of municipal water. Dependent on available water treatment options (which will be investigated as part of the WULA process), some of this surplus water may be treated and re-circulated in the system as potable and process water thereby reducing the total water requirement from the municipal supply scheme and reducing the total volume needing to be discharged to the environment. In this regard, provision has been made for a reverse osmoses (RO) plant as described above.

Routine water quality monitoring of any discharge will be required to demonstrate compliance with the relevant water quality standards, and where exceedances of guidelines are identified, contingency plans will be implemented including a review of the site management practices and treatment plant performance.

FIGURE 8: WET SEASON WATER BALANCE (SLR, SEPTEMBER 2016)

FIGURE 9: DRY SEASON WATER BALANCE (SLR, SEPTEMBER 2016)

DISTURBANCE OF WATERCOURSES

Regulation 704 of the NWA requires that infrastructure including residue facilities (i.e. the slag dump and baghouse slurry facility) should not be located within 100 m from any watercourse or within the 1:100 year floodline, whichever is the greatest. It follows that the slag dump, the baghouse slurry facility and the potential sewage treatment plant will be located outside of the relevant zone of the Brakspruit tributary.

The only project related infrastructure that is planned to cross watercourses is the powerline and associated service road and the backup project access road. It should be noted that the existing dirt road that runs along the southern boundary fence of the SCSC property will be used as the powerline service road and the associated existing river crossings will remain unchanged. The existing backup project access road is also associated with existing river crossings and these will remain unchanged.

The proposed 275 kV powerline will originate from the Spitzkop substation to the south-east of the project area and will run in a northerly direction (along an existing Eskom servitude) before entering the SCSC property and running in a westerly direction towards the smelter complex (Figure 2 and Figure 3). Due to the river crossings required to route the powerline from the Spitzkop substation to the project area, the powerline will require authorisation in terms of WUL approval and will also require exemption in terms of Regulation 704 of the NWA. Prior to its establishment, these necessary approvals/exemptions will need to be obtained from the DWS. Powerline design drawings will be submitted in support of the WULA.

TRANSPORTATION (ROUTES AND MECHANISMS) FOR THE OPERATIONAL PHASE

<u>Internal roads and railway line</u>

Within the proposed project area internal roads will be established (some of these are indicated on Figure 3). These roads will consist of a combination of widening existing gravel roads as well as the establishment of new roads. A railway siding of approximately 700 m (which comes off the main Union Section railway line) will be built to cater for transportation of incoming raw materials and outgoing product.

<u>Access to the site</u>

Access to the proposed project area will be via an upgraded intersection with the D869 (Figure 3 and Figure 4) as discussed in Section 4.2.1.

<u>Transportation of workers and supplies to site</u>

During the operation of the proposed project there will be workers travelling to and from site and trucks supplying input materials, machinery and consumables. Table 8 below provides a conceptual indication of the traffic associated with the operational phase. It should be noted that the vehicle trip generation estimates below assume that the delivery of incoming chrome concentrate and dispatching of product will be done via rail (not via road). See the traffic specialist study in Appendix L for detailed trip generation information.

TABLE 8: OPERATIONAL PHASE TRAFFIC (USING A COMBINATION OF ROAD AND RAIL TRANSPORT): MATERIALS AND STAFF (AM AND PM PEAK COMBINED)

Item	Trips to and from site per day	Transportation routes
Transportation of product off-site by truck	Not relevant. It is assumed that product will be dispatched via rail.	Traffic will make use of the existing D869 (Brits Road) between Dwaalboom and Brits as well as the R510 road between Rustenburg and Thabazimbi.
Operational materials, machinery and consumables transported by trucks (includes incoming raw materials)	12 trucks per day (Approximately 24 trips per day)	
Operational employees transported by private vehicles	Approximately 8 vehicles per day (Approximately 16 trips per day)	
Operational employees transported by taxis/busses	Approximately 10 vehicles per day (Approximately 20 trips per day)	

Conveyors

During the operational phase, the proposed project will make use of the conveyor network as discussed in Section 4.2.1. The conveyors are designed to operate 24 hours a day for seven days a week.

Pipelines

During the operational phase, the project will make use of the pipeline network as discussed under Section 4.2.1.

POWER SUPPLY AND USE FOR THE OPERATIONAL PHASE

The proposed project's 275 kV powerline will originate from the Spitzkop substation to the south-east of the project area and will run in a northerly direction (along an existing Eskom servitude) before entering the SCSC property and running in a westerly direction towards the smelter complex (Figure 2 and Figure 3). The powerline will run to the on-site substation (Figure 3) from where power will be distributed as required throughout the project area. The on-site substation (H-Type configuration) will receive the incoming 275kV overhead line from the where the voltage will be stepped down to 33kV, which will be the primary distribution voltage for the site. A 33kV XLPE cable will feed power from the LV side of the 275/33kV distribution transformers into an indoor 33kV substation. This substation will be the primary distribution switchgear for the site, equipped with feeder circuit breakers for furnace power supply, auxiliary power supply for smelter plant auxiliary loads (including offices and workshops, harmonic filtering and power factor correction and small power supply for offices and workshops.

For the 5.5 km section of the powerline which traverses the SCSC property, four river crossings will be required for the powerline and associated existing service road. In this regard, the powerline will require authorisation in terms of WUL approval and will also require exemption in terms of Regulation 704 of the NWA. Prior to its establishment, these necessary approvals/exemptions will need to be obtained from the DWS. Powerline design drawings will be submitted in support of the WULA.

The proposed powerline routing has incorporated the following routing principles which will be further considered in the detailed design and implementation phases.

In terms of the construction of the powerline, the following recommendations are made (SAS, August 2016):

- The powerline should ideally span the entire delineated riparian zone, with no infrastructure being placed within the active river channels. Placement of the powerline and its support structures will ensure that no upstream ponding and no downstream erosion and scouring occur.
- River crossings will be at the narrowest points in the rivers where practicably possible.
- The powerline will cross the rivers as close to 90 degree angles as practicably possible to minimise the damage to riparian areas.

In addition to power sourced from the Eskom powerline, it is expected that CO gas from furnace off-gas will be used to power the pre-heaters. Approximately 35 MW of energy will be generated in this way. The project will consume approximately 150 MW of power.

MINERALISED WASTE MANAGEMENT FOR THE OPERATIONAL PHASE

Slag dump

Slag material from the furnaces will be disposed of onto the slag dump. When tapped from the furnace the slag is in a hot, molten form whereafter it will cool and harden at the slag dump facility. In compliance with Section 4 of GN. 632 of the NEM:WA, the design features characteristics associated with the slag dump are provided in Table 9 below (and detailed in Appendix S). A conceptual cross section through the proposed slag dump in provided in Figure 10.

TABLE 9: DESIGN FEATURES CHARACTERISTICS FOR THE SLAG DUMP

Feature	Detail
Design life	The design life is 20 years but this may be extended if the project team is successful in finding an alternative use for the slag that will reduce the amount of slag that has to be disposed. If an alternative use is not identified then an alternative facility will have to be assessed, approved and constructed to the east or north of the current faciulity site.
Physical Dimensions	Footprint area: Approximately 21 ha
	Height: Approximately 33 m
Physical Characteristics	Molten slag will be depositied at temperatures of approximately 1650°C. When cooled it is expected that the slag will crack significantly and result in a glassy waste rock-type surface.
Chemical Characteristics	With reference to Section 8.1.1, the ABA results show that the total sulphur content of slag samples tested is reasonably low which suggests that the samples have limited potential to generate acid and are classified as Non-Potentially Acid Generating (Non-PAG). In addition, the neutralising potential ratio (NPR) of all slag samples is above 2, which implies all samples have sufficient neutralising potential to offset the low acid generation potential. The paste pH for all three slag samples was alkaline and indicates that there is negligible potential for the generation of short-term acidity. There is however potential for seepage concentrations to exceed the SANS 241 (2011) Drinking

Feature	Detail
	Water limits for aluminium (Al). For futher information refer to the geochemistry specialist study included in Appendix Q.
Transport and placement	The slag will be tapped from the furnaces (via slag launders) into molten pot carriers. The disposal of slag will be done utilising these molten pot haulers which will transport the molten slag in carrier pots to the slag dump area. The pots will be emptied and returned to the furnace ready for the next slag tap.
Stormwater management	Stormwater channels will be constructed around the slag dump to ensure that all clean water is diverted around the facility. Dirty water will be diverted to the PCD.
Containment barrier system	The containment barrier system as specified by GN 636 calls for a Type 3 waste material (a minimum of a *Class C* barrier system) to be installed. Given the temperatures at which the slag will be disposed, the design includes a thermal protection layer above the Class C barrier system. The purpose of the thermal protection layer is to prevent heat related damage to the underlying barrier system. Further information on the proposed thermal protection layer is included in Appendix S. Due to the waste type assessment having being undertaken on a sample from the project's pilot plant, further confirmatory testing is recommended once operation has commenced in order to determine whether this classification can be downgraded. The facility has a modular development plan which will allow for installation of different barrier systems if relevant and if approved.
Side Slopes	The side slopes will be constructed at approximately 1V:3H in order to maintain structural integrity and incorporate concurrent plans for rehabilitation.
Underdrainage	The slag dump will include an underdrainage monitoring system in order to comply with the requirements of the *Class C* containment barrier system. The underdrainage system will be located in the base preparation layer and will comprise of slotted drainage pipes with stone surrounds, wrapped in a suitable geotextile material. All water collected from the underdrainage system will be conveyed into manholes which will transport the water to the PCD.
Access and Access control	Internal haul roads will be used for access to the slag dump. In addition, access roads around the slag dump will allow for simplicity of operations (and maintenance). A perimeter fence around the proposed project area is envisaged as well as fencing around the wastes facility to prevent unauthorised access.
Waste minimisation	SCSC is investigating options for further reclamation/re-sale of slag material to third parties. This will allow for the footprint of the slag dump to be limited.
Dust control	No dust control will be provided at the slag dump since no significant dust emission sources are expected given the physical characteristics of the material.
Closure and Rehabilitation	The slag dump will be concurrently rehabilitated with every raise of the outer walls. The rehabilitation approach adopted will include the construction of a vegetated final cover to the outer side slopes and top surface of the waste facilities as part of the on-going wall raising operations and final closure. It should be noted that concurrent rehabilitation is dependent on viable third party markets for slag.

The safety classification for the slag dump was determined in accordance with the South African Code of Practice for Mine Residue Deposits (SANS 10286:1998) and the requirements of Section 3(c) of GN 527 of the MPRDA. The summarised safety classification is included in Table 10 below.

TABLE 10: SAFETY CLASSIFICATION CRITERIA FOR THE SLAG DUMP

Criteria No.	Criteria		Comment	Safety Classification
1	No. of Residents in Zone of Influence	0 (Low hazard)	No residents were noted within the zone of influence.	Low Hazard
		1 -10 (Medium hazard		
		>10 (High hazard)		
2	No. of Workers in Zone of Influence	<10 (Low hazard)	Minimal workers will be located in the zone of influence (most likely less than 10).	Low Hazard
		11 – 100 (Medium hazard)		
		>100 (High hazard)		
3	Value of third party property in zone of influence	0 – R2 Million (Low hazard)	The property located immediately to the north of the proposed waste facility is owned by a third party. Despite the conservative rating of medium, it should be noted that the area affected by the potential failure of the waste-rock-type slag dump would be very localised and substantially smaller than the SANS zone of influence.	Medium Hazard
		R2 – R20 million (Medium hazard)		
		>R20 million (High hazard)		
4	Depth to underground mine workings	>200 m (Low hazard)	No underground activities are located within the zone of influence	Low Hazard
		50 m – 200 m (Medium hazard)		
		<50 m (High hazard)		

With reference to Table 10 above, the slag dump is classified as a medium safety risk. It should however be noted that this is a conservative rating since the area affected by the potential failure of the waste-rock-type slag dump would be very localised and substantially smaller than the SANS zone of influence. In this regard, it is the opinion of the design engineer that the overall classification should be a low safety risk.

Environmental classification for the slag dump

In accordance with Section 5 GN. 632 of the NEM:WA, residue deposits need to be assessed taking into account Regulation 8 of GN R. 634 of 2013, which references the following associated National Norms and Standards:

- National Norms and Standards for the assessment of waste for landfill disposal (GN R.635 of 2013).
- National Norms and Standards for disposal of waste to landfill (GN R. 636 of 2013).

A total of three samples, expected to be representative of the slag to be disposed as part of the proposed project were selected. The result of the classification are summarised in Table 11 below.

TABLE 11: RESULTS OF SLAG DUMP CLASSIFICATION

Sample ID	Waste Type	Reason for Classification	Landfill Class
SLAG Tap 42	Type 3	Total Concentrations: As, Ba, Ni, F	Class C
SLAG Tap 75	Type 3	Total Concentrations: Ba, Ni	Class C
SLAG Tap 82	Type 3	Total Concentrations: Ba, Ni	Class C

Based on the outcome of the assessment undertaken in accordance with the national Norms and Standards, the results suggests that the slag dump will be a type 3 waste and will require a Class C liner which comprises both a HDPE geomembrane and a clay liner. Due to the waste type assessment having being undertaken on a sample from the project's pilot plant, further confirmatory testing (on material from the SCSC smelter) is recommended once operation has commenced in order to determine whether this classification can be downgraded. Refer to Appendix S for the conceptual design associated with the slag dump facility and associated containment barrier system.

Baghouse Slurry Facility

Baghouse material collected from taphole fume extraction and furnace off-gas will be slurried through the addition of water (in an agitator) afterwhich the slurry will be pumped to the baghouse slurry facility located immediately adjacent to the slag dump (Figure 3).

In compliance with Section 4 of GN. 632 of the NEM:WA, the design features characteristics associated with the baghouse slurry facility are provided in Table 12 below (and detailed in Appendix S). A conceptual cross section through the proposed baghouse slurry facility in provided in Figure 10.

TABLE 12: DESIGN FEATURES CHARACTERISTICS FOR THE BAGHOUSE SLURRY FACILITY

Feature	Detail
Design life	The design life is 20 years but this may be extended if the project team is successful in finding an alternative use for the slurry that will reduce the amount of slurry that has to be disposed. If an alternative use is not identified then an alternative facility will have to be assessed, approved and constructed to the east or north of the current faciulity site.
Physical Dimensions	Foot print area: Approximately 10 ha
	Height: Approximately 15 m
Physical Characteristics	A summary of the grading analysis for the baghouse material is provided below: • 97% (by mass) passing the 0.075 mm sieve size. • 1% of the particles would be greater than the 0.425 mm sieve size. • 81% of the particles passing the 0.040 mm sieve size. • 36% of the particles passing the 0.002 mm sieve size.
Chemical Characteristics	With reference to Section 8.1.1, the ABA results show that the total sulphur content for the proxy sample testing was relatively elevated (1.8%), indicating a significant potential to generate acid (classified as PAG), although the paste pH was neutral and indicates that there is negligible potential for the generation of short-term acidity). In addition, the NPR for this sample was below 1 which suggests that the sample has insufficient neutralising potential

Feature	Detail
	to offset the acid potential. Manganese (Mn), lead (Pb), zinc (Zn) and sulphate (SO_4) are identified as copc in the proxy baghouse dust sample It is noted that the acid potential calculations have been based on total sulphur. Some of the sulphur in a sample may be present in non-acid producing sulphates or native sulphur. If a significant part of the total sulphur occurs as sulphate sulphur instead of potentially acid generating sulphide sulphur, the overall risk of acid generation is reduced. These results, based on total sulphur concentrations are therefore conservative. If necessary additional testing of the actual waste sample for the presence of sulphide sulphur can be undertaken once these samples are available. For futher information refer to the geochemistry specialist study included in Appendix Q.
Transport and placement	The baghouse dust will be pumped to the facility in slurry form via a pipeline. The slurry will be pumped into geosynthetic de-watering bags and thereafter left to de-water, sun-dry and consolidate over time.
Stormwater management	Stormwater channels will be constructed around the baghouse slurry facility to ensure that all clean water is diverted around the facility. Dirty water will be diverted to the PCD.
Containment barrier system	The containment barrier system as specified by GN 636 calls for a Type 1 waste material (a minimum of a Class A barrier system) to be installed. Due to the waste type assessment having being undertaken on a proxy sample, further confirmatory testing is recommended once operation has commenced in order to determine whether this classification can be downgraded. The facility has a modular development plan which will allow for installation of different barrier systems if relevant and if approved.
Side slopes	The side slopes will be constructed at approximately 1V:3H in order to maintain structural integrity and incorporate concurrent plans.
Under Drainage system	The baghouse slurry facility disposal facility will contain a stone leachate collection system which will be comprised up of intermediately spaced drainage pipes to help increase the removal of filtrate from the geosynthetic de-watering bags and allow for a faster de-watering and consolidation time. All the water collected from the underdrainage systems will be conveyed into manholes which will transport the water to the PCD.
Access and Access control	Internal haul roads will be used for access to the baghouse slurry facility . In addition, access roads around the facility will allow for simplicity of operations (and maintenance). A perimeter fence around the proposed project area is envisaged as well as fencing around the wastes facilities to prevent unauthorised access.
Waste Minimisation	SCSC is investigating options for further reclamation/re-sale of baghouse dust material to third parties. This will allow for the footprint of the baghouse slurry dam to be limited.
Dust control	No dust control will be provided at the baghouse slurry facility since the material will be contained using geosynthetic storage bags and the material will be in slurry form.
Closure	The waste facilities will be concurrently rehabilitated with every raise of the outer walls. The rehabilitation approach adopted will comprise of the construction of a vegetated final cover to the outer side slopes of the waste facilities as part of the on-going wall raising operations.

The safety classification for the baghouse slurry facility was determined in accordance with the South African Code of Practice for Mine Residue Deposits (SANS 10286:1998) and the requirements of Section 3(c) of GN 527 of the MPRDA. The summarised safety classification is included in Table 10 below.

TABLE 13: SAFETY CLASSIFICATION CRITERIA FOR THE BAGHOUSE SLURRY FACILITY

Criteria No.	Criteria		Comment	Safety Classification
1	No. of Residents in Zone of Influence	0 (Low hazard)	No residents were noted within the zone of influence.	Low Hazard
		1 -10 (Medium hazard		
		>10 (High hazard)		
2	No. of Workers in Zone of Influence	<10 (Low hazard)	Minimal workers will be located in the zone of influence (less than 10).	Low Hazard
		11 – 100 (Medium hazard)		
		>100 (High hazard)		
3	Value of third party property in zone of influence	0 – R2 Million (Low hazard)	The property located immediately to the north of the proposed waste facility is owned by a third party.	Medium Hazard
		R2 – R20 million (Medium hazard)		
		>R20 million (High hazard)		
4	Depth to underground mine workings	>200 m (Low hazard)	No underground activities are located within the zone of influence	Low Hazard
		50 m – 200 m (Medium hazard)		
		<50 m (High hazard)		

With reference to Table 10 above, the baghouse slurry facility is classified as a medium safety risk.

Environmental classification for the baghouse slurry facility

In accordance with Section 5 GN. 632 of NEM:WA, residue deposits need to be assessed taking into account Regulation 8 of GN R. 634 of 2013, which references the following associated National Norms and Standards:

- National Norms and Standards for the assessment of waste for landfill disposal (GN R.635 of 2013).
- National Norms and Standards for disposal of waste to landfill (GN R. 636 of 2013).

One proxy sample of the baghouse dust (sourced from Mogale's DC furnace) was selected. The results of the classification are summarised in Table 11 below.

TABLE 14: RESULTS OF BAGHOUSE DUST CLASSIFICATION

Sample ID	Waste Type	Reason for Classification	Landfill Class
Mogale DC Baghouse	Type 1	Total Concentrations: Zn	Class A

Based on the outcome of the assessment undertaken in accordance with the national Norms and Standards, the results suggests that the slag dump will require a Class A liner. Due to the waste type assessment having being undertaken on a proxy sample further confirmatory testing (on material from the SCSC smelter) is recommended once operation has commenced in order to determine whether this classification can be downgraded. Refer to Appendix S for the conceptual design associated with the baghouse slurry facility and associated containment barrier system.

NON-MINERALISED WASTE MANAGEMENT FOR THE OPERATIONAL PHASE

Domestic and industrial waste

Facilities for the temporary storage of non-mineralised waste associated with the proposed project will be provided. The types of waste that could be generated on site during the operational phase include: hazardous industrial waste (such as packaging for hazardous materials, used oil, lubricants), general industrial waste (such as scrap metal and building rubble), medical waste (such as swabs, bandages) from the staff medical station, and domestic waste (such as packaging, canteen waste and office waste). These wastes will be temporarily handled and stored on site at the waste yard before being removed for recycling by suppliers, appointed waste contactors or reuse by scrap dealers, or final disposal at a permitted waste disposal facility such as the Northam municipal refuse facility. .

Sewage

It is expected that approximately 20 m^3 of sewage will be generated per day. Sewage will be temporarily stored on site prior to being removed by an accredited removal contractor and disposed of at the municipal sewage plant in Northam. If there is a time delay between the availability of the off-site solution (i.e. the Northam sewage treatment plant) and the commencement of operations, then Siyanda will implement its own on-site sewage treatment solution. In this regard, provision has been made to cater for the development and operation of an on-site sewage treatment facility with off-site disposal of the treated sewage sludge at the sewage treatment facility in Thabazimbi.

Should an on-site sewage treatment alternative be required, all sewage will be treated in a package sewage treatment facility to be established on site. It is anticipated that the sewage treatment plant will be a sequencing batch reactor system which is a type of activated sludge process. Sewage effluent will be collected from the offices and change houses and will be pumped to the sewage treatment plant via a series of pipelines. The sewage treatment plant will be able to treat approximately 35 m^3 of sewage effluent per day. The treated sewage effluent will pumped via pipelines to the main process water tank for re-use as process water. It is anticipated that approximately 5 m^3 of sewage sludge will be generated on a daily basis which will be removed off-site by a certified contractor for disposal at a licensed facility.

OTHER SUPPORT SERVICES AND FACILITIES

Other support services associated with the proposed project include the following (Figure 3):

- Service yard
- Operational store
- Instrumentation workshop, mechanical workshop, electrical workshop and diesel workshop

- Diesel, lubricants and propane gas storage
- Refractory and general store
- Laboratory
- Substation
- Filter Yard
- Change house
- Clinic
- Main office
- HR/SHEQ office
- Main entrance/security
- Railway siding
- Cooling water circuit (and pumps)
- Topsoil stockpile/berm

EMPLOYMENT AND HOUSING

The proposed project will allow for the creation of approximately 280 jobs during the operational phase. No staff will be housed on-site as part of the proposed project. Operational workers will be accommodated in nearby towns and communities.

OPERATING HOURS

It is expected that the proposed smelter complex will be operational 24 hours a day for 7 days a week (crushing and screening of tapped metal will however be limited to daylight hours only). It is anticipated that there will be two twelve hour shifts (06h00 to 18h00 and 18h00 to 06h00) per day during the operational phase.

LIFE OF PROJECT

The design life of the smelter complex is 30 years. The anticipated life of the project is a minimum of 20 years extending to well beyond 30 years if chrome concentrate input material and infrastructure capacity allows for this.

FIGURE 10: CROSS SECTION THROUGH SLAG DUMP AND BAGHOUSE SLURRY FACILITY (SLR, SEPTEMBER 2016)

4.2.3 DECOMMISSIONING AND CLOSURE

The environmental objective for closure is to minimise the impacts associated with the closure and decommissioning of the project and to restore the land to a useful land use not dissimilar to the pre-project land use.

The project believes in proactive and progressive rehabilitation throughout the life of the project where possible and in this regard a preliminary closure plan has been included in Appendix T. In summary objectives and principles of the closure plan include the following:

- Environmental damage is minimised to the extent that they are acceptable to all parties involved.
- The land is rehabilitated to achieve a condition approximating its natural state, or so that the envisaged end use of grazing and cropping is achieved.
- All surface infrastructure will be removed from site after rehabilitation. It should be noted that this is dependent on viable third party markets for slag and baghouse material. Should no viable market for resale/reclamation be secured, the slag dump and baghouse slurry facility will remain (rehabilitated) post closure. This includes an appropriate covering of the waste facilities according to best practice.
- Contamination beyond the smelter site by surface water run-off, groundwater movement and wind will be prevented. This will be achieved through post-closure monitoring as outlined in Section 27.
- Project closure is achieved efficiently, cost effectively and in compliance with the law.
- The social and economic impacts resulting from closure are managed in such a way that negative socio-economic impacts are minimised.

Additional and more specific closure objectives may be tied to the final land use for the proposed project area, and these will be determined in collaboration with local communities and other stakeholders during the on-going operations of the proposed smelter. In this regard, this closure plan which provides the objectives for closure, the plan for rehabilitation and key performance indicators thereof will need to be reviewed and updated and re-submitted prior to the decommissioning phase.

5 POLICY AND LEGISLATIVE CONTEXT

This section outlines the key legislative requirements applicable to the proposed project. Table 15 below provides a summary of the applicable legislative context and policy.

TABLE 15: LEGAL FRAMEWORK

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
National Environmental Management Act No. 107 of 1998 (NEMA)	As outlined in Section 4.1 and Table 16	An application for environmental authorisation in terms of listed activities in accordance with NEMA and NEM:WA has been applied for. The integrated application was first submitted to the DEA on 8 April 2016, with updated versions submitted subsequently (as agreed to with the DEA). A copy of the application form is attached in Appendix D.
Regulations 983 (Listing Notice 1), 984 (Listing Notice 2) and 985 (Listing Notice 3) in terms of NEMA	As outlined in Section 4.1	
Guideline on the need and desirability in terms of the Impact Assessment (EIA) Regulations, 2010, GNR. 891 of 2014.	Section 6	Need and desirability has been taken into account as part of project planning.
National Environment Management: Waste Act No. 59 of 2008 (NEM:WA)	Section 4.1	An application for environmental authorisation in terms of listed activities in accordance with NEMA and NEM:WA has been applied for. The integrated application was first submitted to the DEA on 8 April 2016, with updated versions submitted subsequently (as agreed to with the DEA). A copy of the application form is attached in Appendix D.
Regulation 921 in terms of NEM:WA	Section 4.1	
Regulations regarding the planning and management of residue stockpiles and deposits from a prospecting, mining, exploration or production operation in terms of NEM:WA, Regulation 632.	Section 4.2.2, Appendix H, Appendix Q and Appendix R	Informs the design requirements for the slag dump and baghouse dust disposal facility associated with the proposed project.
National Norms and Standards for the assessment of waste for landfill disposal (GNR 635 of 2013)		
National Norms and Standards for the disposal of waste to landfill (GNR 636 of 2013)		
National Water Act No. 36 of 1998 (NWA)	Section 4.2.2, 8.1.7, 9.1.8 and 26 and Appendix G	A water use license application will be submitted to the Department of Water and Sanitation for various water uses in accordance with Section 21 of the NWA. As part of the water use license application, exemption in terms of Regulation 704 of 1999 will be applied for.
Regulation 704 of 1999 in terms of the NWA	Section 4.2.2, 8.1.7 and 8.1.8 and Appendix G	
National Environmental Management: Biodiversity Act No. 10 of 2004 (NEM:BA)	Section 8.1.6 and Appendix F	Biodiversity has been taken into account as part of project planning.

Applicable legislation and guidelines used to compile the report	Reference where applied	How does this development comply with and respond to the policy and legislative context
Mining and Biodiversity Guideline (DEA et al, 2013)	Section 8.1.6 and Appendix F	Biodiversity has been taken into account as part of project planning.
National Freshwater Ecosystem Priority Areas 2011 (NFEPA)	Section 8.1.6 and Appendix F	Biodiversity has been taken into account as part of project planning.
National Veld and Forest Fire Act No. 101 of 1998	Section 26	Fire management has been taken into account as part of project planning.
International Union for Conservation of Nature (IUCN)	Section 8.1.6 and Appendix F	Biodiversity has been taken into account as part of project planning.
National Forest Act No. 84 of 1998 (NFA)	Section 8.1.6	An integrated permit application will have to be made to the DAFF to obtain the required permission to remove and/or translocate protected species in terms of the NFA and the NCNCA.
Limpopo Conservation Plan Version 2 of 2013	Section 8.1.6	
Conservation of Agriculture Resources Act No. 43 of 1983	Section 8.1.6 and Appendix F	Agriculture has been taken into account as part of project planning.
National Protected Areas Expansion Strategy 2008 (NPAES)	Section 8.1.6 and Appendix F	Biodiversity has been taken into account as part of project planning.
South African National Botanical Institute (SANBI) Integrated Biodiversity Information	Section 8.1.6 and Appendix F	Biodiversity has been taken into account as part of project planning.
Thabazimbi Local Municipality Spatial Development Framework	Sections 8.1.14 and Appendix P	Land planning has been taken into account as part of project planning.
Waterberg District Municipality Integrated Development Framework and Spatial Development Framework	Sections 8.1.14 and Appendix P	Land planning has been taken into account as part of project planning.
National Heritage Resource Act No. 25 of 1999	Section, 8.1.13, 9.1.16 and 26, Appendix M and Appendix N	Heritage has been taken into account as part of project planning.
Spatial Planning and Land Use Management Act No. 16 of 2013.	Section 10 and 26, Appendix D	Submission of a re-zoning application (the re-zoning application process will be handled by PlanWize Town and Regional Planners).
National Atmospheric Emission Reporting Regulations in terms of the National Environmental Management: Air Quality Act 39 of 2004 (the Reporting Regulations).	Section 26	Registration on the National Emissions Inventory System
South African Code of Practice for Mine Residue Deposits (SANS 10286:1998)	Section 4.2.2	Even though the project is not a mining project, mine residue planning has been taken into account as part of project planning given that a slag dump and baghouse slurry disposal facility will be developed.

This document has been prepared strictly in accordance with the requirements of the National Environmental Management Act (NEMA) (Act 107 of 1998) and specifically Appendix 3 and 4 of the 2014 EIA Regulations. The relevant criteria are indicated in Table 16.

The environmental assessment and specialist studies have also considered (where relevant) the Equator Principles (June 2013), related IFC Performance Standards (January 2012) and relevant World Bank Group Environmental, Health and Safety (EHS) Guidelines (April 2007).

TABLE 16: EIA AND EMP REPORT REQUIREMENTS IN ACCORDANCE WITH APPENDIX 3 AND 4 OF THE 2014 EIA REGULATIONS

EIA and EMP report requirements as per the 2014 NEMA regulations	Reference in the EIA/EMP report
Appendix 3 of the NEMA regulations	**-**
Details of the EAP who prepared the report.	Section 2.1
Details of the expertise of the EAP, including curriculum vitae.	Section 2 and Appendix B
The location of the activity, including - the 21 digit Surveyor General code of each cadastral land parcel. Where available the physical address and farm name. Where the required information is not available, the coordinates of the boundary of the property or properties.	Section 3
A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken or on land where the property has not been defined, the coordinates within which the activity is to be undertaken	Section 4
A description of the scope of the proposed activity, including all listed and specified activities triggered.	Section 4.1
A description of the scope of the proposed activity, including all listed and specified activities triggered and being applied for and a description of the associated structure and infrastructure related to the development	Section 4.2
A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context	Section 5
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 6
A motivation of the preferred development footprint within the approved site including	Section 10
A full description of the process followed to reach the proposed development footprint within the approved site	Section 10
Details of all the alternatives considered.	Section 10
Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs.	Section 7
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 7.2 and 10
The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.	Section 8 and 10
The impacts and risks identified, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts can be reversed, may cause irreplaceable loss of resources and can be avoided, managed and mitigated.	Section 9

EIA and EMP report requirements as per the 2014 NEMA regulations	Reference in the EIA/EMP report
The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks.	Section 9
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 9 and 10
The possible mitigation measures that could be applied and level of residual risk.	Section 9 and 26
If no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such.	Not relevant
A concluding statement indicating the preferred alternatives, including preferred location within the approved site.	Section 10
A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structure and infrastructure will impose on the preferred location through the life of the activity including a description of all environmental issues and risks that were identified during the environmental impact assessment process and an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.	Section 10
An assessment of each identified potentially significant impact and risk including cumulative impacts, the nature, significant and consequence of the impact and risk, the extent and duration of the impact and risk, the probability of the impact and risk occurring, the degree to which the impact can be reversed, the degree to which the impact and risk may cause irreplaceable loss of a resources and the degree to which the impact and risk can be mitigated.	Section 9
Where applicable the summary of the findings and recommendations of any specialist report complying with Appendix 6 of these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.	Section 11 and Appendix E to Appendix T
An environmental impact statement which contains a summary of the key findings of the environmental impact assessment, a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers and a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives	Section 12
Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation	Section 13
The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment	Section 10
Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation	Section 14
A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed	Section 15
Reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation	Section 16
Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised	Section 17
An undertaking under oath or affirmation by the EAP in relation to the correctness of the information provided in the reports, the inclusion of comments and inputs from stakeholders and IAPs, the inclusion of inputs and recommendations from the specialist reports where relevant and any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or	Section 18

EIA and EMP report requirements as per the 2014 NEMA regulations	Reference in the EIA/EMP report
inputs made by interested or affected parties	
Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts	Section 19
An indication of any deviation from the approved scoping report, including the plan of study, including any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and a motivation for the deviation	Section 20
Any specific information required by the competent authority.	Section 21
Any other matter required in terms of section 24(4)(a) and (b) of the Act.	Section 22
Appendix 4 of the NEMA regulations	-
Details of the EAP who prepared the EMPr and the expertise of that EAP to prepare the EMPr, including a curriculum vitae	Section 23
A detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description	Section 24
A map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers	Section 25
A description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including planning and design, pre-construction activities, construction activities, rehabilitation of the environment after construction and where applicable post closure; and where relevant, operation activities	Section 26
A description and identification of impact management outcomes required for the aspects contemplated in paragraph	Section 26
A description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes be achieved, and must, where applicable, include actions to avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; comply with any prescribed environmental management standards or practices; comply with any applicable provisions of the Act regarding closure, where applicable comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable.	Section 26
The method of monitoring the implementation of the impact management actions	Section 27
The frequency of monitoring the implementation of the impact management actions	
An indication of the persons who will be responsible for the implementation of the impact management actions	
The time periods within which the impact management actions must be implemented	
The mechanism for monitoring compliance with the impact management actions	

EIA and EMP report requirements as per the 2014 NEMA regulations	**Reference in the EIA/EMP report**
A program for reporting on compliance, taking into account the requirements as prescribed by the Regulations	
An environmental awareness plan describing the manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work; and risks must be dealt with in order to avoid pollution or the degradation of the environment	Section 28
Any specific information that may be required by the competent authority	Section 29

6 NEED AND DESIRABILITY OF THE PROPOSED PROJECT

The need and desirability of the proposed project is described below. This section has been compiled taking into account the need and desirability guidelines in terms of the 2014 Environmental Impact Assessment Regulations (Regulation 891 of 2014).

6.1 ECOLOGICAL SUSTAINABLE DEVELOPMENT AND USE OF NATURAL RESOURCES

Due to the nature of beneficiation/processing projects, impacts on sensitive biodiversity areas, linkages between biodiversity areas and related species and the role that they play in the ecosystem are possible. The proposed project also has the potential to directly disturb vegetation, vertebrates and invertebrates. In addition to this, soil is a valuable resource that supports a variety of ecological functions. The proposed project has the potential to damage soil resources through physical disturbance and/or contamination, which has a direct impact on the potential loss of the natural capability of the land.

As part of the proposed project, independent biodiversity and soil specialists were appointed to determine the sensitivity of the proposed project area. In this regard, although a large portion of the the proposed project area has been transformed by agricultural grazing and cultivation, it does include areas of high biodiversity sensitivity as well as protected tree species *Vachellia erioloba* (Camel Thorn) and *Boscia albitrunca* (Shepherd's Tree) (refer to Section 8.1.6 for further information), which may be impacted as part of the proposed project (Refer to Appendix F for the detailed assessment). Linked to this, is the loss of soil functionality and related land capability as an ecological driver for vegetation and ecosystems that rely on soil (Refer to Appendix E for the detailed assessment).

Measures that were considered to avoid the destruction and disturbance of biodiversity and the loss of soil resources included limiting the project footprint to what was absolutely necessary. In this regard and with reference to Sections 8, 9 and 10, planned infrastructure has been positioned within close proximity to the primary incoming source of chrome concentrate (i.e. Union Section Mine). This allows for the eastern section of the relevant farm portion to remain undisturbed by activities associated with the proposed project (with the exception of the limited impacts associated with the proposed powerline). In addition, proposed smelter complex infrastructure has been planned outside of sensitive biodiversity areas and outside of the relevant floodlines of the non-perennial Brakspruit tributary (the closest watercourse located to the east of the proposed infrastructure). Only the incoming powerline will cross watercourses. Where the removal of protected trees can not be completely avoided, mitigation measures that focus on ensuring ecological sustainability will be implemented.

Other mitigation measures focus on investigating a third party market for the slag and baghouse dust material to allow for this this material to be re-used/reclaimed (this is in line with the DEA's national drive towards limiting permanent disposal of waste to land) so that the disposal facilities do not remain on-site post closure and the area can be restored to its pre-project land use of cropping and grazing.

6.2 PROMOTING JUSTIFIABLE ECONOMIC AND SOCIAL DEVELOPMENT

The proposed project will result in positive socio-economic impacts (refer to Appendix O for the detailed assessment). In this regard, the proposed development of the project supports the national economy at a macro level by generating exports that will leverage foreign income to the country. Direct economic benefits will be derived from wages, taxes and profits. Indirect economic benefits will be derived from the procurement of goods and services and the spending power of employees. This is in line with the Thabazimbi Local Municipality Spatial Development Framework (TLM, September 2014) which identifies the promotion of mineral processing related job creation as one of the strategies to guide spatial development within the local municipality given that mining and mineral processing form the backbone of employment and is an important source of income within the local municipality. Further to this, through employment (700 jobs during construction and 280 jobs during operation), persons at the proposed smelter operation will gain skills in the construction and operation of a smelter which contributes to the building of the nation. Management measures that will be implemented to further enhance positive socio-economic impacts include the employment of people in local communities (as far as possible), formal bursary and skills development provided to people in the closest communities and the implementation of a procurement mentorship programme which provides support to local businesses.

Further to this, the proposed development will also ensure local economic development through the implementation of projects.

Due to the expectation of employment associated with processing and beneficiation projects there is a potential for negative socio-economic impacts to occur (refer to Appendix P for the detailed assessment). In this regard, there is potential for an influx of job seekers to the area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security. Management measures that will be implemented to manage and remedy these impacts include the implementation of a health policy on HIV/AIDs and tuberculosis, working together with local and regional authorities to address social service constraints and to monitor and prevent the development of informal settlements. In addition to this, no housing will be established on-site and formal communication structures and procurement procedures will be developed (refer to Section 9.1.17 and 26).

7 DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED

This section describes the information provided to landowners and occupiers, adjacent landowners and occupiers, communities in the broader area, regulatory authorities and other interested and affected parties (IAPs) to inform them in sufficient detail of what the proposed project will entail, in order for them to assess what impact the operation will have on them.

7.1.1 DATABASE

The proposed project's public involvement database was developed by sourcing IAPs details relating to immediate landowners and adjacent landowners by means of a deed search. This information was verified during social scans including site visits in the surrounding area, networking and direct consultation with IAPs. In addition to this, the project's public involvement database was supplemented with information on IAPs provided in the scoping and focused meetings. A copy of the project's public involvement database is included in Appendix D. The database will be updated on an on-going basis throughout the environmental process.

7.1.2 BACKGROUND INFORMATION DOCUMENT (BID)

A Background Information Document (BID) was compiled in both English and Setswana and distributed by hand (at the scoping meetings) and sent via email to IAPs and regulatory authorities on the project's public involvement database. The purpose of the BID was to inform IAPs and regulatory authorities about the proposed project, the environmental assessment process, the current status of the environment, possible environmental impacts, and means of providing input into the environmental assessment process. Attached to the BID was a registration and response form, which provided IAPs with an opportunity to submit their names, contact details and comments on the project. A copy of the BID is provided in Appendix D.

7.1.3 REGULATORY AUTHORITIES NOTIFICATIONS

Regulatory authorities and stakeholders were informed in writing of the proposed project. Proof of this notification is provided in Appendix D. The following regulatory authorities, agencies and institutions responsible for the various aspects of the environment, land and infrastructure that may be affected by the proposed project were notified:

- National Department of Environment Affairs (DEA)
- Department of Water and Sanitation (DWS)
- Department of Economic Development, Environment and Tourism (LEDET)
- Department of Agriculture, Forestry and Fisheries (DAFF)
- South Africa Heritage Resource Agency (SAHRA)

- Department of Rural Development and Land Reform (DRDLR)
- Department of Public Works, Roads and Transport (DPWRT)
- Thabazimbi Local Municipality
- Waterberg District Municipality
- Moses Kotane Local Municipality
- Bojanala District Municipality
- Ward Councillor (Ward 5)
- Parastatals:
    - Telkom
    - Transnet
    - Eskom
- Non-government organisations:
    - None identified
- Others:
    - Landowners and land users
    - Surrounding mines

7.1.4 SITE NOTICES AND ADVERTISEMENTS

Site notices in English and Setswana were placed at key conspicuous positions in and around the proposed project area and block advertisements were placed in the Sowetan and Kwevoel newspapers on Friday 3rd July 2015. Photographs of the site notices and copies of the newspaper advertisements are provided in Appendix D.

7.1.5 SCOPING/FOCUSED MEETINGS – IAPS AND REGULATORY AUTHORITIES

IAPs were notified of the public meeting in the following manner:

- Telephonic discussions and emails to notify IAPs of the proposed date for the public meetings (Appendix D).
- Advertisements placed in the Sowetan and Kwevoel newpspapers (Appendix D).
- Site notices placed in and around the proposed project site (Appendix D).

Regulatory authorities were notified of the regulatory authorities meeting in the following manner:

- Telephonic discussions to notify regulatory authorities of the proposed date for the authorities meeting.
- Formal invitations to the regulatory authorities meeting sent via email (Appendix D).

The following public/focused scoping and regulatory authority meetings were held for the proposed project:

- Four public scoping meetings were held between 21 and 23 July 2015. These were held at the community of Mantserre (Community Hall), the community of Kwetsheza (Lekgotla Meeting Area), Northam Town Hall and at the Swartklip town Recreational Club. Meeting attendance registers and minutes are provided in Appendix D.
- One regulatory authorities meeting was held on 23 July 2015 at the Swartklip Recreation Club. The meeting attendance register and minutes are provided in Appendix D.
- One scoping meeting was planned with the community of Sefikile. Due to internal politics within the community, this meeting was cancelled and SLR engaged in a focused manner with the Sefikile leadership. The Sefikile leadership were provided a copy of the BID as well as the presentation presented at the public scoping meetings. Proof is included in Appendix D.
- One focused meeting was held on 26 May 2016 at the home of Mr Johan Young (owner of Portion 9 of Kameelhoek). The meeting attendance register and minutes are provided in Appendix D.

The purpose of the abovementioned meetings was as follows:

- To provide an overview of the proposed project and alternatives.
- To provide an overview of the environmental assessment process that will be undertaken for the proposed project.
- To provide an overview and obtain input on the existing status of the environment.
- To outline and obtain input on potential impacts identified for the proposed project.
- To record any comments and issues raised. These issues and concerns will be used to inform the plan of study for the EIA Phase.
- Agree on the way forward and the logistics for report distribution.

In addition to the above, SLR also held the following meetings with the DEA:

- One pre-application meeting with the DEA Integrated Permitting Department was held on 24 February 2016. The meeting attendance register and minutes are provided in Appendix D.
- One meeting with the DEA Waste Directorate was held on 14 April 2016. The meeting attendance register and minutes are provided in Appendix D.

7.1.6 REVIEW OF THE SCOPING REPORT

The scoping report was made available for public and regulatory authority review from **7 April to 10 May 2016**. Hard copies of the scoping report were available for public review at the following venues:

- Thabazimbi Local Municipality
- Waterberg District Municipality
- Northam public library

- Kwetsheza community (home of ward councillor)
- Mmantserre community (home of ward councillor)
- Sefikile community (Mr Mataboge c/o BBKTA)
- Swartklip recreation centre
- SLR's offices in Johannesburg

In addition, scoping reports were available electronically on a CD, on request.

Summaries of the scoping report were sent by e-mail to all IAPs and authorities that are registered by email on the public involvement database. Communities received hard copies of summary documents and community leaders received hard copies of the scoping report (for members of the community wishing to review the full report). IAPs were notified via SMS when the draft scoping report was available for review. Proof of submission of the scoping reports to the public review venues above, in addition to the summary document is provided in Appendix D.

The scoping report that was subjected to public and regulatory authority review was updated with any comments received during the review period. In order to provide adequate time to address comments/input received from the DEA Waste Directorate, the DEA granted an eight week extension to timeframes in accordance with Regulation 3(7) of Chapter 2 of the Environmental Impact Assessment Regulations, 2014). Following this, the updated scoping report was made available to the DEA for consideration on 8 July 2016.

7.1.7 REVIEW OF THE EIA AND EMP REPORT

The EIA and EMP report will be made available for public and regulatory authority review from **4 November 2016 to 5 December 2016**. Full copies of the EIA and EMP report will be made available for public review at the same venues that the scoping report was made available (Section 7.1.6). Electronic copies of the EIA and EMP report will be made available on request.

Summaries of the EIA and EMP report will be sent by post or e-mail to all IAPs and authorities that were registered on the public involvement database. In addition, IAPs will be notified when the scoping report is available for review via SMS.

7.2 SUMMARY OF ISSUES RAISED BY IAPS

A summary of the issues and concerns raised by IAPs and regulatory authorities including an indication of the manner in which the issues were incorporated has been included in the Comments and Response report included in Appendix C. In summary, issues raised related to:

- Technical issues.

- Procedural issues.
- Ground and surface water issues.
- Biodiversity issues.
- Air Quality issues (including health issues).
- Noise related issues.
- Blasting issues.
- Land use issues.
- Soils impact issues.
- Waste issues.
- Visual impact issues.
- Traffic safety issues.
- Heritage issues.
- Socio-economic issues.

8 ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE PROJECT AND ALTERNATIVES

The baseline information provided below is aimed at giving the reader perspective on the existing status of the cultural, socio-economic and biophysical environment. Where appropriate it includes the detail derived from the specialist reports and other research undertaken for the EIA. It should be noted that the information below on the environmental attributes associated with the project is provided for the considered project alternatives (smelter complex area, powerline and access road alternatives) and is referred to collectively as the site alternatives area, unless otherwise indicated.

8.1 BASELINE ENVIRONMENT AFFECTED BY THE PROPOSED ACTIVITY

8.1.1 GEOLOGY

INTRODUCTION AND LINK TO IMPACT

As a baseline, the geology and associated structural features provides a basis from which to understand:

- The potential for sterilisation of mineral reserves
- The geochemistry and related potential for the pollution of water from mineralised waste facilities
- The related potential for geological lineaments such as faults and dykes. Faults, dykes and other lineaments can act as preferential flow paths of groundwater which can influence the dispersion of potential pollution plumes.

Geological processes also influence soils forms (see Section 8.1.4) and the potential for palaeontological resources (see Section 8.1.13).

To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from the groundwater study (SLR, September 2016) included in Appendix H and the geochemistry study (SLR, August 2016) included in Appendix Q.

Geochemical analysis was undertaken on different materials (slag and baghouse dust) that are likely to be disposed of onto the proposed slag dump and baghouse slurry facility respectively. Since no project specific samples of slag and baghouse dust could be obtained, the slag samples were obtained from Mintek's pilot plant which was set up for the purposes of the project and the baghouse dust sample was obtained from a similar process at Mogale Alloys (Mogale).

RESULTS

<u>Regional geology</u>

The project area lies within the western limb of the Bushveld Igneous Complex (BIC), a large, pear-shaped, layered intrusion, located within the Limpopo Province. The BIC includes the Rustenburg Layered Suite (RLS); a sequence of layered mafic intrusions, comprising gabbros, norites, anorthosites and pyroxenites.The RLS is rich in reserves of platinum group metals (PGM), chromium and vanadium, which are exploited in the region. The orebodies within the BIC include the chromite rich Upper Group 2 (UG2) reef and the platinum-bearing Merensky Reef. A generalised stratigraphic column for the RLS, showing the key sub-divisions, as accepted by the South African Committee for Stratigraphy (SACS, 1980), as cited in (Johnson *et al*, 2006) is presented in Table 17.

TABLE 17: GENERALISED STRATIGRAPHIC COLUMN (JOHNSON *ET AL* (2006))

Suite	Standard Zonal Subdivision		Western Limb Nomenclature as be SACS (1980)	
Rustenburg Layered Suite	Upper Zone (Ferro-gabbroic)	Subzone C: Olivine - Apatite diorite		Bierkraal Magnetite Gabbro
		Subzone B: Olivine - Magnetite Gabbro-norite		
		Subzone A: Magnetite gabbro-norite		
	Main Zone (Gabbro-nortitic)	Upper \ subzone: gabbro-norite		Pyramid Gabbronorite
		Lower Subzone: Gabbro-norite		
	Critical Zone (ultramafic to mafic)	Upper Subzone: norite, anorthosite, pyroxenite	Schilpadnesy Sub-suite	Mathlagame Nortie Anorthosite
		Lower subzone: pyroxenite		Ruighoek Bronzite
	Lower Zone (ultramafic)	Upper Pyroxenite Subzone	Vlakfontein Sub-suite	Tweelaagte Bronzite
		Harzburgite Subzone		Groenfontein Harzburgite
		Lower Pyroxenite Subzone		Makgope Bronzite
				Eerlyk Bronzite
	Marginal Zone (noritic)	Norites		Kroondal Norite
				Kolobeng Norite

<u>Local and operational geology</u>

An extract of the 1:250,000 geological map of the Siyanda Project Area (2426 – Thabazimbi) is presented as Figure 11. The key formations/lithologies identified in the figure are:

- Bierkraal Magnetite Gabbro
- Pyramid Gabbro-norite
- Mathlagame Norite-anorthosite

Characteristics of the three formations/lithologies are presented in Table 18.

TABLE 18: CHARACTERISTICS OF THE MAIN ROCK TYPES FOUND AT SIYANDA

Rock Type	Characteristics
Gabbro	• Basic rock • Coarse grained • Dark in colour • Pyroxene, plagioclase, minor amphibole and olivine • Pyroxene tends to be clinopyroxene
Norite	• Basic rock • Coarse grained

	• Dark in colour • Pyroxene plagioclase, minor amphibole and olivine • Pyroxene tends to be orthopyroxene (high Mg and Fe)
Anorthosite	• Basic rock • Coarse grained • Light in colour • Plagioclase feldspar (>90%)

The geological setting of the proposed project area is shown in Figure 11. Information on existing mineral right and prospecting right holders is included in Section 8.1.15. In summary, it is understood from information provided to SLR that no known mineral resources are associated with the farm portions on which the preferred alternatives for infrastructure are proposed. The only known ore body located within the site alternatives area is a chrome outcrop which traverses portion 6 and 7 of Nooitgedacht and portion 3 of Kameelhoek (associated with access road alternative 3). From information provided to SLR, this mining right is held by BCR mining. BCR Mining is registed in the project's stakeholder database.

FIGURE 11: LOCAL GEOLOGICAL SETTING OF THE PROPOSED PROJECT AREA

Geochemistry analysis – acid base accounting (ABA) for slag and baghouse dust

Acid Base Accounting (ABA) is an internationally accepted analytical procedure that was developed to screen the acid-producing and acid-neutralizing potential of material. A total of four samples (three slag samples from a representaqtive pilot plant and one baghouse dust proxy sample) were tested to determine the potential acid drainage potential associated with these materials. The ABA results are provided in Table 19 (SLR, August 2016).

The ABA results show that the total sulphur content of all three slag samples is reasonably low which suggests that the samples have limited potential to generate acid (classified as Non-Potentially Acid Generating (Non-PAG)). In addition, the neutralising potential ratio (NPR) of all slag samples is above 2, which implies all samples have sufficient neutralising potential to offset the low acid generation potential. The paste pH for all three slag samples was alkaline and indicates that there is negligible potential for the generation of short-term acidity.

The ABA results for the baghouse dust sample show that the total sulphur content was relatively elevated (1.8%), indicating potential to generate acid (classified as PAG), although the paste pH was neutral and indicates that there is negligible potential for the generation of short-term acidity. In addition, the NPR for this sample was below 1 which suggests that the sample has insufficient neutralising potential to offset the acid potential.

It is noted that the acid potential calculations have been based on total sulphur. Some of the sulphur in a sample may be present in non-acid producing sulphates or native sulphur. If a significant part of the total sulphur occurs as sulphate sulphur instead of potentially acid generating sulphide sulphur, the overall risk of acid generation is reduced. These results, based on total sulphur concentrations are therefore conservative. If necessary, additional testing of the actual waste sample for the presence of sulphide sulphur can be undertaken once these samples are available (SLR, August 2016).

TABLE 19: ACID BASE ACCOUNTING RESULTS FOR THE SIYANDA MINERALISED WASTE SAMPLES (SLR, AUGUST 2016)

Sample ID	Paste pH	AP (kg/t)	NP (Kg/t)	NNP (NP-AP)	NPR (NP : AP)	Total Sulphur (%)	Classification
Criteria	***>5.5 (Non-PAG)***	**-**	**-**	***NNP>0 (Non-PAG)***	***>2 (Non-PAG) 1-2 (Inconclusive) <1 (PAG)***	**-**	**-**
SLAG Tap 42	11.4	4.06	57	53	14	0.13	Non-PAG
SLAG Tap 75	10.6	3.44	19	15	5.39	0.11	Non-PAG
SLAG Tap 82	10.1	4.06	12	7.48	2.84	0.13	Non-PAG
Mogale DC Baghouse Dust	7.2	56	8.2	-48	0.146	1.8	PAG

Note: PAG refers to Potentially Acid Generating and Non-PAG refers to Non Potentially Acid Generating

Geochemistry analysis – mineralogy of slag and baghouse dust

The slag samples were submitted for mineralogical analysis. The key minerals of each of the three slag samples are:

- Spinel: A magnesium/aluminium mineral found as a metamorphic mineral, and also as a primary mineral in rare mafic igneous rocks. In these igneous rocks, the magmas are relatively deficient in alkalis relative to aluminium, and aluminium oxide may form as the mineral corundum or may combine with magnesia to form spinel.
- Forsterite: Magnesium rich mineral associated with igneous and metamorphic rocks.
- Diopside: Pyroxene mineral found in ultramafic igneous rocks.
- Akermanite-Gehlenite: Soro-silicates associated with extreme temperature and typically found in glassy blast furnace slag.

The crystalline mineralogy of the slag samples is detailed in Table 20 below.

TABLE 20: MINERAL COMPOSITION (%) OF THE SLAG SAMPLES

Mineral	Formula	SLAG Tap 42	SLAG Tap 75	SLAG Tap 82
Spinel	$MgAl_2O_4$	33.06	57.16	59.3
Forsterite	Mg_2SiO_4	24.14	35.58	38.61
Diopside	$MgCaSi_2O_6$	28.64	7.26	2.09
Akermanite-Gehlenite	$Ca_2Mg(Si_2O_7)$ to $Ca_2Al(AlSiO_7)$	14.16	-	-

The baghouse dust sample was submitted for mineralogical analysis. The key minerals of the baghouse dust sample are:

- Chromite: Iron chromium oxide mineral.
- Zincite: Zinc oxide mineral. Synthetic zincite crystals are available as a by-product of zinc smelting. This can be due to iron and manganese dopants, and associated with willemite and franklinite.
- Forsterite: Magnesium rich mineral associated with igneous and metamorphic rocks.

The crystalline mineralogy of the baghouse dust sample is detailed in Table 21 below.

TABLE 21: MINERAL COMPOSITION (%) OF THE BAGHOUSE DUST SAMPLE

Mineral	Formula	Mogale DC Baghouse Dust
Chromite	$FeCr_2O_4$	37.35
Zincite	ZnO	26.8
Forsterite	Mg_2SiO_4	22.86
Willemite	Zn_2SiO_4	6.32
Gordaite	$NaZn_4(SO_4)(OH)_6Cl\cdot 6H_2O$	3.46
Wurtzite	$(Zn,Fe)S$	3.21

The baghousee dust sample does contain a sulphide mineral (wurtzite) as indicated by the results of the ABA testing. This is similar to sphalerite with an iron content that is variable but can be up to 8%. Acid generation usually occurs when the metal to sulphur ratio is less than one (e.g. FeS_2), and does not occur when the metal sulphur ratio is equal to one (e.g. ZnS). If the iron content is low in the wurtzite then it is less likely it will form acidic drainage. Therefore it is recommended that once the baghouse dust waste stream is generated by the operational project and additional sampling and analysis is undertaken, the sulphide and iron content is re-assessed.

Geochemistry analysis – Leachate potential of slag and baghouse dust

Synthetic Precipitation Leaching Procedure (SPLP) is a laboratory extraction method designed to determine the leachability of both organic and inorganic elements present in liquids, soils, and wastes under certain conditions. Leach test results are not an indicator of drainage quality as the conditions of the test do not represent actual field conditions. Therefore, leachate concentrations are not representative of seepage or run-off that could emanate from site. However, the results may indicate chemicals of potential concern (copc) in drainage from the waste facilities (SLR, August 2016).

As a preliminary screening to identify copc, the leachates were compared to the following relevant water quality standards:

- South African National Standard (SANS) 241: 2015 Limits for Drinking Water. Note that the application of drinking water guidelines does not suggest that leachates and drainage from processing activities will be used for drinking purposes.
- Department of Water Affairs and Forestry (DWAF) (2009) Target Water Quality Range for Livestock Watering.

Results for all four samples, as presented in Table 22 below show:

- The concentrations of the majority of elements are low in all samples, with many below the laboratory detection limit.
- Higher concentrations of elements are generally recorded in the baghouse dust sample.
- Aluminium (Al) is identified as a copc in one slag sample (Slag Tap 42).
- Manganese (Mn), lead (Pb), zinc (Zn) and sulphate (SO_4) are identified as copc in the baghouse dust sample. This is consistent with the mineralogy of the sample.

TABLE 22: LEACHATE RESULTS FOR THE PROPOSED PROJECT (SLR, AUGUST 2016)

Element (mg/L)	DWAF TWQR (2009)	SANS 241 (2015)				Siyanda Samples			
	Livestock Watering	Operational	Aesthetic	Acute Heath	Chronic Health	SLAG Tap 42	SLAG Tap 75	SLAG Tap 82	Mogale DC BHD

Element (mg/L)	DWAF TWQR (2009)	SANS 241 (2015)				Siyanda Samples			
	Livestock Watering	Operational	Aesthetic	Acute Heath	Chronic Health	SLAG Tap 42	SLAG Tap 75	SLAG Tap 82	Mogale DC BHD
Ag						<0.010	<0.010	<0.010	<0.010
Al	0-5	0.3				0.71	0.14	<0.010	<0.010
As	0-1				0.01	<0.010	<0.010	<0.010	<0.02
Au						0.034	<0.010	<0.010	0.019
B	0-5				2.4	<0.010	<0.010	<0.010	0.037
Ba					0.7	0.025	<0.010	<0.010	0.053
Be						<0.010	<0.010	<0.010	<0.010
Bi						<0.010	<0.010	<0.010	<0.010
Ca	0-1000					8.80	1.06	0.010	38.00
Cd	0-0.01				0.003	<0.010	<0.010	<0.010	<0.010
Co	0-1				0.5	<0.010	<0.010	<0.010	<0.010
Cr					0.05	<0.010	<0.010	<0.010	<0.010
Cr VI	0-1					<0.010	<0.010	<0.010	<0.010
Cu	0-0.5				2	<0.010	<0.010	<0.010	<0.010
Fe	0-10		0.3		2	<0.010	<0.010	<0.010	<0.025
Hg					0.006	<0.001	<0.001	<0.001	<0.001
K						0.033	<0.010	<0.010	114
Li						<0.010	<0.010	<0.010	0.013
Mg	0-500					1.49	0.79	0.084	36.00
Mn	0-10		0.1		0.4	<0.010	0.059	<0.010	0.89
Mo	0-0.01					<0.010	<0.010	<0.010	<0.010
Na	0-2000		200			<0.010	<0.010	<0.010	96.00
Ni	0-0.1				0.07	<0.010	<0.010	<0.010	0.013
P						<0.010	<0.010	0.010	<0.010
Pb	0-0.1				0.01	<0.010	<0.010	<0.010	0.10
Sb					0.02	<0.010	<0.010	<0.010	<0.010
Se	0-50				0.04	<0.010	<0.010	<0.010	0.016
Si						2.38	0.63	0.097	<0.2
Sn						<0.010	<0.010	<0.010	<0.010
Sr						0.036	<0.010	<0.010	0.52
Ti						0.017	<0.010	<0.010	0.075
U					0.03	<0.010	<0.010	<0.010	<0.010
V	0-1				0.2	<0.010	<0.010	<0.010	<0.010
W						<0.010	<0.010	<0.010	<0.010
Zn	0-20		5			<0.010	<0.010	0.012	32.00
pH (pH unit)		5 - 9.7				7.6	7.2	6.3	6.5
EC (mS/m)			170			6.00	1.40	0.40	161
TDS			1200			26.00	<10	<10	1002
Total Alkalinity as $CaCO_3$						24.00	8.00	<5	<5
Cl	0-1500		300			6.00	<5	<5	219.0
SO_4	0-1000		250	500		<5	<5	<5	389
NO_3- N	0-100			11		<0.2	<0.2	<0.2	0.50
F	0-2				1.5	<0.2	<0.2	<0.2	1.30
Total CN				0.2		<0.01	0.010	<0.01	<0.01

CONCLUSION

Where new infrastructure is placed within close proximity to mineable ore there is the possibility that sterilisation can occur. Since the only known ore body underlies access road alternative 3 and this is not the preferred access road alternative for the project, it is not expected that any sterilisation of minerals will occur.

Geochemical tests and analysis indicate that the proposed slag to be disposed of onto the slag dump is non-acid generating however there is a potential for seepage concentrations to exceed the SANS 241 (2011) Drinking Water limits for aluminium (Al). This was observed in only one of the three slag samples. The baghouse dust to be disposed of onto the proposed baghouse slurry facility has significant potential to generate acid although the paste pH was neutral and indicates that there is negligible potential for the generation of short-term acidity. In addition manganese (Mn), lead (Pb), zinc (Zn) and sulphate (SO_4) are identified as copc in the proxy baghouse dust sample. This is consistent with the mineralogy of the sample.

8.1.2 TOPOGRAPHY

INTRODUCTION AND LINK TO IMPACT

Changes to topography through the development of the proposed project may impact on surface water drainage (Section 8.1.7), visual aspects (Section 8.1.11) and the safety of both people and animals. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from site visits undertaken by the EIA team.

RESULTS

The topographic relief within the site alternatives area can be described as gently sloping towards the east or south-east. Topographic elevation varies between 988 to 1002 metres above mean sea level (mamsl). This gently sloping topography is uninterrupted, with the exception of watercourses (Phufane, Brakspruit and two unnamed tributaries which flow through the site alternatives area), altering the topography slightly (Figure 2).

It is important to note that the natural topography of the proposed project area (where the proposed smelter complex will be located) has largely been disturbed by historical cropping (Figure 2). No excavations or other hazardous infrastructure is currently on the proposed project site.

CONCLUSION

The project and associated infrastructure has the potential to alter the topography and the natural state of areas. An alteration of the natural topography through the establishment of hazardous excavations and infrastructure has the potential to present physical dangers to both animals and people that have access to the infrastructure sites.

8.1.3 CLIMATE

INTRODUCTION AND LINK TO IMPACT

Climate can influence the potential for environmental impacts and related project design. Specific issues are listed below:

- Rainfall could influence erosion, evaporation, vegetation growth, rehabilitation planning, dust suppression, and surface water management planning.
- Temperature could influence air dispersion through impacts on atmospheric stability and mixing layers, vegetation growth, and evaporation which could influence rehabilitation planning.
- Wind could influence erosion, the dispersion of potential atmospheric pollutants, and rehabilitation planning.

To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from the surface water study (SLR, September 2016) included in Appendix G and the air quality study (Airshed, September 2016) included in Appendix I.

Suitable records of rainfall recorded for the project area are not available and as such rainfall data from the following sources was reviewed to characterise rainfall patterns at the site:

- The Daily Rainfall Extraction Utility programme (Middelkop and Northam stations).
- Water Resources of South Africa 2005 Study (WR2005).

Monthly evaporation data was obtained from the Water Resources of South Africa manual (WR2005, 2009).

RESULTS

<u>Regional climate</u>

The proposed site alternatives area falls within the Highveld Climatic Zone, as defined by the South African Weather Bureau. The region is characterised by seasonal rainfall, hot temperatures in summer, and colder temperatures in winter.

Rainfall, rainfall depths and wettest periods

The rainfall data extracted using the Daily Rainfall Extraction Utility programme includes the Middelkop station (0587139 W) and the Northam station (0587477 W). This data is presented in Table 23 alongside monthly average rainfall data obtained from the Water Resources of South Africa manual, (WR2005, 2009).

TABLE 23: SUMMARY OF MONTHLY RAINFALL DATA FOR THE PROPOSED SITE ALTERNATIVES AREA (SLR, SEPTEMBER 2016)

Month	Rainfall (mm)		
	Middelkop (0587139 W)	Northam (0587477 W)	WR2005
January	119	117	106.4
February	96	82	92.9
March	83	81	79.6
April	48	35	40.7
May	20	8	13.8
June	8	2	6.3
July	6	1	3.6
August	4	2	4.9
September	15	16	13.7
October	48	51	46.2
November	84	81	79.6
December	106	95	104.1
Annual	**639**	**571**	**592**

The adopted Mean Annual Precipitation (MAP) for the site alternatives area was obtained from the Northam station which totals 571 mm. It is located fairly close to the site alternatives area (approximately 8 km), and falls within the quaternary boundary of A24E and is a more complete rainfall record than Middelkop.

A review of the daily rainfall records from the Northam rain gauge illustrates that the maximum rainfall depth within one day between 1968 and 2000 was 163 mm. Several other high rainfall depths are also shown in Table 24 (SLR, September 2016).

TABLE 24: FIVE GREATEST DEPTHS OF RAINFALL RECORDED IN 1 DAY (SLR, SEPTEMBER 2016)

Date	Rainfall (mm)
17/12/1995	163.0
11/03/1969	130.5
05/11/1994	104.0
16/02/1978	99.0
09/03/1997	95.0

A review of the wettest multi-day periods recorded is presented in Table 25 which shows the maximum depth of rain falling over consecutive days ranging from 1 to 30 days. As can be seen, the greatest depth of rain falling within a 30 day period was 512 mm which is almost 90 percent of the adopted MAP, whilst the greatest depth within a 180 day period was 892 mm which is over one and a half times the MAP. It is concluded that whilst MAP in this area is fairly low there has been significant rainfall on occasions (SLR, September 2016).

TABLE 25: WETTEST PERIODS RECORDED ON CONSECUTIVE DAYS (SLR, SEPTEMBER 2016)

Number of consecutive days	Total depth of rainfall (mm)
1	163.0
2	163.2
3	173.2
4	202.0
5	241.0
6	241.0
7	241.0
15	271.0
30	512.0
60	679.5
120	823.0
180	892.0

<u>Evaporation</u>

Monthly evaporation data was obtained from the Water Resources of South Africa manual, (WR2005, 2009). The project area lies within evaporation zone 3A, which has a total Mean Annual Evaporation (MAE) of 1801 mm. The evaporation obtained is based on Symons pan evaporation measurements and needs to be converted to Lake evaporation. This is due to the Symons pan being located below the ground surface, and painted black which results in the temperature in the water being higher than of a natural open water body. The Symons pan is then multiplied by a lake evaporation factor[1] to obtain the adopted Lake evaporation. Below in Table 26 is a summary of the adopted evaporation for the project area (SLR, September 2016). MAE exceeds precipitation.

TABLE 26:SUMMARY OF EVAPORATION DATA (SLR, SEPTEMBER 2016)

Months	Symons pan evaporation (mm)	Lake evaporation factor	Lake evaporation (mm)
January	201.7	0.84	169.4
February	165.7	0.88	145.8
March	153.1	0.88	134.7
April	114.9	0.88	101.1
May	91.3	0.87	79.4
June	71.9	0.85	61.1
July	83.2	0.83	69.1

Months	Symons pan evaporation (mm)	Lake evaporation factor	Lake evaporation (mm)
August	122.1	0.81	98.9
September	168.2	0.81	136.3
October	207.5	0.81	168.1
November	207.8	0.82	170.4
December	213.6	0.83	177.3
Total	**1801**	**N/A**	**1512**

Temperature

Minimum, maximum and mean temperatures for the site alternatives area, as obtained from AERMET processed MM5 data, are shown in Table 27.

Average, maximum and minimum temperatures were 20℃, 34℃ and 1℃, respectively. The month of June and July experienced the lowest temperature of 1℃ whereas the maximum temperature of 34℃ occurred in November and January. Temperatures reach their minimum just before sunrise and their maximum between midday and sunset (Airshed, September 2016).

TABLE 27: MONTHLY TEMPERATURE DATA (AIRSHED, SEPTEMBER 2016)

Months	Minimum (º)	Maximum (º)	Average (º)
January	16	34	25
February	17	33	25
March	15	33	23
April	9	29	19
May	5	27	15
June	1	24	12
July	1	22	12
August	2	28	15
September	4	30	19
October	9	32	21
November	12	34	24
December	16	33	25

Wind

Wind roses comprise 16 spokes, which represent the directions from which winds blew during a specific period. The colours used in the wind roses in Figure 12 reflect the different categories of wind speeds; the yellow area, for example, representing winds in between 5 and 6 m/s. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. The frequency with which calms occurred, i.e. periods during which the wind speed was below 1 m/s are also indicated. The data described below is MM5 data as processed by the AERMOD suite's meteorological data pre-processor.

A wind rose for the period January 2012 to December 2014 and day-time and night-time wind roses are shown in Figure 12. The wind field is dominated by winds from the east-south-east. Less frequent winds also occur from the westerly sectors. Calm conditions occur 3% of the time. During the day, winds occur more frequently from the east-south-easterly sector with almost 4% calm conditions. Night-time airflow has less frequent winds from the east-south-easterly sector and at lower wind speeds with winds most frequently occurring from the north-north-easterly sector. The autumn and winter seasons reflect the prevailing wind direction as being from the east-south-east. The spring and summer seasons reflect the prevailing wind direction as from the north-north-east and an increase in winds from the easterly sector (Airshed, September 2016). Winds in excess of 5m/s do occur. It is these winds that are most likely to mobilise and transport wind blown dust particles.

CONCLUSION

The proposed project area is characterised by hot summers and cooler winters with rain generally occurring in the form of thunderstorms at a time during rainy periods. High evaporation rates reduce infiltration, while rainfall events can increase the erosion potential and the formation of erosion gullies. The presence of vegetation does however reduce the effects of erosion. Wind significantly affects the amount of material that is suspended from exposed surface to the atmosphere. The wind speed determines the distance of downward transport as well as the rate of dilution of pollutants in the atmosphere. These climatic aspects need to be taken into consideration during rehabilitation and surface water management planning.

FIGURE 12: PERIOD AVERAGE AND DAY- AND NIGHT-TIME WIND ROSES (AIRSHED, SEPTEMBER 2016)

8.1.4 SOIL

INTRODUCTION AND LINK TO IMPACT

Soils are a significant component of most ecosystems. As an ecological driver, soil is the medium in which most vegetation grows and a range of vertebrates and invertebrates exist. In the context of a smelter project with a fixed life, soil is even more significant if one considers that the project is a temporary land use whereafter rehabilitation (using soil) is the key to re-establishing post closure land capability that will support post closure land uses.

Smelter related activities have the potential to damage soil resources through physical loss of soil and/or the contamination of soils, thereby impacting on the soils' ability to sustain natural vegetation and altering land capability. Contamination of soils may in turn contribute to the contamination of surface and groundwater resources. Loss of the topsoil resource reduces chances of successful rehabilitation and restoration. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from the soils, land use and land capability study for the proposed project (Terra Africa, March 2016) included in Appendix E.

A soil survey was undertaken in order to identify the soil forms located within the site alternatives area. Observations were made regarding soil texture, structure, colour and soil depth. The soil forms were classified using the S.A. Soil Classification Taxonomic System (Soil Classification Working Group, 1991) published as memoirs on the Agricultural Natural Resources of South Africa No.15. In addition to this, samples of the various soil forms were taken in order to determine the chemical composition of the soil forms (Terra Africa, March 2016).

RESULTS

<u>Soil forms</u>

Arcadia soil form (Ar)

Soils of the Arcadia form occur within the majority of the site alternatives area (Figure 13) and is the only soil form found within the preferred smelter footprint location. The vertic A-horizon is calcareous which makes it part of the Rustenburg soil family. These dark brown to black vertic soils have deep A-horizons (60 cm to 150 cm deep) and are high in clay content with swelling-shrinking properties under conditions of water content changes. These expansive materials have a characteristic appearance: structure is strongly developed, ped faces are shiny, and consistency is highly plastic when moist and sticky when wet. The swell-shrink potential is manifested typically by the formation of conspicuous vertical cracks in the dry state and the presence, at some depth, of slickensides (polished or grooved glide planes produced by internal movement). The tendency of vertic soils to alternate from being either too dry and hard or excessively wet and sticky causes the workable period to be very short and in some years almost non-existent. Despite their problematic physical properties vertic soils are extremely fertile chemically.

Most Arcadia soils in the site alternatives area have medium to high agricultural potential. Crop production on these soils may require irrigation although cracks after the dry season make it possible for the soil to “tank up” with spring rain and sustain crops like sunflowers and cotton without irrigation. Some of the most palatable, nutritious (sweet) grazing that allows year-round grazing potential occurs on these soils.

Bonheim soil form (Bo)

The Bonheim soil form is found mostly within the corridors proposed for the linear infrastructure (preferred access road alternative and preferred powerline routing alternative) (Figure 13) with some Bonheim soil form found within the area identified for access road alternative 3. The Bonheim soil form consists of a melanic A horizon (20 cm to 80 cm deep), overlying a pedocutanic B horizon that is distinguished on the basis of an increase in clay as a result primarily of illuviation and accumulation and visually expressed as cutans. These soils are often found in similar topographic positions as vertic soils but commonly are slightly higher upslope. The B horizon of Bonheim soils may have a plasticity index that would qualify it as vertic if it was a topsoil horizon. The melanic A horizon lacks slickensides that are diagnostic of vertic horizons but has structure that is strong enough so that the major part of the horizon is not both massive and hard or very hard when dry. Absence of vertic properties is usually because of either a lower clay content, or a predominance of other clay minerals than the high expansive smectitic clay minerals which are predominant in vertic soils.

The Bonheim soil form is often one of the most productive soils within its climatic area. If irrigation is possible, arable crops, pastures and horticultural crops can be cultivated. The strong structure of the melanic soils is able to withstand repeated cultivation though the low amount of organic matter may become problematic with continuous cultivation. Natural veld on melanic soils provides sweet grazing and ecosystems dominated by melanic soils are highly productive.

Glenrosa soil form (Gs)

The Glenrosa soil form is found to occur to a limited extent only and is found within the footprint of the initial section (approximately 1 km) of access road alternative 3 (Figure 13) which is already built and operational and has therefore already been compromised. The Glenrosa soil form consists of an orthic A horizon underlain by a hard lithocutanic B horizon. The lithocutanic B horizon (distinguished from hard rock by not only consistence and degree of weathering but also tonguing and cutanic character) may itself be 'hard or not hard' (Soil Classification Working Group 1991). To be called hard, more than 70% must be parent rock, fresh or partly weathered with a hard consistence in the dry, moist and wet states. The cutanic character of the B horizon of the Glenrosa soil form may take the form of tongues of topsoil extending into the partly weathered parent rock.

Lithic soils often have better quality and are far more useful than expected because of their shallow nature. Deciduous fruits and vines are often grown on lithic soils under irrigation and forest plantations in higher rainfall regions. Where there are better soils to choose from, Glenrosa soil form soils are avoided for intensive use and left as unimproved veld for grazing. A very shallow layer of topsoil is available for stockpiling for rehabilitation purposes in the area.

Hutton soil form (Hu)

The Hutton soil form is found to occur only in the area identified for the preferred powerline routing (Figure 13). The Hutton soil form consists of an orthic A horizon on a red apedal B horizon overlying unspecified material. The red apedal soils' B1-horizon has more or less uniform "red" soil colours in both the moist and dry states and has weak structure or is structureless in the moist state. The range of red colours that is a key identification tool in differentiating between a red apedal and yellow-brown apedal is defined by the Soil Classification Working Group Book, 1991. The clay content of Hutton soils identified is between 10% and 25%.

Soil depths of the Hutton profiles surveyed ranged between 90 cm and 110 cm with restrictive layers of rock or unspecified material without signs of wetness. Hutton soils with no restrictions shallower than 500mm are generally good for crop production. All Hutton profiles are structureless or have very weakly developed structure. The high quality orthic A and red apedal B-horizons make it a suitable soil form for annual crop production (good rooting medium) and use as 'topsoil', having favourable structure (weak blocky to apedal) and consistence (slightly firm to friable). However, its suitability for crop production will probably be limited by climatic factors like rainfall, temperature and evaporation rate. These topsoils are ideal for stripping and stockpiling for rehabilitation purposes since they are deep and have a favourable structure.

Witbank form (Wb)

The Witbank soil type is found to occur to a very limited extent only and is found within the footprint of access road alternative 3 adjacent to the historic BCR mining area (Figure 13). In South Africa there is currently only one soil form that caters for the anthropic group of soils, namely the Witbank soil form. Anthropic soils are those soils that have been so profoundly affected by human disturbance that their natural genetic character (i.e. their link to the natural factors of soil formation) has largely been destroyed or has had insufficient time to express itself. The Witbank soil form encountered consists of old mining areas where backfilling was done but the topsoil is not yet replaced.

Soil chemical properties

The general chemical properties of the soils located within the proposed site alternatives area are discussed below.

Soil fertility

The pH of the majority of the analysed soil samples in the site alternatives area ranges from 6.0 (medium acid) to 6.5 (slightly acid). For successful crop production, a pH of between 5.8 and 7.5 is optimum and crops produced in soils with lower pH may suffer aluminium (Al) toxicities if toxic levels of Al are present. The danger of Al toxicity in maize only exists when the pH (KCl) is lower than 4.5. Typical of vertic soils the pH of the soils in the project area is mildly acid and there is no need for the pH to be improved by the addition of dolomitic lime or gypsum. The organic carbon is less than 2% as is usually the case with vertic soils.

Phosphorus levels are very low (ranging between 1 mg/kg and 15 mg/kg P). The clay plus silt content in the top 150 mm of the soil ranges between 78% and 91%. For crop production optimum extractable P levels in the soil according to Bray 1 are 14.6 mg/kg for soils with a clay plus silt content of 60% and more. The calcium and magnesium levels are higher than what is adequate for crop plants but is not considered as toxic. The potassium levels are higher than what is considered adequate at all sampling points. The balance between these three cations can be corrected with chemical fertilizer.

The soil chemistry of the samples analysed indicate that soil in the site alternatives area has the chemical suitability for crop production. Intensive annual crop production would however require proper fertilisation as soil nutrients should be balanced and will get depleted.

No serious soil chemical issues such as soil salinity or sodicity occur on site. Where the sodium (Na) concentration is more than 15% of the sum of all cations, crop production may be impaired. However, the sodium concentration at all the sampling points ranges from 0.34% to 2.44% of the cations.

Metal content

Government Notice 331 (GN R.331) provides norms and standards for screening and assessing contaminated sites. Soil screening values (SSVs) are used to determine whether the concentration of constituents present in the soil is high enough to be a potential risk to receptors in the environment.

Soil screening values are defined as follows:

- "Soil Screening Value 1" means soil quality values that are protective of both human health and eco-toxicological risk for multi-exposure pathways, inclusive of contaminant migration to the water resource.
- "Soil Screening Value 2" means soil quality values that are protective of risk to human health in the absence of a water resource.

Since the site alternatives area is located within the quaternary catchment A24E with the Crocodile River as the main river downstream of the proposed site alternatives area, the SSV1 values are appropriate to assess potential soil contamination. When comparing the analysis results of the samples taken within the site alternatives area with SSV1 values which are the strictest values prescribed by the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) it is clear that there are elevated levels of Copper and Manganese present in the samples. During the rehabilitation and closure phases a land contamination assessment must be conducted. The data presented in Table 28 below can be used as a baseline to measure any variances that may occur as a result of project related activities. This is included as a commitment in the EMP in Section 26.

TABLE 28: METAL ANALYSIS OF SOIL SAMPLES AS COMPARED TO SOIL SCREENING VALUES (SSV 1) AS PRESCRIBED IN GN R.331 (TERRA AFRICA, MARCH 2016)

Parameter	Soil (mg/kg)	SCSC samples (mg/kg)					
	SSV 1 All land uses Protective of water resources	SY 5	SY6	SY7	SY8	SY9	SY10
Arsenic (As)	5,8	1.50	1.30	1.40	1.30	1.40	1.30
Cadmium (Cd)	7.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium (III) (Cr)	46 000	160.00	164.00	170.00	173.00	169.00	160.00
Chromium (IV) (Cr)	6.5	-	-	-	-	-	-
Cobalt (Co)	300	38.2	34.00	37.70	37.20	47.50	48.90
Copper (Cu)	16	22.2	224.00	21.20	20.50	34.60	33.90
Lead (Pb)	20	8.4	8.00	8.10	8.30	8.30	7.90
Manganese (Mn)	740	1636.0	1340.0	1649.0	1627.0	1635.0	1656.0
Mercury (Hg)	0.93	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel (Ni)	91	83.00	77.50	81.30	80.80	60.50	55.40
Vanadium (V)	150	91.00	93.70	87.40	88.20	117.00	113.00
Zinc (Zn)	240	31.70	31.30	29.30	28.00	37.90	36.50

Agricultural potential

Dryland Crop Production

The majority of the site alternatives area (and the entire area identified for the preferred location of the smelter) was previously used for crop production and evidence of cropping activities still remains. Soils of the Arcadia and Bonheim soil forms are suitable for crop production and the average annual rainfall of 570 mm is sufficient for successful maize production. The vertic Arcadia soil form is highly suitable for crops like cotton and sunflower, since the roots of these crops are not so sensitive to the swelling and shrinking movements within the soil.

Irrigated Crop Production

The site alternatives area does not have any current irrigation infrastructure for irrigation purposes and no large dams with irrigation potential were observed. The Arcadia soil form identified within the site alternatives area has medium suitability for irrigated crop production since water management is of critical importance. These vertic soils alternate from being either too wet and sticky or too hard and dry to be cultivated. The Bonheim soil form is more suitable to irrigated crop production and although the establishment of irrigation infrastructure requires high initial capital investment, the site alternatives area has potential for this production method should it ever become a future land use possibility.

Cattle Farming

The grazing capacity of the veld for the site alternatives area is 7 hectares per large animal unit or large stock unit (LSU). The area where infrastructure will be developed (i.e. preferred alternatives area only) covers an area of approximately 140 ha and can thus provide grazing for around 20 LSU.

CONCLUSION

Soil types Arcadia and Bonheim located within the site alternatives area are productive soils and suited to crop cultivation and sweet grazing both with or without irrigation. Soil fertility within the proposed site alternatives area is generally good, however metals analysis suggests elevated levels of Copper and Manganese present in the soil.

The soils will require appropriate management measures during construction and operation to prevent the loss of soil resources through pollution and erosion as soil resources form a crucial role during rehabilitation.

FIGURE 13: SOIL FORMS (TERRA AFRICA, MARCH 2016)

8.1.5 LAND CAPABILITY

INTRODUCTION AND LINK TO IMPACT

The land capability classification is based on the soil properties and related potential to support various land use activities. smelter projects have the potential to significantly transform the land capability. To understand the basis of this potential impact, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from the soils, land use and land capability study for the proposed project (Terra Africa, March 2016) included in Appendix E.

RESULTS

Land capability classes were determined using the guidelines outlined in Section 7 of The Chamber of Mines Handbook of Guidelines for Environmental Protection (Volume 3, 1981). The Chamber of Mines pre-mining land capability system was utilised, given that this is the dominant capability classification system used for the mining and mineral processing industry. Table 29 below indicates the set of criteria as stipulated by the Chamber of Mines to group soil forms into different land capability classes.

TABLE 29: PRE PROJECT LAND CAPABILITY REQUIREMENTS

Criteria	Requirements
Criteria for Wetland	• Land with organic soils or; • A horizon that is gleyed throughout more than 50 % of its volume and is significantly thick, occurring within 750mm of the surface.
Criteria for Arable Land	• Land, which does not qualify as a wetland. • The soil is readily permeable to the roots of common cultivated plants to a depth of 750mm. • The soil has a pH value of between 4,0 and 8.4. • The soil has a low salinity and SAR. • The soil has a permeability of at least 1,5-mm per hour in the upper 500-mm of soil. • The soil has less than 10 % (by volume) rocks or pedocrete fragments larger than 100-mm in diameter in the upper 750-mm. • Has a slope (in %) and erodibility factor (K) such that their product is <2.0. • Occurs under a climatic regime, which facilitates crop yields that are at least equal to the current national average for these crops, or is currently being irrigated successfully.
Criteria for Grazing Land	• Land, which does not qualify as wetland or arable land. • Has soil, or soil-like material, permeable to roots of native plants, that is more than 250-mm thick and contains less than 50 % by volume of rocks or pedocrete fragments larger than 100-mm. • Supports, or is capable of supporting, a stand of native or introduced grass species, or other forage plants, utilisable by domesticated livestock or game animals on a commercial basis.
Criteria for Wilderness Land	• Land, which does not qualify as wetland, arable land or grazing land.

Following the classification system above, the soil and land types identified in the site alternatives area could all be classified into two land capability classes. Deeper soils of the Arcadia, Hutton and Bonheim soil forms have arable land capability which could also been suitable for irrigated crop production should irrigation water be available. Because of difficulties in the agricultural management of the Arcadia soil form the land capability is also suitable to extensive grazing where the soil has year-round grazing potential but it is possible to be used for crop production. The area consisting of the Glenrosa soil form as well as the area already disturbed by BCR mining activities (where the Witbank soil form occurs) have wilderness land capability. These areas are not currently suitable for grazing or arable crop production. No wetland capability soils were observed.

CONCLUSION

The land capability within the site alternatives area will be changed with the placement of infrastructure. Therefore, impact management and rehabilitation planning is required to achieve acceptable post rehabilitation land capabilities.

FIGURE 14: LAND CAPABILITY (TERRA AFRICA, MARCH 2016)

8.1.6 BIODIVERSITY

INTRODUCTION AND LINK TO IMPACT

In the broadest sense, biodiversity provides value for ecosystem functionality, aesthetic, spiritual, cultural, and recreational reasons. The known value of biodiversity and ecosystems is as follows:

- Soil formation and fertility maintenance.
- Primary production through photosynthesis, as the supportive foundation for all life.
- Provision of food and fuel.
- Provision of shelter and building materials.
- Regulation of water flows and water quality.
- Regulation and purification of atmospheric gases.
- Moderation of climate and weather.
- Control of pests and diseases.
- Maintenance of genetic resources.

The establishment of infrastructure as well as certain supportive activities have the potential to result in the loss of vegetation, habitat and related ecosystem functionality through physical disturbance and/or contamination of soil and/or water resources.

As a baseline, this section provides an outline of the type and status of flora and fauna occurring at the project area and highlights the occurrence of sensitive ecological environments including sensitive/ endangered species (if present) that require protection and/or additional mitigation should they be disturbed.

DATA SOURCE - FLORA

Information in this section was sourced from the biodiversity study undertaken for the proposed project (SAS, August 2016) included in Appendix F.

The initial field assessments were undertaken during April 2015 (Autumn/late Summer) and August 2015 (late Winter) respectively, in order to determine the ecological status of the SCSC property and proposed powerline alignment. Additional field assessments were completed in December 2015 to assess the proposed access road (alternative 2 in Figure 25) and in July 2016 to assess the additional proposed access road (alternative 3 in Figure 25).

A reconnaissance site visit was initially undertaken to determine the general habitat types found throughout the site alternatives area and, following this, specific study sites were selected that were considered to be representative of the habitats found within the area, with special emphasis being placed on areas that may potentially support floral Species of Conservational Concern (SCC). Sites were investigated on foot in order to identify the occurrence of the dominant plant species and habitat diversities (SAS, August 2016).

DATA SOURCES - FAUNA

Initially a desktop study was undertaken to gather background information regarding the site alternatives area. Relevant authorities were consulted regarding conservational species lists, and all the latest available literature was utilised to gain a thorough understanding of the area and its surrounding habitats. This information was then used to determine the potential biodiversity lists, an expected list of Red Data Listed (RDL) and other faunal SCC and to compile the anticipated SCC Sensitivity Index Score (SCCSIS) list of faunal species for the site alternatives area. This information incorporated (amongst others) data on vegetation types, habitat suitability and biodiversity potential coupled to this information (SAS, August 2016).

The presence of any faunal inhabitants within the site alternatives area was assessed through direct visual observation or identifying such species through calls, tracks, scats, burrows and other methods. The site work dates correspond largely to the fauna dates listed above.

It is important to note that due to the nature and habits of fauna, varied stages of life cycles, seasonal and temporal fluctuations along with other external factors, it is unlikely that all faunal species will have been recorded during the field assessment. In addition, the levels of anthropogenic activity (historical cropping etc.) within the site alternatives area and surrounding area may influence the diversity and abundance of faunal species observed.

RESULTS - FLORA

Vegetation types

Vegetation associated with the site alternatives area is comprised of four broad habitat units, namely the Bushveld Habitat Unit, the Riparian Wetland Habitat Unit, the Secondary Bushveld Habitat Unit and the Transformed Habitat Unit (Figure 15). Each of these habitats is described in further detail below.

Bushveld Habitat

The Bushveld Habitat Unit covers the majority of the site alternatives area and comprises vegetation that is in a largely natural condition. It consists of thornveld with an open savannah vegetation structure which is representative of the majority of the site alternatives area (including the proposed powerline and access road), with the proposed smelter infrastructure footprint marginally encroaching into this habitat unit. The most significant impact on the Bushveld Habitat Unit is grazing by livestock, which has particularly impacted on the graminoid layer. Due to differences in soil types and local topography within the site alternatives area, which play a role in determining floral species composition, four sub-habitat units have been identified within this habitat unit (Figure 15), namely:

- Sandy Thorn Bushveld. A high abundance of *Vachellia erioloba* (Camel thorn) trees is present within this habitat unit.
- Plains (low-lying) Thorn Bushveld, which plays an importance role in flood control and management within the SCSC property.
- Turf Thorn Bushveld.
- Mixed Bushveld.

Dominant graminoid species present within the Bushveld Habitat Unit include *Digitaria eriantha, Cymbopogon plurinodis, Eragrostis curvula, E. lehmanniana* and *Heteropogon contortus,* as well as grasses such as *Chloris gayana, Dicanthium annulatum, Aristida bipartita* and *Melinis repens* within overgrazed areas.

The forb community present within this habitat unit includes species such as *Aloe greatheadii* var *davyana, Lycium cinereum, Ammocharis coranica, Asparagus suaveolens, Clematis brachiata, Commelina erecta, Crabbea hirsuta, Elephantorrhiza elephantina, Corbichonia decumbens* and *Commicarpus pentandrus* with alien floral species such as *Tagetes minuta, Sesbania bispinosa, Alternanthera pungens, Datura ferox, Opuntia ficus-indica, Tribulus terrestris, Zinnia peruviana* and *Hibiscus trionum* also present.

One floral SCC species listed in terms of The Limpopo Environmental Management Act (Act 7 of 2003) LEMA, namely *Scadoxus puniceus* was encountered within the Bushveld Habitat Unit (although it was encountered outside of the proposed project footprint areas) and it is highly likely that *Boophane disticha* (listed by SANBI as 'Declining') will be present too. *Boophane disticha* is absent from the proposed smelter footprint area given the extent to which this area has been disturbed by cultivation. No floral SCC listed under the National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEMBA) Threatened or Protected Species (TOPS) species list were observed.

The woody layer is dominated by thorny, woody species of which the dominant species are *Vachellia karroo,* and *V. tortilis,* with *Senegalia mellifera* subsp. *detinens* also present in high abundance. Other woody species include *Ziziphus mucronata* and *Grewia flava.* Two species protected under the National Forests Act (Act 84 of 1998) (NFA) were encountered within the Bushveld Habitat Unit, namely *Vachellia erioloba* and *Boscia albitrunca* with suitable habitat for *Sclerocarya birrea* subsp. *caffra* also present, although the latter species was not encountered.

Riparian Wetland Habitat

The Riparian Habitat Unit is associated with various drainage lines within the site alternatives area, including riparian features located within the SCSC property, namely the Brakspruit River and its associated two unnamed tributaries and the Phufane River. These non-perennial watercourses are all located to the east of the proposed smelter complex and are all identified as areas of high sensitivity which should be avoided. An unchannelled valley bottom wetland feature is situated within the western portion of the SCSC property (within proximity of the smelter complex and related infrastructure). The western portion of this wetland feature (where a separate drainage line has been formed) appears to have been artificially created by overflow from a man-made dam immediately upstream of the feature, to the south of the proposed project area. Wetland vegetation as observed within the remainder of the feature was identified within this portion of the riparian wetland and has therefore been assessed as part of the wetland feature. In addition, a single ephemeral depression was identified further to the east, as well as three off-channel dams located in close proximity to the Phufane River. The ephemeral depression and artificial dams were not defined as true wetland features and were therefore not assessed in detail as part of the wetland assessment.

The vegetation associated with the Brakspruit River (and associated two unnamed tributaries) and Phufane River is of a distinct riparian nature and is dominated by woody species including *Vachellia karroo*, *Combretum erythrophyllum*, *Gymnosporia senegalensis, G. buxifolia, Heteromorpha arborescens, Searsia lancea* and *S. pyroides.* Although not encountered, there is a possibility that the tree species, *Combretum imberbe* (protected under the NFA) is present within this habitat unit, as suitable habitat for this species is available.

Forb species encountered within the riparian areas include *Geigeria burkei* var. *elata*, *Gladiolus* sp. and *Nidorella hottentotica*, with the floral SCC *Crinum macowanii* also occurring throughout this habitat unit in relatively low abundance. This species is listed by SANBI as ‘Declining’ and should this species be encountered within the proposed powerline footprint area in the vicinity of stream crossings, it is recommended that these species be relocated to similar suitable habitat under the supervision of a qualified botanist.

Graminoid species present within the riparian areas include *Heteropogon contortus, Panicum maximum* and *Setaria sphacelata*.

Woody species associated with the temporary zone of the wetland feature within the west of the site alternatives area include *Diospyros lycioides*, *V. karroo* and *V. tortilis*. Woody species are largely absent from the permanent and seasonal wetland zones, which is dominated by the graminoid species *Sorghum versicolor* and *Cynodon dactylon*, with several sedges also present. *Sorghum versicolor* , a species associated with disturbance and moist, clay soils, is particularly dominant within the artificial portion of the wetland feature Alien species are prevalent within the wetland habitat and include *Achyranthes aspera, Hibiscus trionum, Persicaria lapathifolia, Rumex crispus, Sesbania bispinosa* and *Verbena bonariensis.*

Secondary Bushveld Habitat Unit

The Secondary Bushveld Habitat Unit is present within the east and west of the site alternatives area as well as along the proposed routing for the 3rd access road alternative. It is associated with historically cultivated land in various stages of succession, with subsequent dominance of secondary bushveld (referring to the reestablishment of indigenous vegetation after clearing/ disturbance of original vegetation has occurred) and altered vegetation composition.

Woody species such as *Vachellia karroo, V. tortilis* and *Senegalia mellifera* subsp. *detinens* dominate this habitat unit with the graminoid layer being characterised by similar grass species as occurring within the Mixed Bushveld habitat.

Historical vegetation clearing has led to localised bush encroachment and the presence of alien floral species within this habitat unit, with current grazing activities by livestock also taking place within this area. The Secondary Bushveld Habitat Unit is considered to have a low ecological sensitivity and conservation value due to the alteration of floral species composition and vegetation structure as a result of the abovementioned impacts.

Transformed Habitat

A number of transformed areas primarily associated with existing agricultural activities, residential buildings and outbuildings, livestock camps and access roads are present throughout the site alternatives area. Existing access roads and powerlines present in the site alternatives area have affected the vegetation structure due to clearing of land for servitudes and maintenance roads. Existing fallow agricultural lands are dominated by typical agricultural weeds including *Datura ferox, Bidens pilosa, Tagetes minuta*, as well as pioneer grass species and grass species associated with disturbance such as *Sorghum versicolor, Cynodon dactylon, Aristida bipartita and Heteropogon contortus.*

The vegetation structure and species composition of the Transformed Habitat Unit have been completely altered, and apart from the occurrence of *V. erioloba* provides limited natural habitat for floral species as such, has low conservation value and ecological sensitivity from a floral perspective.

<u>Red data listed (RDL) and protected species</u>

An assessment considering the presence of any floral RDL species and other floral SCC, as well as suitable habitat to support any such species, was undertaken. The complete Pretoria Computer

Information Systems (PRECIS) RDL floral lists for the Quarter Degreee Square (QDS) references 2427CC were acquired from SANBI whereby it was found that no RDL species were listed for the QDS.

Two SANBI RDL floral species, listed as 'Declining', namely *Vachellia erioloba* (Camel thorn) and *Crinum macowanii*, were encountered within the site alternatives area. *Vachellia erioloba* trees occur scattered, but in low abundance throughout the Bushveld Habitat Unit and are present in high abundance within the Sandy Thorn Bushveld Habitat Unit. No *Vachellia erioloba* trees are present within the preferred smelter complex footprint area, but a number of these species have been encountered within the preferred powerline footprint area. All *Vachellia erioloba* trees located along the 30 m wide powerline servitude have been marked through the use of GPS and their locations are indicated in Figure 16. In addition to *Vachellia erioloba.* one other tree species, namely *Boscia albitrunca*, also protected under the NFA was encountered within the Sandy Thorn Bushveld habitat. This species is however not located within the proposed smelter, powerline or access road footprint areas and is therefore unlikely to be impacted by the project. Other protected tree species that have not been encountered within the site alternatives area, but which may occur due to suitable habitat being available within the Wetland/ riparian and Bushveld Habitat units respectively are *Combretum imberbe* and *Sclerocarya birrea* subsp. *caffra*. These species were not noted within the proposed smelter, powerline or access road footprint areas and, if present within the remainder of the site alternatives area, will not be impacted by the proposed project.

Crinum macowanii was encountered within the Wetland/ Riparian Habitat Unit, but was not found within the proposed project footprint area.

One other SANBI RDL floral species that was not encountered within site alternatives area, namely *Boophane disticha* (also listed as 'Declining'), has a high likelihood of occurring within the Bushveld Habitat Unit. Due to the proposed smelter infrastructure being located almost in its entirety within the Transformed Habitat Unit, it is unlikely that *Boophane disticha* will be encountered within the smelter development footprint.

One provincially protected floral species, as stipulated in Section 12 of the LEMA namely *Scadoxus puniceus*, was encountered within the Bushveld Habitat Unit. This species is however located outside of the proposed smelter, powerline routing and access road footprint areas. No protected floral species as listed under Section 56 (1) d) of the TOPS Regulations under NEMBA (Act 10 of 2004) were encountered in the site alternatives area.

Due to the location of the proposed smelter infrastructure almost in its entirety within the Transformed Habitat Unit, it is highly unlikely that these species will be present within its development footprint and none were encountered.

Alien and invasive species

Alien and invasive floral species are plants that are of exotic origin and are invading previously pristine areas or ecological niches (Bromilow, 2001). Not all weeds are exotic in origin but, as these exotic plant species have very limited natural "check" mechanisms within the natural environment, they are often the most opportunistic and aggressively growing species within the ecosystem. Therefore, they are often the most dominant and noticeable within an area. Disturbances of the ground through trampling, excavations or landscaping often leads to the dominance of exotic pioneer species that rapidly dominate the area. Under natural conditions, these pioneer species are overtaken by sub-climax and climax species through natural veld succession. This process however takes many years to occur, with the natural vegetation never reaching the balanced, pristine species composition prior to the disturbance. There are many species of indigenous pioneer plants, but very few indigenous species can out-compete their more aggressively growing exotic counterparts.

Alien vegetation invasion causes degradation of the ecological integrity of an area, causing:

- A decline in species diversity.
- Local extinction of indigenous species.
- Ecological imbalance.
- Decreased productivity of grazing pastures.
- Increased agricultural input costs (Bromilow, 2001).

Alien and invasive species located within the site alternatives area are provided in Table 30 below.

TABLE 30: ALIEN AND INVASIVE SPECIES LOCATED WITHIN THE PROPOSED SITE ALTERNATIVES AREA (SAS, AUGUST 2016)

SPECIES	COMMON NAME	NEMBA CATEGORY*
Trees/ Shrubs		
Opuntia ficus-indica	Sweet prickly pear	1b
Forbs/ Sedges		
Achyranthes aspera	Burweed	N/L
Alternanthera pungens	Khakiweed	N/L
Bidens pilosa	Common blackjack	N/L
Conyza bonariensis	Flax-leaf fleabane	N/L
Datura ferox	Large thorn-apple	1b
Hibiscus trionum	Bladder hibiscus	N/L
Persicaria lapathifolia	Spotted knotweed	N/L
Rumex crispus	Curly dock	N/L
Schkuhria pinnata	Dwarf marigold	N/L
Sesbania bispinosa	Spiny sesbania	N/L
Tagetes minuta	Tall khakiweed	N/L
Tribulus terrestris	Devil's thorn	N/L

Verbena bonariensis	Purple top	1b
Zinnia peruviana	Redstar zinnia	N/L

N/L = Not Listed and not categorised

* National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, GN R598 of 2014
Category 1a – Invasive species that require compulsory control.
Category 1b – Invasive species that require control by means of an invasive species management programme.
Category 2 – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.
Category 3 – Ornamentally used plants that may no longer be planted. Existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread (Bromilow, 2001).

From the table above it is clear that although a moderate diversity of alien floral species occur within the site alternatives area, the majority of species are not listed as declared invaders, with the exception of *Datura ferox, Verbena bonariensis* and *Opuntia ficus-indica,* that are listed as Category 1b invaders that require mandatory eradication. Most alien floral species occur throughout the site alternatives area with the majority being present within the Wetland/ riparian Habitat Unit and within transformed areas.

FIGURE 15: HABITAT UNITS (SAS, AUGUST 2016)

FIGURE 16: BIODIVERSITY SENSITIVITY (SAS, AUGUST 2016)

RESULTS – FAUNA

Although the western part of the site alternatives area (where the majority of infrastructure is proposed) has been transformed by cattle farming and maize cultivation, the Wetland/ Riparian Habitat Unit (located close to the watercourses) and Bushveld Habitat Unit (which covers the remainder of the site alternatives area) still provide sufficiently intact habitat for many mammal species. The Wetland/ Riparian Habitat Unit was also the habitat unit where nearly all of the mammal species were encountered.

Mammals

Mammal species observed during the field survey include Slender Mongoose, Warthog, Cape Porcupine, Steenbuck, Reedbuck, Kudu, Scrub Hare, Red Veld Rat, Black-backed jackal.

All the above listed species were observed either directly, by spoor, territorial markings or through the use of motion sensitive camera traps or sherman traps placed throughout the SCSC property. Field signs of *Phacochoerus aethiopicus* (Warthog) were present in the Wetland/ Riparian Habitat Unit and *Redunca arundinum* (Reedbuck) was observed several times during the field assessment. *Herpestes sanguineus* (Slender Mongoose) and scats indicating the presence of other small omnivorous predators were noted within the site alternatives area. *Canis mesomelas* (Black-backed Jackal) was also observed using camera traps during the survey, with spoor of domestic dog also noted within the site alternatives area. Although portions of the site alternatives area have been transformed by cattle farming and maize cultivation, the Wetland/ Riparian Habitat Unit and Bushveld Habitat Unit present within the SCSC property still provide sufficiently intact habitat for many mammal species. The Wetland/ Riparian Habitat Unit was also the habitat unit where nearly all of the mammal species were encountered.

In terms of conservation, no mammal SCC was encountered during the field assessment. The likelihood of any mammal SCC being encountered is considered to be low due to the anthropogenic activities and agricultural activity that is currently taking place throughout the site alternatives area and surrounding areas. The proposed location of the smelter infrastructure, powerline alignment and access road have been placed in such a way as to minimise the loss of mammal habitat.

Birds

Approximately 100 avifaunal species were observed during the field assessment. The majority of avifaunal species observed were common species, with several avifaunal SCC that were also observed within the boundaries of the site alternatives area. Both the Bushveld and Wetland/Riparian Habitat Units provide consistent habitat for a number of common avifaunal species, with the Transformed Habitat Unit being subject to change due to varying degrees of usage through agricultural activities. The Wetland/ Riparian Habitat Unit had a higher diversity and number of common avifaunal species, which utilise these areas for breeding and foraging.

TABLE 31: AVIFAUNAL SCC RECORDED DURING THE FIELD ASSESSMENT (SAS, AUGUST 2016)

SCIENTIFIC NAME	COMMON NAME	IUCN STATUS	LIMPOPO SoER 2004 STATUS
Coracias garrulus	European Roller	NT	
Polemaetus bellicosus	Martial Eagle	VU	T
Pterocles gutturalis	Yellow-throated Sandgrouse	**LC**	

NT = Near Threatened, VU = Vulnerable, T = Listed as threatened but with no specific status for the Limpopo Province

Although not all identified during the field assessment, the full list of avifaunal SCC occurring in the Limpopo DFED 2004 report (and which could potentially occur within the site alternatives area) including IUCN status is provided in Table 32 below.

TABLE 32: RED DATA BIRD SPECIES LISTED IN THE LIMPOPO DFED REPORT INCLUDING IUCN STATUS (SAS, AUGUST 2016)

SCIENTIFIC NAME	COMMON NAME	LIMPOPO DFED 2004 STATUS	IUCN RED LIST STATUS
Gyps coprotheres	Cape Vulture	T	VU
Ciconia nigra	Black Stork	T	LC
Falco naumanni	Lesser Kestrel	T	LC
Certhilauda chuana	Short-clawed Lark	T	LC
Pterocles gutturalis	Yellow-throated Sandgrouse	T	LC
Anthropoides paradiseus	Blue Crane	T	VU
Gyps africanus	Whitebacked Vultures	T	E
Ardeotis kori	Kori Bustard	T	LC
Scotopelia peli	Pel's Fishing Owl	T	LC
Bucorvus leadbeateri	Southern Ground Hornbill	T	VU
Buphagus erythrorhynchus	Red-billed Oxpecker	T	LC
Terathopius ecaudatus	Bateleur	T	NT
Polemaetus bellicosus	Martial Eagle	T	NT
Aquila rapax	Tawny Eagle	T	LC
Torgos tracheliotos	Lappetfaced Vulture	T	VU
Trigonoceps occipitalis	Whiteheaded Vulture	T	VU
Buphagus africanus	Yellow billed Oxpecker	T	LC
Stephanoaetus coronatus	Crowned hawk Eagle	T	NT

LC = Least concerned, CE = Critically Endangered, E = Endangered, VU = Vulnerable, NT = Near Threatened. NYBA = Not yet been assessed by the IUCN. T = listed as threatened but with no specific status for the Limpopo Province.

The site alternatives area does not fall within an Important Bird Area (IBA), but the Northern Turf Thornveld IBA is situated between 500m and 1.5 km to the north thereof. The Northern Turf Thornveld IBA holds the core of the remaining resident South African *Pterocles gutturalis* (Yellow-throated Sandgrouse) population, which inhabits short open grasslands, fallow fields and recently burnt veld, especially on black clay soils near water and is regionally threatened. In addition to *P. gutturalis*, the globally threatened avifaunal species *Glareola nordmanni* (Black-winged Pratincole) and *Sagittarius serpentarius* (Secretary Bird), as well as other regionally threatened species namely *Falco biarmicus* (Lanner Falcon) and *Ardeotis kori* (Kori Bustard) occur within this IBA.

Amphibians

Common amphibian species that are expected to occur in this region include *Ptychadena anchietae* (Plain Grass Frog), *Amietophrynus gutteralis* (Guttural Toad) and *Schismaderma carens* (Red Toad). Although not observed during the field assessment, there remains the possibility that *Pyxicephalus adspersus* (Giant Bullfrog) may occur within the Wetland/ Riparian Habitat Unit. *Pyxicephalus adspersus* is listed by the IUCN as being of Least Concern, but on a provincial basis this species is listed as Vulnerable by the LEMA (Act 7 of 2003) under Schedule 3 (Protected Wild Animals).

The complete list of amphibian SCC known to occur within the Limpopo Province (and which could therefore potentially be found to occur within the site alternatives area) is included in Table 33 below.

TABLE 33: RED DATA AMPHIBIAN SPECIES LISTED IN THE LIMPOPO DFED 2004 REPORT INCLUDING IUCN STATUS (SAS, AUGUST 2016)

SCIENTIFIC NAME	COMMON NAME	LIMPOPO DFED 2004 STATUS	IUCN RED LIST STATUS
Breviceps sylvestris	Transvaal forest rain frog	VU	E
Ptychadena uzungwensis		P	LC
Leptopelis bocagii		P	LC
Hemisus guineensis	Guinea Snout-burrower	P	LC

LC = Least concerned, CE = Critically Endangered, E = Endangered, VU = Vulnerable, NT = Near Threatened, P = Peripheral. NYBA = Not yet been assessed by the IUCN.

Reptiles

Trachylepis punctatissima (Montane Striped Skink) and a shed skin of *Psammophylax sp.* (Skaapsteker) was observed during the field assessment. An overall low reptile species diversity was observed within the site alternatives area mainly due to the on-going anthropogenic and agricultural and grazing activities coupled with the general secretive behaviour of reptile species. Reptile species are most likely to be found in the more intact Bushveld and Wetland/Riparian Habitat Units as these areas provide suitable and varied habitat for reptiles and their food sources.

Although no reptile SCC were observed during the field surveys, one reptile SCC *Python natalensis* (Southern African Python), is likely to be present in the site alternativecs area as suitable habitat for this species is present in the Wetland/Riparian Habitat Unit.

A full list of reptile SCC occurring within the Limpopo Province (and which could therefore occur within the site alternatives area) is included in Table 34 below.

TABLE 34: RED DATA REPTILE SPECIES LISTED IN THE LIMPOPO DFED 2004 REPORT INCLUDING IUCN STATUS (SAS, AUGUST 2016)

SCIENTIFIC NAME	COMMON NAME	LIMPOPO DFED 2004 STATUS	IUCN RED LIST STATUS
Homoroselaps dorsalis	Striped Harlequin snake	R	NT
Xenocalamus transvaalensis	Transvaal Quill-snout snake	R	DD
Lamprophis swazicus	Swaziland House Snake	R	NT
Python sebae natalensis	Python	VU	NYBA
Lygodactylus methueni	Methuen's Dwarf Gecko	VU	VU
Crocodylus niloticus	Nile Crocodile	VU	LC
Lycophidion variegatum	Variegated Wolf snake	P	NYBA
Psammophis jallae	Jalla's Sand snake	P	NYBA

R = Rare, DD = Data Deficient, LC = Least concerned, CE = Critically Endangered, E = Endangered, VU = Vulnerable, NT = Near Threatened, P = Peripheral. NYBA = Not yet been assessed by the IUCN.

<u>Invertebrates</u>

The invertebrate assessment conducted was a general assessment with the purpose of identifying common species and taxa in the site alternatives area. As such, the invertebrate assessment is not an indication of the complete invertebrate diversity of the site alternatives area. A representation of commonly encountered families in the Insecta class that were observed during the assessment is listed in Table 35 below.

TABLE 35: GENERAL RESULTS FROM INVERTEBRATE OBSERVED DURING THE ASSESSMENT OF THE SITE ALTERNATIVES AREA (SAS, AUGUST 2016)

SCIENTIFIC NAME	COMMON NAME	IUCN 2015 LIST STATUS
Eurema brigitta	Broad-bordered Grass Yellow	NYBA
Belenois aurota	Brown-veined White	NYBA
Junonia hierta	Yellow Pansy	LC
Danaus chrysippus	African Monarch	NYBA
Trinervitermes sp.	Snouted harvester Termites	NYBA
Musca domestica	House fly	NYBA
Catantops humeralis	N/A	NYBA
Orthoctha dasycnemis	N/A	NYBA
Rhachitopis sp.		NYBA
Anterhynchium natalense	N/A	NYBA
Anoplolepis custodiens	Pugnacious Ant	NYBA
Gryllus bimaculatus	Common Garden Cricket	NYBA
Phymateus morbillosus	Common Milkweed Locust	NYBA
Conocephalus caudalis	Meadow Katydid	LC

SCIENTIFIC NAME	COMMON NAME	IUCN 2015 LIST STATUS
Lycus melanurus	Hooked-winged Net-winged Beetle	NYBA
Astylus atromaculatus	Spotted Maize Beetle	NYBA
Exochomus flavipes	Black Mealy Bug Predator	NYBA

LC = Least Concern, NYBA = Not yet been assessed by the IUCN

No invertebrate SCC were observed during the field assessment and it is also important to note that the distribution of all the red data species listed in the Limpopo Province LDFED 2004 report fall outside of the site alternatives area, and hence are not discussed further.

Arachnids

Four spider species were identified during the field investigation (Table 36). These species are considered to be common within the region and are not listed as threatened by either the IUCN, National or Provincial databases. All baboon spider species from the genera *Ceratgyrus, Harpactira* and *Pterinochilus* are protected under NEMBA (Act 10 of 2004) for South Africa. None were observed and the probability of them utilising the site alternatives area is deemed unlikely.

TABLE 36: SPIDER SPECIES RECORDED DURING THE FIELD SURVEY

SCIENTIFIC NAME	COMMON NAME	IUCN 2015 LIST STATUS
Thomisus onustus	Crab spider	NYBA
Argiope australis	Garden orb spider	NYBA
Stegodyphus dumicola	Community nest spider	NYBA
Olurunia ocellata	Grass funnel-web spider	LC

LC = Least Concern, NYBA = Not Yet Been Assessed

No scorpion species were identified within the site alternatives area. All scorpion species from the genera *Hadogenes, Opisthacanthus* and *Opistophthalmus* are also protected under NEMBA (Act 10 of 2004) in South Africa.

No threatened spider or scorpion species are listed for the Limpopo Province LDFED nor were any spider or scorpion SCC encountered, and as such these SCC species are not expected to occur in the site alternatives area. It is likely that only common arachnid species will be present within the site alternatives area. The proposed smelter infrastructure, powerline alignment and access road alternatives have been placed in such a way as to minimise the impact on arachnid SCC habitat. In addition both of the smelter infrastructure alternatives are placed on a cultivated land, and as such will not pose a significant threat to arachnid SCC habitat.

Ecological sensitivity and areas of conservation importance

A sensitivity map (Figure 16) was compiled with the use of the floral and faunal integrity and diversity encountered during the assessment of the site alternatives area as well as taking consideration of the location and extent of wetland and riparian features traversing the site alternatives area. The Wetland/ Riparian Habitat Unit is regarded as being of high ecological sensitivity due to the contribution of the various wetland features to faunal migratory connectivity, wetland eco-services provision and the habitat provided for faunal and floral species. A recommended biodiversity buffer zone is also indicated. This recommended buffer zone is measured as being 32 m from the estimated transition zone from terrestrial to riparian habitat. As part of the project, the proposed powerline and associated service road will be required to cross the various drainage lines, and in this regard care should be taken to ensure that these infrastructure components cross at existing crossings where possible, to avoid further impacts on the drainage features. Where this is not possible, it must be ensured that crossings span as far as possible at right angles to the features, with no infrastructure to be placed within the active riparian channels or within the delineated extent of the wetland feature. The remainder of infrastructure associated with the proposed project will be located outside of relevant floodlines and areas of high sensitivity with the exception of the PCD which although will be located outside of relevant floodlines may encroach marginally within the recommended buffer zone illustrated in Figure 16.

The Bushveld Habitat Unit comprises the majority of the site alternatives area and is in a largely natural condition. Due to differences in soil types and local topography within the site alternatives area, which determines species composition, four sub-habitat units have been identified within this habitat unit, with differing ecological importance, as follows (Figure 15):

- Sandy Thorn Bushveld: this habitat provides largely intact habitat and a high abundance of floral SCC occur in this area. This habitat is considered to be of a Moderately High ecological sensitivity.
- Plains (low-lying) Thorn Bushveld: this habitat plays an important role in flood control within this area and is therefore also considered to be of Moderately High ecological sensitivity.
- Turf Thorn Bushveld: This habitat is considered to be largely intact, provides good habitat for floral and faunal species and is considered to be of Moderate ecological importance and sensitivity.
- Mixed Bushveld: This habitat is considered to have a lowered ecological sensitivity and conservation value due to the alteration of floral species composition and vegetation structure as a result of the abovementioned impacts.

Both the Secondary Bushveld and the Transformed Habitat Units are considered to have Low ecological sensitivity. One protected tree species namely *Vachellia erioloba* was encountered along the proposed powerline alignment. The positions of this species, in addition to ecologically sensitive habitats identified, are also presented in the site sensitivity illustrated in Figure 16.

The Limpopo Conservation Plan v2 was consulted in order to determine whether the site alternatives area falls within any areas of conservation importance. From preliminary information obtained, it is evident that the area where the smelter complex infrastructure will be developed falls within an area with No Natural Habitat Remaining (NNHR), whilst the preferred access road alternative will be developed within an area with NNHR and an area identified as an Other Natural Area (ONA). The central and eastern portions of the study area, as well as the preferred powerline alignment is located within a Critical Biodiversity Area 1 (CBA 1) however it is noted that the majority of the proposed routing of the proposed powerline has already been heavily disturbed by existing powerline servitude networks.

According to the National Biodiversity Assessment (NBA, 2011), which includes a summary of spatial biodiversity priority areas that have been identified through systematic biodiversity plans at national, provincial and local levels (SANBI BGIS), the site alternatives area is not located within a formally or informally protected area and falls within an area classified as poorly protected.

CONCLUSION

The placement of infrastructure as well as smelting and associated activities have the potential to disturb and/or destroy vegetation, habitat units and related ecosystem functionality including the disturbance of sensitive/ endangered species.

During the design of the infrastructure layout, areas of sensitivity should be taken into consideration in order to minimise the disturbance and destruction of these areas. In addition to this, mitigation measures need to be formulated to conserve and reduce the impacts that the proposed project may have towards these areas.

8.1.7 SURFACE WATER

INTRODUCTION AND LINK TO IMPACT

Surface water resources include watercourses and paths of preferential flow of stormwater runoff. Smelter related activities have the potential to alter the drainage of surface water through the establishment of infrastructure and/or result in the contamination of the surface water resources through seepage and/or spillage of process materials, non-mineralised (general and hazardous) and mineralised wastes (slag dump and baghouse slurry facility). To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from the surface water assessment undertaken for the proposed project (SLR, August 2016) included in Appendix G and the biodiversity assessment (SAS, August 2016) included in Appendix F.

Information pertaining to catchments, mean annual run-off and water management areas was sourced from the National Water Resource Strategy, 2004. Information regarding the relevant rivers located within the site alternatives area was sourced from the review of topographical data. It should be noted that the surface water assessment compiled for the proposed project focused predominantly on the watercourse located closest to the proposed project smelter infrastructure (an unnamed tributary of the Brakspruit River) as indicated in Figure 2.

RESULT

Catchments within the context of South Africa

South Africa is divided into 19 water management areas (National Water Resource Strategy, 2004), managed by separate water boards. Each of the water management areas (WMA) is made up of quaternary catchments which relate to the drainage regions of South Africa. The site alternatives area falls within the Crocodile West and Marico WMA with the major rivers falling within the mentioned WMA being the Crocodile River, and the Marico River. All runoff from the site alternatives area is eventually drained north into the Limpopo River (SLR, September 2016).

Regional hydrology

The proposed site alternatives area falls within the quaternary catchment A24E (Figure 17) which has a gross total catchment area of 688 km^2 with a net MAR of 9.86 million cubic meters (mcm).

The main river within quaternary catchments A24E is the Brakspruit, which flows to the north, firstly to a confluence with the Bierspruit (7.5 km north-east of the site alternatives area), which then flows onwards to a confluence with the Crocodile River approximately 33 km north of the site alternatives area. The A24E quaternary catchment is bounded to the south by the Pilanesberg, which comprises an area of elevated topography and hills.

Based on the 1:50 000 topographical maps of the area, the tributaries of the Brakspruit are all non-perennial and include :

- The Sefatlhane (also known as the Moruleng in upstream reaches) which flows north from the Pilanesberg to a confluence with the Lesobeng. Closer to the site alternatives area, and downstream of a confluence with the Diphiri, the Sefatlhane becomes the Brakspruit.
- The Lesobeng (also known as the Lesele in upstream reaches) flows north from the Pilanesberg to a confluence with the Sefathlane, approximately 23km south of the site alternatives area.

- The Phufane flows north and north-west from Sandfontein / Welgeval to a confluence with the Brakspruit, 2km east of the site alternatives area.
- An unnamed tributary (referred to from here onwards as the Brakspruit tributary) flows past the south eastern site boundary (closest to the proposed smelter complex) to a confluence with the Brakspruit 2 km east of the site alternatives area.

Local hydrology

The Brakspruit tributary flows through the Union Section Mine (located south-west of the site alternatives area) which features various tailings facilities, waste rock dumps and other surface infrastructure. At the eastern boundary of Union Section Mine, an earth dam wall has been constructed, effectively forming a large return water dam (RWD) for Union Section which is divided into two compartments and collects all runoff from the mine which is used as makeup water within the mine's processing plant. The smaller compartment has a footprint of approximately 11 ha, it always contains water and discharges into the larger (downstream) compartment during extended wet periods. The larger compartment has a footprint of approximately 39 ha, it rarely contains a significant volume of water but is equipped with a concrete spillway which discharges to the Brakspruit tributary which flows through the SCSC property close to where the preferred alternative for the smelter infrastructure is proposed. It is assumed that stormwater from operational areas of the Union Section Mine (estimated to be at least 4.5 km^2), will be collected and re-used in accordance with typical best practice. Downstream of Union Section Mine, the Brakspruit tributary features several small scale agricultural dams, which typically impound any flow within the watercourse, which will occur following significant rainfall. Further information on these man-made containment features is provided in Section 8.1.6.

Mean Annual Runoff

The Brakspruit and its tributaries including the Phufane, Sefatlhane and the Brakspruit tributary, all fall within the A24E quaternary catchment, and estimates of the MAR for these catchments are presented in Table 37 assuming that MAR is proportional to catchment area.

TABLE 37: ESTIMATED MEAN ANNUAL RUNOFF (MAR) FOR LOCAL WATERCOURSES

Catchment Name	Area (km2)	Total MAR (mcm)
Phufane Catchment	156.7	2.20
Sefathlane Catchment	451.0	6.35
Brakspruit Tributary Catchment	23.4	0.33
A24E Quaternary Catchment	688	9.86

Estimates for the Phufane and the Sefatlhane catchments, indicate an MAR of 2.20 mcm and 6.35 mcm respectively, which correspond to a steady year round flow of 70 l/s and 201 l/s. Since these rivers are non-perennial, it can be assumed that little or no flows occur during the dry period, whilst significant flows occur during the wet season to makeup the steady flows mentioned.

Flow peaks

The peak flow rates for the unnamed Brakspruit tributary for the 1:50 and 1:100 year return period are summarised in Table 38 for the various methods used to determine peak flows.

TABLE 38: PEAK FLOW ESTMATES – RATIONAL METHOD AND SCS METHOD (SLR, SEPTEMBER 2016)

Sub-Catchment	Rational Method	
	1:50 year flow(m^3/s)	1:100 year Flow (m^3/s)
Brakspruit Tributary	32	37

Floodlines

A detailed LiDAR survey of the site alternatives area and surrounding area was undertaken and this data was used to generate a DEM of the area and modelled section of the Brakspruit tributary. The topographical data forms the foundation for the HEC-RAS model and is used to extract elevation data for the river profile together with the river cross-sections. The topographical data is also used to determine placement positions for the cross-sections along the river profile, such that the watercourse can be accurately modelled.

The 1:100 year floodline and the 100m buffer from the edge of the Brakspruit tributary are illustrated in Figure 18. With the exception of the powerline which will require several crossings over non-perennial watercourses (including the Phufane, Brakspruit and tributaries thereof), all project infrastructure will be located outside of the 1:100 floodline and the 100m buffer of the Brakspruit tributary (SLR, September 2016).

Surface water users

Watercourses and surface water resources identified during the hydrocensus were dry at the time of the hydrocensus being undertaken and are understood to flow/contain water for limited periods after rainfall. It is therefore not expected that there is material reliance on surface water by third parties or livestock.

Surface water quality

Surface water monitoring was undertaken subsequent to the hydrocensus (and after periods of rainfall) at surface water quality at points SWB and SWC (see Figure 19). Exceedences of relevant water quality standards for various parameters is illustrated in Table 39 below.

TABLE 39: SURFACE WATER QUALITY DATA FOR CHEMICALS OF CONCERN (SLR, SEPTEMBER 2016)

Sample ID/	Date of Sampling	Concentration (mg/L)		
		Al	Fe	Mn

DWAF TWQR - Livestock Watering		**5**	**10**	**10**
SANS 241 (2015) Operational		**0.3**	**N/A**	**N/A**
SANS 241 (2015) Aesthetic		**N/A**	**0.3**	**0.1**
SANS 241 (2015) Acute Heath		**N/A**	**N/A**	**N/A**
SANS 241 (2015) Chronic Health		**N/A**	**2**	**0.4**
SWB	2016/03/18	<0.1	0.051	<0.01
	2016/07/29	2.86	2.66	0.324
SWC	2016/03/18	2.10	1.95	0.278
	2016/07/29	-	-	-

Note: highlighted cells indicate which water quality standard has been exceeded.

Riparian wetland feature

According to the biodiversity specialist report, a riparian feature is associated with the Brakspruit tributary (Figure 16). The western portion of this riparian feature (where a separate drainage line has been formed) appears to have been artificially created by overflow from a man-made dam immediately upstream of the feature, to the south of the SCSC property. In addition, a single ephemeral depression was identified further to the west, as well as three off-channel dams located in close proximity to the Phufane River. The ephemeral depression and artificial dams were not defined as true wetland features and were therefore not assessed in detail as part of the wetland assessment (SAS, August 2016).

CONCLUSION

The nature of the proposed project and activities are such that they present potential for pollution of water resources and disturbance of natural surface water run off and flow patterns. The proposed project must therefore be managed/implemented in a way that pollution of water resources is prevented. Moreover, care is required to ensure that surface run-off patterns are disturbed as little as possible to promote the continued flows of water and nutrients.

FIGURE 17: CATCHMENTS (SLR, SEPTEMBER 2016)

FIGURE 18: FLOODLINES (SLR, SEPTEMBER 2016)

8.1.8 GROUNDWATER

INTRODUCTION AND LINK TO IMPACT

Groundwater is a valuable resource and is defined as water which is located beneath the ground in soil/rock pore spaces and in the fractures of lithological formations. Activities such as the handling and storage of hazardous materials and handling and storage of mineralised and non-mineralised wastes have the potential to impact groundwater resources, both to the environment and third party users, through pollution. In addition, where a project requires abstraction of groundwater for water supply, there is the potential for a dewatering cone to develop and this can result in a loss of water supply to surrounding users. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from the groundwater assessment (SLR, September 2016) included in Appendix H.

Information pertaining to aquifer characteristics was sourced from available information including borehole logs and pumping tests.

A hydrocensus was undertaken to identify water users as well as to determine the quality and quantity of water resources within and surrounding the proposed site alternatives area. In addition to this, groundwater samples were also taken as part of pumping test to determine the groundwater quality.

The regional groundwater flow pattern was determined by linear interpolation of available groundwater levels and hydraulic heads. Water levels measured during the hydrocensus, water level information in the National Groundwater Database (NGDB), and water level information from published literature was used.

Groundwater yields for the proposed project area were determined through pumping tests.

RESULTS

Aquifer systems

The BIC comprises two aquifer systems, namely:

- A shallow weathered aquifer system formed as a result of intensive, in-situ chemical weathering processes of the underlying bedrock. Groundwater flow is typically intergranular and may be laterally connected to alluvial aquifers associated with river systems.
- A deep un-weathered aquifer system with negligible matrix porosity and permeability but contains planes of discontinuity in the rock matrix, including both faults and joint planes (collectively referred to as fractures). The infiltration and flow of groundwater in such systems is controlled by the prevailing

complex fracture network and can vary in space and time. Such conditions relate to structurally controlled flow systems.

The shallow weathered aquifer can vary in thickness, typically between 12 to 30 m (average 15 m). The degree and intensity of weathering, or more specifically the spatial and depth variations control the geometry of the shallow weathered aquifer profile.

The shallow weathered aquifer is considered to have low to moderate transmissivity, but high storativity. It is recharged by rainfall or by leakage from perennial and non-perennial surface water drainages and dams, although direct recharge from rainfall is limited, as the mafic rocks of the BIC tend to weather to a swelling clay rich soil, referred to turf or black cotton soil, which demonstrated low permeability and can reduce infiltration unless preferential flow paths are opened by vertical desiccation cracks.

The deeper un-weathered aquifer that underlies the shallow weathered aquifer typically has a very low hydraulic conductivity where the bedrock matrix is intact. The effective hydraulic conductivity is determined by the presence of fractures, however fractures may be poorly connected resulting in significant local variations in yield.

The infiltration of water from the shallow weathered to the deeper fractured bedrock aquifer system (vertical leakage) is strongly heterogeneous and requires permeable soils and interconnected fracture systems which act as conduits.

Lateral groundwater flow in the shallow aquifer, is typically driven by topographic gradients.

Aquifer type and classification

Table 40 presents the details of the principal groundwater occurrence in the project area.

TABLE 40: ESTIMATED YIELDS BASED ON HYDROGEOLOGICAL MAP FOR THE PROJECT AREA

Farm	Lithology	Matrix	Yield (L/s)
Grootkuil	**Mafic / ultra mafic intrusive rocks:** dolerite, diabase, diorite, gabbro, dunite, pyroxenite, norite, anorthosite, hornblendite, carbonatite	Intergranular and Fractured	0.5 – 2.0

In terms of the Aquifer Classification Map of South Africa (Conrad *et al*, 1999), project area is classified as a **minor aquifer region,** which implies a moderately-yielding aquifer system of variable water quality.

Although borehole yields in the deeper aquifer are generally considered low, structural features such as faults and fractures can produce higher yielding boreholes.

Aquifer vulnerability and susceptibility

The Aquifer Vulnerability Map of South Africa (Conrad et al. 1999c) indicates the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer. Based on the map, the project area is a 'least vulnerable area' that is only vulnerable to conservative pollutants in the long term when continuously discharged or leached.

The Aquifer Susceptibility Map of South Africa (Conrad *et al*, 1999b), indicates the qualitative measure of the relative ease with which a groundwater body can be potentially contaminated by anthropogenic activities and includes both aquifer vulnerability and the relative importance of the aquifer in terms of its classification. The map indicates that the project area (minor aquifer with least vulnerability) has 'low' susceptibility.

Water users and baseline water conditions

A hydrocensus was conducted by SLR Africa between 14 July 2015 and 6 August 2015. The time of the site work has negligible implications on the outcome of the assessment, although groundwater levels are likely to be at their lowest. The objective of the hydrocensus was to identify groundwater and surface water users within a 5 km radius of the project area. Details such as depth of boreholes, water use and owners were recorded. Groundwater levels were measured and groundwater samples collected for water quality purposes from selected locations.

In total, 16 sites were visited; 13 groundwater monitoring points and 3 surface water monitoring points. Details of the locations are presented in Table 41 and Table 42 below. Locations of all monitoring points visited during the hydrocensus are presented on Figure 19. Key observations include:

- The depth of boreholes ranged from 10 m to over 100 m. Due to the geology of the area, boreholes and their yield are associated with fractures.
- Primary groundwater and surface water uses at identified sites include domestic use, drinking water for livestock (cattle / game). It should however be noted that surface water points identified as part of the hydrocensus contain water only after periods of rainfall and therefore reliance on surface water is limited.
- Surface water courses and dams were dry during the hydrocensus. Surface water courses in the area are ephemeral and flow only during times of rainfall.

TABLE 41: SUMMARY OF THE GROUNDWATER MONITORING POINTS FOR THE 2015 HYDROCENSUS (SLR, SEPTEMBER 2016)

Borehole ID	Farm Name	Borehole Coordinates (WGS84)		Borehole Depth (m)	Borehole Status	Site Purpose	Water Application	Water Level Recorded	Water Sample Collected	Method
		Latitude	Longitude							
BH1	Grootkuil 3	-24.9357222	27.2147222	Obstruction at 10m	Not in use	Game farm	None	No	No	-
BH3	Grootkuil 3	-24.9336667	27.2125000	19	Not in use	Game farm	None	Yes	Yes	Pump
BH4	Grootkuil 3	-24.9306667	27.2036944	51	In use	Game farm	Livestock watering	Yes	Yes	Bailer
BH5	Grootkuil 3	-24.9329167	27.2180833	37	Not in use	Game farm	None	Yes	Yes	Bailer
BH6	Grootkuil 0	-24.9117222	27.2203888	130	Not in use	Farm	None	Yes	Yes	Bailer
BH7	Grootkuil 0	-24.9155278	27.2237500	>100	Not in use	Farm	None	Yes	Yes	Bailer
BH10	Grootkuil 4 (Union Section Mine) (Swartklip)	-24.9315833	27.1821944	10	Not in use	Game farm	None	No	No	-
BH11	Nooitgedacht	-24.8923333	27.1516944	50	In use	Farm/guesthouse	Domestic	No	Yes	Tap – Jo-Jo
BH12	Wildebeestlagte	-24.9598333	27.2357222	60	In use	Game farm	Domestic	No	Yes	Tap
Johan Young BH1	Kameelhoek 3	-24.9071180	27.1720370	60	In use	Farm	Domestic, Livestock Watering	Yes	Yes	Tap in House
Johan Young BH2	Kameelhoek 3	-24.9068800	27.1687860	60	In use	Farm	Domestic, Livestock Watering	Yes	Yes	Tap in House
WM11	Union Section Mine (Swartklip)	-24.9402500	27.1785000	25	Not in use	Down-gradient of TSF	Monitoring only	Yes	Yes	Bailer
WM6	Union Section Mine (Swartklip) M	-24.9451111	27.1792777	27	Not in use	Down-gradient of TSF	Monitoring only	Yes	Yes	Bailer

TABLE 42: SUMMARY OF THE SURFACE WATER MONITORING POINTS FOR THE 2015 HYDROCENSUS (SLR, SEPTEMBER 2016)

Monitoring Point ID	Farm Name	Borehole Coordinates (WGS84)		Source	Water Application	Flow Velocity	Water Sample Collected During Hydrocensus
		Latitude	Longitude				
SW1	Grootkuil 4	-24.9342500	27.17766666	Ephemeral stream / Weir	Weir from Union Section (Swartklip) mine	Dry	No
SW2	Grootkuil 0	-24.9237500	27.21511111	Small dam	Livestock Watering	Dry	No
SW3	Grootkuil 3	-24.9335556	27.21533333	Ephemeral stream	None	Dry	No

Groundwater levels and flow

A total of 9 water levels were recorded in boreholes during the hydrocensus, while the remaining water levels were unable to be measured due to the presence of installed pumps or other obstructions within the boreholes. Recorded groundwater levels ranged between 7.3 mbgl (WM11) and 19.4 mbgl (Johan Young BH1). Groundwater levels are presented in Table 43 below.

TABLE 43: GROUNDWATER LEVELS RECORDED DURING THE HYDROCENSUS

Borehole ID	Borehole Depth (m)	Water Level (mbgl)	Groundwater Elevation (mamsl)
BH1	10.00*	Borehole obstructed at 10.00m	
BH3	19.00	13.31	978.19
BH4	51.00	13.65	979.38
BH5	37.00	18.70	971.94
BH6	>100	12.87	967.12
BH7	>100	18.41	963.26
BH10	10.00	DRY	
BH11	~50.00	Inaccessible for water level measurements	
BH12	~60.00	Inaccessible for water level measurements	
WM11	25.00	7.31	996.73
WM6	27.00	11.78	995.80
J Young BH1	60.00	19.40	967.46
J Young BH2	60.00	13.80	972.64

Note: *blocked at 10m. True depth of borehole unknown

Groundwater flow is in a north-north-easterly direction and follows topography.

Groundwater quality

Groundwater sampling was performed at 11 of the boreholes visited by SLR. Sampled boreholes were selected based on location, in order to gather a spread of data across the area. Sampling was undertaken in accordance with the Water Research Commission's (WRC) Groundwater Sampling Report (Weaver, et al, 2007). Samples were submitted to an accredited laboratory for analysis of general and inorganic parameters. The predominant water supply source in the area is for domestic uses (including drinking) and livestock watering. Therefore the water quality results were compared against the following guidelines:

- South African National Standards (SANS: 241 (2015)) Water Quality Standards.
- Department of Water Affairs (DWAF) (now Department of Water and Sanitation [DWS]) Target Water Quality Range (TWQR) for Livestock Watering (2009).

The SANS 241: 2015 specifies limits in terms of four categories:

- Acute Health – poses an immediate unacceptable health risk if present at concentrations exceeding the numerical limits specified.
- Aesthetics – does not pose an unacceptable health risk if present at concentrations exceeding the numerical limits specified, but will taint water with respect to taste, odour and colour.
- Chronic Health – poses an unacceptable health risk if ingested over an extended period if present at concentrations exceeding the numerical limits specified.
- Operational – is essential for assessing the efficient operation of treatment systems and risks to infrastructure.

The DWAF TWQR for Livestock Watering refers to a 'No Effect Range'. This is the range of concentrations at which the presence of each constituent would have no known or anticipated adverse effects on the suitability of water for livestock watering. These ranges were determined by assuming long-term continuous use (lifelong exposure) and incorporate a margin of safety.

Based on the results presented in Table **44** below, findings with regards to water quality include:

- Concentrations of the majority of elements were low and recorded at concentrations below relevant water quality standards.
- Concentrations of arsenic (As), iron (Fe), manganese (Mn), sodium (Na), nickel (Ni), electrical conductivity (EC), total dissolved solids (TDS), chloride (Cl), sulphate (SO_4) and ammonia (NH_4-N) were reported at concentrations in excess of one of the stipulated water quality standards in at least one sample and considered chemicals of concern (CoCs).
- **Arsenic (As)** concentrations ranged from below the laboratory detection limit of <0.01 mg/L and 0.037 mg/L (WM11). Concentrations were recorded above the SANS 241: 2015 water standard for chronic health (0.01 mg/L) in three boreholes (BH3, MW6 and WM11), two of which are located adjacent to the Union Section Mine Tailings storage facility (TSF).
- **Iron (Fe)** concentrations ranged from below the laboratory detection limit of <0.025 mg/L and 10.64 mg/L (BH3). Concentrations were recorded above the relevant water quality standards in seven boreholes:
  - Concentrations recorded in three boreholes (BH12, MW6 and WM11) were elevated above the SANS 241: 2015 limit for aesthetics (0.3 mg/L).
  - Concentrations recorded in two boreholes (BH4 and BH5) were also elevated above the SANS 241: 2015 limit for chronic health (2 mg/L).
  - Concentrations recorded in two boreholes (BH3 and BH7) were also elevated above the DWAF TWQR for livestock watering (10 mg/L).

- **Sodium (Na)** concentrations ranged between 31 mg/L in Johan Young BH2 and 368 mg/L in WM11. Concentrations recorded in the two boreholes located adjacent to the Union Section Mine TSF (MW6 and WM11) were elevated above the SANS 241: 2015 limit for aesthetics (200 mg/L).
- **Nickel (Ni)** concentrations ranged from below the laboratory detection limit of <0.01 mg/L and 0.071 mg/L in BH3 which exceeded the SANS 241: 2015 DWS for chronic health (0.07 mg/L).
- **Electrical conductivity (EC)** ranged between 70.4 mS/m in BH7 and 484 mS/m in WM11. Concentrations in three boreholes (MW6, WM11 and J Young BH1) exceeded the SANS 241: 2015 DWS for aesthetics (170 mS/m).
- **Total Dissolved Solids (TDS)** ranged between 458 mg/L in BH6 and 3646 mg/L in WM11. Concentrations in three boreholes (MW6, WM11 and J Young BH1) exceeded the SANS 241: 2015 DWS for aesthetics (1200 mg/L).
- **Chloride (Cl)** concentrations ranged between 18 mg/L in BH7 to 1041 mg/L in WM11. Concentrations in four boreholes (BH4, MW6, WM11 and J Young BH1) exceeded the SANS 241: 2015 DWS for aesthetics (300 mg/L).
- **Sulphate (SO_4)** concentrations ranged from below the laboratory detection limit of <5 mg/L to 991 mg/L in WM11. Concentrations were recorded above the relevant water quality standards in three boreholes:
    - The concentration in J Young BH1 exceeded the SANS 241: 2015 DWS for aesthetics (250 mg/L).
    - Concentrations recorded in boreholes MW6 and WM11 exceeded the SANS 241: 2015 DWS for acute health (500 mg/L). Boreholes are located adjacent to the Union Section Mine TSF.
- **Ammonia (NH_4-N)** concentrations ranged from below the laboratory detection limit of <0.2 mg/L and 61 mg/L in BH3, although the concentration recorded in BH3 is significantly higher than all other samples. Excluding the concentration of 61 mg/L, the maximum concentration recorded was 13 mg/L in BH7.

TABLE 44: GROUNDWATER QUALITY RESULTS FOR THE SIYANDA HYDROCENSUS SAMPLES (SLR, SEPTEMBER 2016)

BH ID	Al (mg/L)	As (mg/L)	B (mg/L)	Ba (mg/L)	Be (mg/L)	Bi (mg/L)	Ca (mg/L)	Cd (mg/L)	Co (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (mg/L)	K (mg/L)	Li (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Na (mg/L)	Ni (mg/L)
DWAF TWQR	**5.00**	**1.00**	**5.00**				**1000**	**0.01**	**1.00**		**0.50**	**10**				**500**	**10**	**0.01**	**2000**	**1.00**
SANS 241: OP	**0.3**																			
SANS 241: AS												**0.3**					**0.1**		**200**	
SANS 241: AH																				
SANS 241: CH		**0.01**	**2.4**	**0.7**				**0.03**	**0.5**	**0.05**	**2**	**2**	**0.006**				**0.4**			**0.07**
BH3	<0.100	0.014	0.060	0.286	<0.010	<0.010	35	<0.010	<0.010	<0.010	<0.010	10.64	<0.010	9.1	<0.010	25	0.568	<0.010	65	0.071
BH4	<0.100	<0.010	0.074	0.179	<0.010	<0.010	54	<0.010	<0.010	<0.010	<0.010	8.46	<0.010	3.1	<0.010	25	0.177	<0.010	200	0.057
BH5	<0.100	<0.010	0.048	0.099	<0.010	<0.010	96	<0.010	<0.010	<0.010	<0.010	3.56	<0.010	3.8	<0.010	45	1.22	<0.010	137	0.026
BH6	<0.100	<0.010	0.041	0.071	<0.010	<0.010	6	<0.010	<0.010	<0.010	<0.010	0.20	<0.010	1.9	<0.010	21	<0.025	<0.010	133	<0.010
BH7	<0.100	<0.010	0.083	0.212	<0.010	<0.010	32	<0.010	<0.010	<0.010	<0.010	10.15	<0.010	5.2	<0.010	10	0.430	<0.010	99	0.066
BH11	<0.100	<0.010	0.018	0.034	<0.010	<0.010	38	<0.010	<0.010	<0.010	<0.010	0.183	<0.010	1.4	<0.010	150	<0.025	<0.010	79	<0.010
BH12	<0.100	<0.010	0.046	0.108	<0.010	<0.010	103	<0.010	<0.010	<0.010	<0.010	0.387	<0.010	2.2	<0.010	48	<0.025	<0.010	83	<0.010
MW6	<0.100	0.021	0.112	0.060	<0.010	<0.010	307	<0.010	<0.010	<0.010	<0.010	1.02	<0.010	1.4	<0.010	221	0.056	<0.010	363	0.019
WM11	<0.100	0.037	0.168	0.071	<0.010	<0.010	397	<0.010	<0.010	<0.010	<0.010	1.41	<0.010	4.3	<0.010	231	<0.025	<0.010	368	0.024
J Young BH1	<0.100	<0.010	0.029	0.051	<0.010	<0.010	43	<0.010	<0.010	<0.010	<0.010	0.072	<0.010	2.8	<0.010	327	<0.025	<0.010	177	<0.010
J Young BH2	<0.100	<0.010	0.013	0.038	<0.010	<0.010	3	<0.010	<0.010	<0.010	0.126	<0.025	<0.010	1.1	<0.010	146	<0.025	<0.010	31	<0.010

BH	P	Pb	Sb	Se	Si	Sn	Sr	Ti	U	V	Zn	p	Electrical	Total	Total	Chlori	Sulph	Fluori	Nitra	Nitrit	Free &

ID	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	H	Conductivity (mS/m)	Dissolved Solids (mg/L)	Alkalinity as $CaCO_3$ (mg/L)	de as Cl (mg/L)	ate as SO_4 (mg/L)	de as F (mg/L)	te as N (mg/L)	e as N (mg/L)	Saline Ammonia as N (mg/L)
DWAF TWQR		**0.10**		**50**						**1.00**	**20**					**1500**	**1000**	**2**	**100**		
SANS 241: OP												**5 - 9.7**									
SANS 241: AS											**5**		**170**	**1200**		**300**	**250**				**1.5**
SANS 241: AH																	**500**		**11**	**0.9**	
SANS 241: CH		**0.01**	**0.02**	**0.04**					**0.03**	**0.2**								**1.5**			
BH3	0.266	<0.010	<0.010	0.012	6.3	<0.010	0.368	0.071	<0.010	<0.010	0.111	7.9	123	526	620	38	5	0.5	<0.2	<0.1	61
BH4	0.020	<0.010	<0.010	<0.010	1.3	<0.010	0.590	0.082	<0.010	<0.010	0.033	8.2	144	802	240	341	<5	0.3	0.2	<0.1	1
BH5	0.402	<0.010	<0.010	<0.010	7.0	<0.010	0.561	0.134	<0.010	<0.010	0.011	8.3	124	810	568	140	10	0.5	0.2	<0.1	9
BH6	0.021	<0.010	<0.010	<0.010	0.3	<0.010	0.035	0.010	<0.010	<0.010	<0.010	8.8	83.8	458	196	110	79	1.1	<0.2	<0.1	3.4
BH7	0.391	<0.010	<0.010	<0.010	4.6	<0.010	0.231	0.047	<0.010	<0.010	0.061	7.7	70.4	482	352	18	<5	1.4	<0.2	<0.1	13
BH11	0.024	<0.010	<0.010	<0.010	5.7	<0.010	0.245	0.059	<0.010	<0.010	0.010	8.4	153	940	400	231	147	0.2	1.4	<0.1	0.2
BH12	0.012	<0.010	<0.010	<0.010	7.9	<0.010	0.580	0.158	<0.010	<0.010	2.42	8.1	117	772	432	128	54	0.9	3.8	<0.1	<0.2

MW6	0.024	<0.010	<0.010	<0.010	5.8	<0.010	1.63	0.494	<0.010	0.023	0.034	8.1	423	3094	524	892	816	<0.2	0.6	<0.1	0.2
WM11	0.024	<0.010	<0.010	0.026	5.9	<0.010	1.83	0.647	<0.010	0.011	0.039	8.0	484	3646	464	1041	991	<0.2	0.5	<0.1	0.2
J Young BH1	0.017	<0.010	<0.010	<0.010	29	<0.010	0.362	0.040	<0.010	0.017	0.010	8	323	2116	464	681	382	<0.2	0.2	<0.1	0.2
J Young BH2	<0.010	<0.010	<0.010	<0.010	31	<0.010	0.083	<0.010	<0.010	0.018	0.037	8.5	104	628	600	34	15	<0.2	2.2	0.1	0.3

Note: Highlighted cells indicate the water quality standard that has been exceeded.
DWAF TWQR refers to DWAF Target Water Quality Range for Livestock Watering
SANS 241: OP – Operational. AS – Aesthetics. AH – Acute Heath. CH – Chronic Health. 2015 Standards

Groundwater yields

Based on literature and pumping tests undertaken on one borehole drilled for the project (SIY-BH02S), borehole yields generally range between 0.5 – 5.0 L/s regardless of geology. The transmissivity of the aquifer determined through pumping tests was calculated to be 80 m^2/day (SLR, September 2016).

CONCLUSION

The nature of the proposed infrastructure and activities are such that they present potential for pollution of groundwater resources and lowering of groundwater resources. It should however be noted that the lowering of groundwater levels is highly unlikely. The proposed project must be implemented/ managed in a way that pollution and reduction of groundwater resources is prevented.

FIGURE 19: GROUNDWATER AND SURFACE WATER MONITORING POINTS IDENTIFIED DURING THE HYDROCENSUS AND ON-GOING BASELINE MONITORING POINTS (SLR, OCTOBER 2015)

8.1.9 AIR QUALITY

INTRODUCTION AND LINK TO IMPACT

Existing sources of emissions in the region and the characterisation of existing ambient pollution concentrations is fundamental to the assessment of cumulative air impacts. A change in ambient air quality can result in a range of impacts which in turn may cause a disturbance and/or health impacts to nearby receptors. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCES

Information in this section was sourced from the air quality specialist study undertaken by Airshed Planning Professionals (Airshed, September 2016) for the proposed project and included in Appendix I.

RESULTS

Ambient air quality within the region

Neighbouring land use in the area surrounding the proposed project comprises predominantly mining, residential and farming activities (cropping and game farming) (Figure 24). These land uses contribute to baseline pollutant concentrations via the following sources (Airshed, September 2016):

- Platinum Processing Operations: There are platinum processing operations located in the vicinity of the site alternatives area. Processing emissions and fugitive emission sources from these operations mainly comprise of smelter operations, materials handling operations (tipping, off-loading and loading, conveyor transfer points), vehicle entrainment from plant roads and windblown dust from open areas. These activities result in particulate matter (PM), mono-nitrogen oxides (NOx), carbon monoxide (CO), sulphur dioxide (SO_2), volatile organic compounds (VOCs) and trace metal releases.
- Mining Operations: There are numerous existing and proposed mines located in the vicinity of the site alternatives area. The closest mines located in the vicinity include Union Section Mine and Northam Mine (Figure 24). Fugitive emissions sources from mining operations mainly comprise of land clearing operations (scraping, dozing and excavating), materials handling operations (tipping, off-loading and loading, conveyor transfer points), vehicle entrainment from haul roads, wind erosion from open areas and drilling and blasting. These activities mainly result in fugitive PM releases with NOx, CO, SO_2 and VOC being released during blasting operations as well as a result of diesel combustion and storage.
- Miscelaneous fugitive dust sources: Fugitive PM emissions are generated through entrainment from local paved and unpaved roads, and erosion of open or sparsely vegetated areas. The extent of particulate emissions from the main roads will depend on the number of vehicles using the roads and on the silt loading on the roadways. The an extent, nature and duration of road use activity and the moisture and silt content of soils are required to be known in order to quantify fugitive emissions from

this source. The quantity of windblown dust is similarly a function of the wind speed, the extent of exposed areas and the moisture and silt content of such areas

- Vehicle tailpipe emissions: Air pollution from vehicle emissions may be grouped into primary and secondary pollutants. Primary pollutants are those emitted directly into the atmosphere, and secondary, those pollutants formed in the atmosphere as a result of chemical reactions, such as hydrolysis, oxidation, or photochemical reactions. Notable primary pollutants emitted by vehicles include carbon dioxide (CO_2), CO, hydrocarbons (HCs), SO_2, NO_x, Diesel Particulate Matter (DPM) and lead (Pb). Secondary pollutants include: nitrogen dioxide (NO_2), photochemical oxidants (ozone), HCs, sulphur acid, sulphates, nitric acid, nitric acid and nitrate aerosols. Hydrocarbons emitted include benzene, 1.2-butadiene, aldehydes and polycyclic aromatic hydrocarbons (PAH). Benzene represents an aromatic HC present in petrol, with 85% to 90% of benzene emissions emanating from the exhaust and the remainder from evaporative losses. Vehicle tailpipe emissions are localised sources and unlikely to impact far-field.
- Household fuel burning: Energy use within the residential sector is given as falling within three main categories, viz.: (i) traditional - consisting of wood, dung and bagasse, (ii) transitional - consisting of coal, paraffin and liquefied petroleum gas (LPG), and (iii) modern - consisting of electricity (increasingly this includes the use of renewable energy). The typical universal trend is given as being from (i) through (ii) to (iii). Pollutants include products of combustion (CO, NOx, SO_2 and VOC), unburned HC and PM.
- Biomass burning: Biomass burning includes the burning of evergreen and deciduous forests, woodlands, grasslands, and agricultural lands. Within the vicinity of the site alternatives wild fires may therefore represent a source of combustion-related emissions. Biomass burning is an incomplete combustion process, with (CO) and (NO_2) gases being emitted. Approximately 40% of the nitrogen in biomass is emitted as nitrogen (N_2), 10% is left is the ashes, and it may be assumed that 20% of the nitrogen is emitted as higher molecular weight nitrogen compounds. The visibility of the smoke plumes is attributed to the aerosol (particulate matter) content. In addition to the impact of biomass burning within the vicinity of the project, long-range transported emissions from this source can further be expected to impact on the air quality. It is impossible to control this source of atmospheric pollution loading however it should be noted as part of the background or baseline condition before considering the impacts of other local sources.
- Agriculture: Agriculture is a land use surrounding the site alternatives area. PM is the main pollutant of concern from agricultural activities as particulate emissions are deriving from windblown dust, burning crop residue, and entrainment from dirt roads. In addition, pollen grains, mould spores and plant and insect parts from agricultural activities all contribute to the particulate load. Should chemicals be used for crop spraying, they would typically result in odoriferous emissions.

<u>Pre-project air pollutant concentrations and dust fallout rates</u>

Baseline/pre-project ambient air quality sampling began on 1 June 2015 (Figure 20). Sampling included:

- Dust fallout at five locations (DB1, DB2, DB3, DB4 and DB5) in accordance with ASTM D1739 (1970).
- Alternate 24-hour PM_{10} (inhalable particulate matter less than 10 microns in size) and $PM_{2.5}$ (inhalable particulate matter less than 2.5 microns in size) concentration sampling at one location according to the method as set out by British Standards (BS EN 12341).
- Passive diffusive sampling of SO_2, NO_2 and VOC concentrations at one location using passive diffuse samplers.

Figure 20 shows the locations of baseline monitoring locations for dust fallout, PM_{10} and $PM_{2.5}$ and $S0_2$, NO_2 and VOC concentrations. Results of the baseline sampling campaign available to date are summarised below (Airshed, September 2016):

- The area is dominated by winds from the east-south-east. Frequent winds also occur from the south-eastern and eastern sectors. Long term air quality impacts are therefore expected to be most significant to the west-north-west of operations.
- The main sources likely to contribute to baseline PM concentrations include vehicle entrained dust from local roads, mining operations, platinum processing operations, biomass burning, household fuel burning, vehicle exhaust and windblown dust from exposed areas.
- Ambient baseline air quality monitoring over the six month monitoring period to date indicated:
  - Low NO_2, SO_2, benzene and $PM_{2.5}$ concentrations that are within National Ambient Air Quality Standards (NAAQS).
  - PM_{10} concentrations at levels that likely exceed short term NAAQS.
  - Low dust fallout rates within the NDCR for residential areas.

<u>Potential air receptors</u>

Potential air receptors include, but are not limited to, the following (listed below in a clockwise manner according to Figure 21):

- The Swartklip Mine Village (associated with and immediately adjacent to Union Section Mine) situated less than 1km west of the proposed smelter complex infrastructure area.
- The Bierspruit community situated approximately 2.6 km west-north-west of the proposed smelter complex infrastructure area.
- House located immediately adjacent to the Union Section Mine access road illustrated as point 28 on Figure 21).
- Farm residence (and farm worker residences) on portion 3 and 9 of the farm Kameelhoek situated approximately 2 km north-west of the proposed smelter complex infrastructure area (illustrated as points 30 and 31 on Figure 21). It should be noted that the proposed 3rd access road alternative

passes immediately adjacent to the farmstead and farm worker residences on portion 9 of Kameelhoek (Figure 25).

- Farm residence on portion 4 of the farm Kameelhoek situated approximately 4.5 km north of the smelter infrastructure area (illustrated as point 4 on Figure 21).
- Farm residence on portion 2 of Grootkuil situated approximately 1.5 km north of the proposed smelter complex infrastructure area (illustrated as point 1 on Figure 21).
- Residence located on portion 7 of the farm Kaalvlakte approximately 8.5 km north-east of the proposed smelter infrastructure area (illustrated as point 5 on Figure 21).
- Farmstead (and farm worker residences) located on the SCSC property (approximately 2 km east of the smelter complex infrastructure) (illustrated as point 26 and 27 on Figure 21). It should be noted that this is owned by SCSC and will therefore not be utilised by third parties.
- The town of Northam, located approximately 8 km east-south-east of the proposed infrastructure area.
- The Wildebeeslaagte residential development located approximately 6 km south-east of the proposed smelter complex infrastructure area (illustrated as points 6 to 25 on Figure 21).
- Tiramogo Lodge, belonging to Anglo and located on Portion 4 of Grootkuil (approximately 3 km east-south-east of the smelter complex infrastructure area) (illustrated as point 2 and 3 on Figure 21).
- The communities of Sefikile and Kwetsheza located approximately 6.5 km south of the proposed smelter complex infrastructure area.

CONCLUSION

The proposed site alternatives area is situated within a region that is surrounded by activities and infrastructure that contribute towards sources of emissions such as dust fallout and PM. The proposed project will present sources of potential pollutants which which may influence existing pollutant concentrations. The proposed activities should therefore be carefully designed and managed to ensure that contributions from the proposed project remain within acceptable limits.

8.1.10 NOISE

INTRODUCTION AND LINK TO IMPACT

Certain noise generating activities associated with the proposed project infrastructure/activities could cause an increase in ambient noise levels in and around the proposed site alternatives area. This may cause a disturbance to nearby receptors. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCE

Information in this section was sourced from the noise specialist study undertaken by Airshed Planning Professionals (Airshed, August 2016) for the proposed project and included in Appendix J.

Data provided in this section was sourced through the review of available literature including on-site observations. Further to this, day-time and night-time ambient noise levels for the proposed site alternatives area were obtained through an on-site noise sampling survey that was undertaken in accordance to the International Finance Corporation (IFC) General Environmental Health and Safety Guidelines and the South African National Standards (SANS) 10103 of 2008 (Airshed, June 2015).

RESULTS

As part of the proposed project a noise sampling survey was undertaken to determine the day-time and night-time ambient noise levels. The location of the five sampling points is illustrated in Figure 20. The sampling results are provided for points 1 to 5 in Table 45 below (Airshed, August 2016).

TABLE 45: SUMMARY OF NOISE SAMPLING SURVEY (AIRSHED, AUGUST 2016)

Sampling point	Noise 1 (Swartklip Mine Village)		Noise 2 (south of smelter complex)		Noise 3 (north of smelter complex)		Noise 4 (north-east of smelter complex)		Noise 5 (Anglo's Tiramogo Lodge)	
Time of Day	**Day**	**Night**	**Day**	**Night**	**Day**	**Night**	**Day**	**Night**	**Day**	**Night**
L_{Aeq} (dBA)	43.9	37.1	28.1	21.8	27.7	20.6	28.1	24.6	29.5	39.4

Ambient noise levels are affected by road and rail traffic and natural noise sources such as birds and insects. Barking dogs and cattle also added to the acoustic climate. The acoustic climate at site Noise 1 is comparable to urban districts according to SANS 10103 (2008). At sites Noise 2 to 5 noise levels are currently low and comparable to levels typically found in rural districts except for occasional railway noise.

Potential noise receptors

Noise receptors generally include places of residence and areas where members of the public may be affected by noise generated by industrial activities. Those that could potentially be affected by noise from the project include, but are not limited to, those that are presented in Figure 21 and summarised below:

- The Swartklip Mine Village (associated with and immediately Union Section Mine) situated less than 1km west of the proposed smelter complex infrastructure area.
- The Bierspruit community situated approximately 2.6 km west-north-west of the proposed smelter complex infrastructure area.
- Farm residence (and farm worker residences) on portion 3 and 9 of the farm Kameelhoek situated approximately 2 km north-west of the proposed smelter complex infrastructure area (illustrated as points 30 and 31 on Figure 21). It should be noted that the proposed 3rd access road alternative

passes immediately adjacent to the farmstead and farm worker residences on portion 9 of Kameelhoek (Figure 25).

- Farm residence on portion 2 of Grootkuil situated approximately 1.5 km north of the proposed smelter complex infrastructure area (illustrated as point 1 on Figure 21).
- Farmstead (and farm worker residences) located on the SCSC property (approximately 2 km east of the smelter complex infrastructure) (illustrated as point 26 and 27 on Figure 21). It should be noted that this is owned by SCSC and will therefore not be utilised by third parties.
- Tiramogo Lodge, belonging to Anglo and located on Portion 4 of Grootkuil (approximately 3 km east-south-east of the smelter complex infrastructure area) (illustrated as point 2 and 3 on Figure 21).

Potential noise receptors within residential areas (Swartklip Mine Village) are generally exposed to higher background noise levels than those at farmsteads. Community noise such as traffic, television and radio, barking dogs etc. are main contributors to noise levels within residential areas. The proximity of the Swartklip Mine Village to existing mining activities at Union Section Mine further increases noise levels within the community. Potential noise receptors within community/residential areas are therefore generally less sensitive to intruding noise than those within rural areas or on farms.

CONCLUSION

The proposed project has the potential to increase disturbing noise levels within and surrounding the site alternatives area. It is however important to note that the current mining and suburban activities associated with the Union Section Mine and associated Swartklip Mine Village as well as traffic along the existing D869 road already generate noise. An increase in disturbing noise levels may influence nearby potential noise receptors. Careful planning should therefore be taken into consideration for the proposed project in order to minimise increasing disturbing noise levels.

FIGURE 20: BASELINE AIR QUALITY AND NOISE SAMPLING POINTS (AIRSHED, AUGUST/SEPTEMBER 2016)

FIGURE 21: POTENTIAL NOISE AND AIR QUALITY RECEPTORS (AIRSHED, AUGUST/SEPTEMBER 2016)

8.1.11 VISUAL ASPECTS

INTRODUCTION AND LINK TO IMPACT

Project-related activities have the potential to alter the landscape character of the site and surrounding area through the establishment of both temporary and permanent infrastructure. To understand the basis of these potential impacts, a baseline situational analysis is described below.

DATA SOURCE

Information in this section was sourced from the visual specialist study undertaken by Newtown Landscape Architects (NLA) (August 2016) for the proposed project and included in Appendix K.

RESULTS

Landscape character/quality and visual resource value

The proposed project area lies in a flat, open area characterised by bushveld vegetation and non-perennial drainage lines. Immediately south-west of the site alternatives area, is the Union Section Mine and associated infrastructure (including Swartklip Mine Village) which physically dominates the area and determines the landscape character associated therewith. East of the site, approximately 8km away, is the town of Northam. Crop and game farms and associated isolated farmsteads are typical of the region in addition to isolated communities (such as Sefikile located approximately 5 km south of the site alternatives area). The D869 is located to the north of the site alternatives area and Eskom lines traverse the site alternatives area.

The scenic quality of the proposed site alternatives area and surrounding area is linked to the type of landscapes that occur within an area. In this regard, scenic quality can range from high to low as follows:

- High – these include the natural features such as mountains and koppies and drainage systems;
- Moderate – these include agricultural activities, smallholdings, and recreational areas; and
- Low – these include towns, communities, roads, railway line, industries and existing mines.

This landscape type of the project area and immediate surrounds is of low visual quality and sensitivity since the landscape character has been disturbed due to the presence of mining and anthropogenic activities (Figure 24).

The landscape of the surrounding area has however many redeeming aesthetic features primarily due to its physical setting, which comprises flat plains (dominated by Acacia species) with a backdrop of mountains to the north and north-east. The Spitzkop koppie, around which the settlement of Sefikile is located, protrudes above the plain and is a geographic focal point in the broader area.

The broader area, which, in its original natural state would have been considered of high visual value, has in the past, and is currently experiencing a decline in its landscape character value due to the cumulative impact of mining operations and settlements and community activities in the area.

Sensitivity of Visual Resource

It follows that the highest value visual resource described above is also the most sensitive to changes. In contrast, areas, which are not considered to have a high scenic value, are expected to be the least sensitive to change such as the infrastructure areas.

Sense of place

The sense of place results from the combined influence of landscape diversity and distinctive features. The primary informant of these qualities is the spatial form and character of the natural landscape taken together with the cultural transformations and traditions associated with the historic use and habitation of the area. The proposed site alternatives area is located within a “mining focus area”.

Prior to surrounding mining activities, the greater area projected a strong sense of place with aesthetic value and there still remain areas where a strong sense of place is experienced. This value would also relate to the night time experience of ‘remoteness’ or wilderness which lacked many light sources. However, the advent of mining, settlement and utility activities has eroded the experience and the sense of place is being accumulatively impacted upon by cultural activities and the steady growth of informal homesteads and communities. The area to the north of the site alternatives area still exhibits a strong natural sense of place and this is where a number of tourism activities (hunting and game viewing) are found.

Visual receptors

When viewed from the perspective of tourists and residences within the area, mineral processing activities such as the proposed smelter development could be associated with a sense of disenchantment. People who benefit from the proposed project (employees, contractors, service providers etc.) may not experience this disenchantment but rather see the project with a sense of excitement and anticipation.

It follows that the sensitive viewers are a combination of landowners/land users on surrounding farms and possibly some residents of the Swartklip Mine Village, albeit that it is a mining village and these people are only there because of their association with the Union Section mine.

CONCLUSION

Visual impacts require consideration, particularly as part of closure planning, but none of the potential visual impacts are considered to be exclusively new given the existing mining activities located immediately adjacent to the proposed site alternatives area.

8.1.12 TRAFFIC

INTRODUCTION AND LINK TO IMPACT

Traffic from smelter developments have the potential to affect the capacity of existing road networks as well as result in noise, air quality and public road safety issues. This section provides an overview of the current road network, conditions and road use. Information on use of the rail network is also provided. Understanding the layout, use and conditions of transport systems relevant to the proposed project provides a basis for understanding a change as a result of project contributions.

DATA COLLECTION

Information was sourced from the traffic specialist study (Siyazi, February 2016) included in Appendix L.

The study comprised sourcing relevant data from a site inspection of the existing road network, consultations with the roads authorities, traffic counts, calculations and reference to relevant traffic impact assessment guideline documents. Further details are provided in the traffic study included in Appendix L.

RESULTS

The proposed site alternatives area is located approximately 8km north-west of the town Northam. The D869 between Northam and Dwaalboom runs to the north of the site alternatives area (Figure 24). An overview of the relevant intersections and road sections along the D869 that were investigated by the traffic specialist are included in Table 46 below and Table 47 below and are illustrated in Figure 22.

TABLE 46: INTERSECTIONS RELEVANT TO THE PROPOSED PROJECT

Intersection	Description	Intersection control	Pedestrian Activities
A	Road R510 and Road D869 (Brits Road) (Intersection Northam)	Stop controlled on all approaches	Pedestrian and Hawkers activity present
B	Road D869 (Brits Road) and Proposed Access Road	Proposed access road	Proposed access road
C	Brits and Swartklip Roads (Entrance to Union Section Mine/Swartklip Mine Village)	Free-flow on Road D869 (Brits Road)	Low pedestrian activity

TABLE 47: ROAD CHARACTERISTICS (SIYAZI, FEBRUARY 2016)

Relevant Road Section	Access spacing	Road Reserve	Number of Lanes	Lane Width	Type Of Surface	Anticipated Traffic Growth Per Annum (over 10 years)	Speed Limit
Road Section 1 (Road R510) (Road link between Thabazimbi and Rustenburg)	800m (±15%)	60m	One/two lane per direction	3.7m wide	Asphalt	3%	120 km/h
Road Section 2 (Road D869: Brits Road) (Provides local communities access to main Road R510)	> 150m	40m	One lane per direction	3.7m wide	Asphalt	3%	60 to 100 km/h
Road Section 3 (Road D869: Brits Road) (Provides local communities access to main Road R510)	> 150m	40m	One lane per direction	3.7m wide	Asphalt	3%	60 to 100 km/h
Road Section 4 (Swartklip Road) (Provides local area access to Road D869 (Brits Road))	> 150m	40m	One lane per direction	3.7m wide	Asphalt	3%	60 km/h

Peak-hour traffic counts were conducted for the two relevant intersections along the D689 (Table 48). The peak-hour traffic flow at the relevant intersections shows a general increase in traffic volumes during the afternoon (PM) peak period on the assessed day (a Friday) (Table 48). With reference to Section8.1.15, the Union Section Mine is operative immediately adjacent to the proposed Siyanda site alternatives area. In this regard, it is evident that there is more vehicular activity transporting ore/materials/staff noted during peak-afternoon hours than peak-morning hours. It should however be noted that the traffic counts were conducted on a Friday and this increased peak-afternoon vehicular activity may also be attributed to weekend traffic.

TABLE 48: PEAK-HOUR TRAFFIC COUNTS AT THE RELEVANT INTERSECTIONS ALONG THE D869(SIYAZI, FEBRUARY 2016)

Intersection	Description	Am peak		Pm peak	
		Time interval	Number of vehicles	Time interval	Number of vehicles
A	Road R510 and Road D869 (Brits Road) (in Northam)	06:15 – 07:15	810	15:00 – 16:00	1694
C	Road D869 (Brits Road) and Swartklip Road (entrance to Union Section/Swartklip Mine Village)	06:15 – 07:15	306	15:00 – 16:00	334

With reference to Table 47 and Table 48, the traffic specialist has concluded that the current level of service associated with the D869 and R510 is inadequate and that these roads operate at an unacceptable level of service (even without the consideration of additional project related traffic).

CONCLUSION

Traffic along the D869 in the vicinity of the proposed site alternatives area is currently freeflow and this will need to be maintained. It is recommended by the traffic specialist that both the intersection of the D869 and the Union Section/Swartklip Mine Village road as well as the intersection between the D869 and the Brits Road (i.e. entrance to Northam) be upgraded regardless of whether the proposed project is developed or not. Any changes to the road network or designs of traffic management measures will need to consider both road capacity and safety-related issues.

FIGURE 22: EXISTING ROAD NETWORK LAYOUT (SIYAZI, FEBRUARY 2016)

8.1.13 HERITAGE/CULTURAL AND PALAEONTOLOGICAL RESOURCES

INTRODUCTION AND LINK TO IMPACT

This section describes the existing status of the heritage and cultural environment that may be affected by the proposed project. Heritage (and cultural) resources include all human-made phenomena and intangible products that are the result of the human mind. Natural, technological or industrial features may also be part of heritage resources as places that have made an outstanding contribution to the cultures, traditions and lifestyles of the people or groups of people of South Africa.

Paleontological resources are fossils, the remains or traces of prehistoric life preserved in the geological (rock stratigraphic) record. They range from the well-known and well publicized (such as dinosaur and mammoth bones) to the more obscure but nevertheless scientifically important fossils (such as palaeobotanical remains, trace fossils, and microfossils). Paleontological resources include the casts or impressions of ancient animals and plants, their trace remains (for example, burrows and trackways), microfossils (for example, fossil pollen, ostracodes, and diatoms), and unmineralised remains (for example, bones of Ice Age mammals).

DATA SOURCE

Information was sourced from the Heritage Impact Assessment (HIA) undertaken by Julius Pistorius cc (Julius Pistorius cc, August 2016) included in Appendix M and the Palaentological Impact Assessment (Bruce Rubidge, December 2015) included in Appendix N.

As part of the heritage/cultural and palaeontological studies information was sourced from the review of available literature and through on-site observations.

RESULTS

The Phase I HIA study did not reveal any of the types and ranges of heritage resources as outlined in Section 38 of the National Heritage Resources Act (No 25 of 1999).

With regards to palaeontological resources, as the rocks underlying the site alternatives area are of the Bushveld Complex are of igneous origin there is no possibility of fossils being present. There is a slight, but very unlikely, possibility that fossils could be present in Quaternary alluvial deposits present in low-lying areas.

CONCLUSION

Although no palaeontological or cultural heritage resources were found to occur within the site alternatives area, there is a slight, but very unlikely, possibility that fossils could be present in Quaternary alluvial deposits present in low-lying areas. In the event that resources are identified, a chance find emergency procedure should be implemented.

8.1.14 SOCIO-ECONOMIC

INTRODUCTION AND LINK TO IMPACT

The proposed project has the potential to result in both positive and negative socio-economic impacts.

The positive impacts are usually economic in nature with mineral processing projects contributing directly towards employment, procurement, skills development and taxes on a local, regional and national scale. In addition, projects such as these indirectly contribute to economic growth in the national, local and regional economies by strengthening the national economy and because the increase in the number of income earning people has a multiplying effect on the trade of other goods and services in other sectors.

The negative impacts can be both social and economic in nature. In this regard, mineral processing projects can cause:

- Influx of people seeking job opportunities which can lead to increased pressure on basic infrastructure and services (housing, health, sanitation and education), informal settlement development, increased crime, introduction of diseases and disruption to the existing social structures within communities
- A change to not only pre-existing land uses, but also the associated social structure and meaning associated with these land uses and way of life. This is particularly relevant in the closure phase when the economic support provided by such projects ends and the social structure that has been transformed to deal with the threats and opportunities associated with such projects finds it difficult to readapt.

DATA SOURCE

Information in this section was sourced from the Economic Impact Assessment (Mercury Financial Consultants, August 2016) and the Social Impact Assessment (Synergistics, August 2016) included in Appendix O and Appendix P respectively. As part of these investigations, socio-economic profile data was sourced from the Waterberg District Municipality (WDM), the Thabazimbi Local Municipality (TLM), the Bojanala District Municipality (BDM) and the Moses Kotane Local Municipality (MKLM) Integrated Development Plans (IDPs) and Spatial Development Framework (SDFs).

RESULTS

<u>Population</u>

The average population within the WDM is approximately 679 366 people while the average population within the TLM is approximately 85 234.

Dwellings

The most dominant type of dwelling utilised within both the WDM and the TLM is a formally constructed house or brick structure. This consists of 87% within the WDM and 78% within the TLM. Informal dwellings are the second highest used dwelling type with percentages ranging from 11% to 20% within the WDM and the TLM respectively.

Basic services

As would be expected with the relatively formalised housing infrastructure within both the WDM and the TLM, basic services infrastructure appears to be relatively well formalised too. In the WDM, 48% of the population has access to flushing toilets, while 44% of the population utilises pit toilets. In the TLM, 68% of the population have access to flushing toilets, while 21% of the population within the TLM utilises pit toilets.

Approximately 70% of the WDM population has access to piped water with 71% of the TLM population having access to piped water. In the WDM, 24% have access to a communal stand and only 5% have no access to piped water. In the TLM's households, 22 % have access to a communal water stand and only 6% have no access to piped water.

Approximately 45% of the WDM population and 63% of the TLM population have access to refuse removal through municipalities or private companies, while approximately 7% of the WDM population and 5% of the TLM population have no access to refuse removal. Other forms of refuse removal include own refuse dumps and communal refuse dumps.

Education

Overall statistics throughout the WDM and TLM show poor educational profiles which results in a shortage of labour with required education. Significant numbers of the population at these levels have received either no schooling (12% of WDM and 9% of JMLM) or only limited primary education.

Employment

There is an overall unemployment rate of 28% at a district level (WDM) and 20% at a local municipal level (TLM).

CONCLUSION

In general smelter projects have the potential to influence socio-economic conditions both positively and negatively. In terms of the proposed project, positive socio-economic influences include contributions in various ways to the local and regional economies while negative socio-economic influences include inward migration of people with the resultant pressure on basic infrastructure and services, informal settlement development, increased crime, introduction of diseases and disruption to the existing social structures within established communities.

8.1.15 CURRENT LAND USES

INTRODUCTION AND LINK TO IMPACT

The proposed project has the potential to affect land uses both within the site alternatives area and in the surrounding areas. This can be caused by physical land transformation and through direct or secondary impacts. To understand the basis of the potential land use impacts, a baseline situational analysis is described below. This section should be read with reference to the regional and local land use maps presented in Figure 23 and Figure 24.

DATA SOURCE

Mining right and land ownership details were sourced from SCSC and a deed search. On-site and surrounding land use data was sourced from site observations, the review of topographical maps and satellite imagery, as well as focused meetings with local landowners.

RESULTS – MINERAL AND PROSPECTING RIGHTS

Anglo Platinum currently holds a mining right over the farms Haakdoorn 6 JQ, Syferkuil 9 JQ, Grootkuil 409 KQ, Zwartklip 405 KQ, Spitskop 410 KQ, Turfbult 404 KQ and Elandsfontein 402 KQ under the mining right number ML83/2003. In addition, Anglo Platinum holds a mining right on portion 2 of Spitskop 410 KQ under the mining right ML12/2002. These numbers refer to the old mineral rights which have subsequently been converted to new order mineral rights which were notarially executed on 7 October 2011 and 29 July 2010 respectively.

BCR Mining holds a mining right over the farms Nooitgedacht (portion 6 and 7) and Kameelhoek (portion 3) located immediately adjacent to the SCSC project property. From the point of view of a commercially viable mineral resource, the SCSC project team is aware of this and it would need to be considered if access road alternative 3 was selected as the preferred option for the project.

All holders of the above described mining rights have been engaged as described in Section 7.

RESULTS - EXISTING ENVIRONMENTAL AUTHORISATIONS IN TERMS OF NEMA

In addition to environmental approval for the Union Section Mine and associated activities and infrastructure, Anglo Platinum currently holds an environmental authorisation (NWP/47/EIA/2008) for the aboveground storage of diesel on the farm Turfbult 404KQ.

In addition, Anglo Platinum currently holds an environmental authorisation (16/2/7/A240/C5/Z1/P440) for the construction of a 75 MW photovoltaic power plant on portion 5 of the farm Grootkuil 409 KQ.

RESULTS - LAND OWNERS WITHIN AND ADJACENT TO THE SITE ALTERNATIVES AREA

The landowners and corresponding title deeds numbers of the land in and adjacent to the proposed site alternatives area are listed in Table 49. It should be noted that the table below provides the property details and landowners for all landowners within and adjacent to both smelter location alternatives, all three access road alternatives and all four powerline alternatives. Farm and farm portion delineations are illustrated in Figure 24. The site alternatives are presented in Figure 25.

TABLE 49: LANDOWNERS LOCATED WITHIN AND ADJACENT TO THE PROPOSED SITE ALTERNATIVES AREA

RELEVANT FARMS	RELEVANT PORTION	LANDOWNER	RELEVANT INFRASTRUCTURE
Grootkuil	Portion 2	Ingrid Morrison	Alternative 2 for the smelter infrastructure is located on this portion of land. A small portion of this property may be required in order to cater for road access to the preferred project area (depending on the routing of the preferred access road within the access road corridor)
	Portion 3	Siyanda Chrome Smelting Company (SCSC)	The preferred alternative for the smelter complex will be located within SCSC owned land.
	Portion 4 Portion 5	Rustenburg Platinum Mines (Ltd) (RPM)/ Anglo Platinum	The preferred powerline alternative will traverse the eastern boundary of Anglo property before turning west and entering SCSC property. The 2nd, 3rd and 4th powerline alternatives will also traverse portion 4 and 5 of Grootkuil.
	Portion 7	Transnet	The preferred access road

RELEVANT FARMS	RELEVANT PORTION	LANDOWNER	RELEVANT INFRASTRUCTURE
Kameelhoek	Portion 1	Transnet	(shown as an access road corridor in Figure 25) may pass through Transnet property as it comes off the main D869 road, in the direction of the project area.
	Portion 3	Benhaus Aviation	The preferred access road alternative (shown as an access road corridor in Figure 25) will pass through Benhaus property as it runs south off the main D869 road, in the direction of the project area.
	Portion 9	Johan Young	Access road alternative 3 will pass by portion 9 of Kameelhoek as it runs south off the main Dwaalboom road, in the direction of the project area.
	Portion 10	Benhaus Aviation	Access road alternative 3 will pass by Benhaus property as it runs south off the main D869 road, in the direction of the project area.
	Portion 11		The preferred access road (shown as an access road corridor in Figure 25) may pass through Benhaus property as it runs south off the main D869 road, in the direction of the project area.
	Portion 12	Kameelhoek Game Ranch Pty Ltd	The access road corridor (preferred alternative) and access road alternative 3 are south of the D869 which is south of portion 12 of Kameelhoek.
Nooitgedacht	Portion 7	Samancor Chrome (Ltd)	The preferred access road (alternative 1) may briefly traverse Samancor property as it turns eastwards to enter the SCSC project area.

RELEVANT FARMS	RELEVANT PORTION	LANDOWNER	RELEVANT INFRASTRUCTURE
Zwartklip	Portion 2	Rustenburg Platinum Mines (Ltd) (RPM)	A small section of the preferred access road (within the access road corridor) may need to be developed within this property.
Grootkuil	Portion 2	Ingrid Morrison	The 2nd alternative for the smelter complex is located within this property. In addition, a small section of the preferred access road (within the access road corridor) may traverse a section of this property.
	Portion 6		Immediately east of the preferred alternative for smelter infrastructure
	Portion 0	Martha Schoeman	North east of the preferred alternative for smelter infrastructure
Wildebeeslaagte	Portion 10	Masood Mohammed	Adjacent to the site alternatives area. Immediately east of the existing Eskom servitude through which the preferred powerline will traverse. Immediately north of the existing Spitzkop substation.
Wildebeeslaagte	Portion 0	Dorsland Ontwikkelings Pty Ltd	Adjacent to the site alternatives area. This is the location of the existing Spitzkop substation from where the project powerline will originate.
	Portion 17	Eskom Holdings Ltd	Adjacent to the existing Spitzkop substation from where the project powerline will originate.
	Portion 18	Eskom Holdings Ltd	
	Portion 12	Eskom Holdings Ltd	
	Portion 15	Eskom Holdings SOC Ltd	
Leeuwkopje	Portion 3	Northam Inv Pty Ltd	East of access road alternative 1 and north-east of the powerline routing alternatives.
Spitzkop	Portion 0	Unknown	West of the existing Spitzkop substation from where the project powerline will originate.

RESULTS - LAND CLAIMS

According to the Department of Rural Development and Land Reform (DRDLR), no land claims have been lodged on portion 3 of the farm Grootkuil where the preferred alternative for the proposed smelter and related infrastructure is proposed, or on the portions of land where the linear infrastructure (access road and powerline) are planned (Appendix D).

RESULTS – LAND USE WITHIN AND SURROUNDING THE PROPOSED SITE ALTERNATIVES AREA

Land use within the proposed project area includes mining activities and infrastructure associated with neighbouring mines, road and powerline infrastructure, historically mined out areas, cropping, and game and livestock farming. This is discussed in more details below.

Neighbouring mines

The currently operative Union Section Mine is located immediately adjacent to the proposed SCSC smelter infrastructure area, on Portion 2 of Zwartklip 405 KQ. BCR previously had mining right operations on portion 7 of Nooitgedacht (owned by Samancor) however this is now dormant/closed.

Road infrastructure

Existing roads within the vicinity of the proposed site alternatives area include (Figure 24):

- The tarred Northam-Swartklip road (also referred to as the D869/Dwaalboom road) which runs in a west-east direction, to the north of the site alternatives area.
- The Swartklip town/Union Section Mine access road which runs in a southerly direction (off the main Northam-Swartklip Road).
- The tarred R510 that runs between Northam and Amandelbult.
- Numerous unnamed gravel roads within and around the proposed site alternatives area.

Cultivation, game and cattle grazing

The majority of the site alternatives area is or was previously utilised for agricultural activities (livestock grazing and cropping). Given that the proposed project infrastructure will be limited mostly to the western most part of the site alternatives area, it is likely that agricultural activities on parts of the property might continue, however this will need to be restricted and managed by SCSC to ensure alignment with project planning. Game and cattle grazing takes place in the broader area with several eco-tourism (hunting and game viewing farms) being located within the broader area.

Communities/towns and isolated farmsteads

With reference to Figure 24, the nearest residential areas include the following (these have been listed below in a clockwise manner):

- The Swartklip Mine Village (associated with and immediately Union Section Mine) situated less than 1km west of the proposed smelter complex infrastructure area.
- The Bierspruit community situated approximately 2.6 km west-north-west of the proposed smelter complex infrastructure area.

- House located immediately adjacent to the Union Section Mine access road illustrated as point 28 on Figure 21).
- Farm residence (and farm worker residences) on portion 3 and 9 of the farm Kameelhoek situated approximately 2 km north-west of the proposed smelter complex infrastructure area (illustrated as points 30 and 31 on Figure 24). It should be noted that the proposed 3rd access road alternative passes immediately adjacent to the farmstead and farm worker residences on portion 9 of Kameelhoek (Figure 25).
- Farm residence on portion 4 of the farm Kameelhoek situated approximately 4.5 km north of the smelter infrastructure area (illustrated as point 4 on Figure 24).
- Farm residence on portion 2 of Grootkuil situated approximately 1.5 km north of the proposed smelter complex infrastructure area (illustrated as point 1 on Figure 24).
- Residence located on portion 7 of the farm Kaalvlakte approximately 8.5 km north-east of the proposed smelter complex infrastructure area (illustrated as point 5 on Figure 24).
- Farmstead (and farm worker residences) located on the SCSC property (approximately 2 km east of the smelter complex infrastructure) (illustrated as point 26 and 27 on Figure 24). It should be noted that this is owned by SCSC and will therefore not be utilised by third parties.
- The town of Northam, located approximately 8 km east-south-east of the proposed infrastructure area.
- The Wildebeeslaagte residential development located approximately 6 km south-east of the proposed smelter complex infrastructure area (illustrated as points 6 to 25 on Figure 24).
- Tiramogo Lodge, belonging to Anglo and located on Portion 4 of Grootkuil (approximately 3 km east-south-east of the smelter complex infrastructure area) (illustrated as point 2 and 3 on Figure 24).
- The communities of Sefikile and Kwetsheza located approximately 6.5 km south of the proposed smelter complex infrastructure area.

No informal settlements are located in immediate proximity to the proposed site alternatives area.

Regional powerline infrastructure

Given the proximity of the proposed site alternatives area to the Spitzkop substation there are various powerlines located within and/or within proximity of the proposed site alternatives area. The most relevant of these lines include the 132 kV bus (powerline corridor) which traverses the eastern boundary of the SCSC owned property (and along which the preferred proposed powerline alternative will be built) and the 400kV Matimba powerline which runs through the site alternatives area approximately 2 km from where the proposed smelter infrastructure alternative areas are located. The abovementioned powerlines are illustrated in Figure 24.

Regional railway infrastructure

A railway line connecting Northam to Dwaalboom runs adjacent to the Dwaalboom road (D869) to the north of the proposed site alternatives area. The Union Section Mine railway line joins this main Transnet line at the Kilkenny railway siding (Figure 24).

Servitudes

Known servitudes are associated with the existing railway lines, powerlines and roads.

CONCLUSION

There are a number of land uses which may be influenced by the proposed project and associated potential environmental impacts. It should however be noted that areas within and surrounding the proposed site alternatives have already been significantly influenced through mining and related infrastructure, road networks, powerlines, railway networks and grazing and cropping activities. Conceptual maps showing topographical information as well as land uses on and immediately surrounding the proposed site alternatives area are provided in Figure 23 and Figure 24.

FIGURE 23: REGIONAL LAND USE MAP

FIGURE 24: LOCAL LAND USE MAP

9 IMPACT ASSESSMENT

Table 50 below provides a description of the impacts on environmental and socio-economic aspects in respect of each of the main project actions / activities and processes that will be assessed in Section 9.1 below.

TABLE 50: LIST OF POTENTIAL IMPACTS AS THEY RELATE TO PROJECT ACTIONS / ACTIVITIES / PROCESSES

Main activity/process	Impacts (unmitigated)
Site preparation	Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Pollution from emissions to air Noise pollution Blasting impacts Negative visual impacts Loss of heritage/palaeontological resources Positive socio-economic impacts (Economic impact) Negative socio-economic impacts (Inward migration) Change in land use
Earthworks	Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of natural drainage patterns Contamination of groundwater Pollution from emissions to air Noise pollution Blasting impacts Negative visual impacts Loss of heritage/palaeontological resources Positive socio-economic impacts (Economic impact) Negative socio-economic impacts (Inward migration) Change in land use
Civil works	Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of natural drainage patterns Contamination of groundwater Pollution from emissions to air Noise pollution Blasting impacts Negative visual impacts Positive socio-economic impacts (Economic impact) Negative socio-economic impacts (Inward migration) Change in land use

Main activity/process	Impacts (unmitigated)
Smelter plant	Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of natural drainage patterns Contamination of groundwater Pollution from emissions to air Noise pollution Negative visual impacts Loss of heritage/palaeontological resources Positive socio-economic impacts (Economic impact) Negative socio-economic impacts (Inward migration) Change in land use
Transport systems	Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of natural drainage patterns Contamination of groundwater Pollution from emissions to air Noise pollution Road disturbance and traffic safety Negative visual impacts Loss of heritage/palaeontological resources Positive socio-economic impacts (Economic impact) Negative socio-economic impacts (Inward migration) Change in land use
Power supply and use	Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of natural drainage patterns Contamination of groundwater Pollution from emissions to air Noise pollution Negative visual impacts Loss of heritage/palaeontological resources Positive socio-economic impacts (Economic impact) Negative socio-economic impacts (Inward migration) Change in land use
Water supply and use	Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of natural drainage patterns Contamination of groundwater Reduction of groundwater levels and availability Negative visual impacts Loss of heritage/palaeontological resources Positive socio-economic impacts (Economic impact) Negative socio-economic impacts (Inward migration) Change in land use

Main activity/process	**Impacts (unmitigated)**
Mineralised waste	Loss and sterilization of mineral resources Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of natural drainage patterns Contamination of groundwater Pollution from emissions to air Noise pollution Negative visual impacts Loss of heritage/palaeontological resources Positive socio-economic impacts (Economic impact) Negative socio-economic impacts (Inward migration) Change in land use
Non-mineralised waste management (general and hazardous)	Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of natural drainage patterns Contamination of groundwater Pollution from emissions to air Noise pollution Negative visual impacts Loss of heritage/palaeontological resources Positive socio-economic impacts (Economic impact) Negative socio-economic impacts (Inward migration) Change in land use
Support services	Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of natural drainage patterns Contamination of groundwater Pollution from emissions to air Noise pollution Negative visual impacts Loss of heritage/palaeontological resources Positive socio-economic impacts (Economic impact) Negative socio-economic impacts (Inward migration) Change in land use
General site management	Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of natural drainage patterns Contamination of groundwater Pollution from emissions to air Negative visual impacts Loss of heritage/palaeontological resources Positive socio-economic impacts (Economic impact) Negative socio-economic impacts (Inward migration) Change in land use
Demolition	Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution

Main activity/process	Impacts (unmitigated)
	Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of natural drainage patterns Contamination of groundwater Pollution from emissions to air Noise pollution Negative visual impacts Loss of heritage/palaeontological resources Positive socio-economic impacts (Economic impact) Negative socio-economic impacts (Inward migration) Change in land use
Rehabilitation	Loss and sterilization of mineral resources Hazardous excavations, surface subsidence and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of natural drainage patterns Contamination of groundwater Pollution from emissions to air Noise pollution negative visual impacts Loss of heritage/palaeontological resources Positive socio-economic impacts (Economic impact) Negative socio-economic impacts (Inward migration) Change in land use
Maintenance and aftercare	Loss and sterilization of mineral resources Hazardous excavations and infrastructure Loss of soil resources and land capability through pollution Loss of soil resources and land capability through physical disturbance Physical destruction of biodiversity General disturbance of biodiversity Contamination of surface water resources Alteration of natural drainage patterns Contamination of groundwater Pollution from emissions to air Negative visual impacts Loss of heritage/palaeontological resources Positive socio-economic impacts (Economic impact) Negative socio-economic impacts (Inward migration) Change in land use

The method for the assessment of environmental issues is set out in the Table 51 below. Part A in Table 51 below provides a list of criteria that can be selected in order to rank the severity, duration and spatial scale of an impact. The consequence of the impact is determined by combining the selected criteria ratings allocated for severity, spatial scale and duration in part B of Table 51. The significance of the impact is determined in Part C of Table 51 whereby the consequence determined in part B is combined with the probability of the impact occurring. The interpretation of the impact significance is given in Part D.

This assessment methodology enables the assessment of environmental issues including: cumulative impacts, the severity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent/spatial scale 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. This assessment method was used to assess impacts associated with all project alternatives. A full impact assessment is provided in Section 9.1.

TABLE 51: CRITERIA FOR ASSESSING IMPACTS

PART A: DEFINITION AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of severity, spatial extent and duration**
Criteria for ranking of the SEVERITY of environmental impacts	**H**	Substantial deterioration (death, illness or injury). Recommended level will often be violated. Vigorous community action.
	M	Moderate/ measurable deterioration (discomfort). Recommended level will occasionally be violated. Widespread complaints.
	L	Minor deterioration (nuisance or minor deterioration). Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	L+	Minor improvement. Change not measurable/ will remain in the current range. Recommended level will never be violated. Sporadic complaints.
	M+	Moderate improvement. Will be within or better than the recommended level. No observed reaction.
	H+	Substantial improvement. Will be within or better than the recommended level. Favourable publicity.
Criteria for ranking the DURATION of impacts	**L**	Quickly reversible. Less than the project life. Short term
	M	Reversible over time. Life of the project. Medium term
	H	Permanent. Beyond closure. Long term.
Criteria for ranking the SPATIAL SCALE of impacts	**L**	Localised - Within the site boundary.
	M	Fairly widespread – Beyond the site boundary. Local
	H	Widespread – Far beyond site boundary. Regional/ national

PART B: DETERMINING CONSEQUENCE

SEVERITY = L

DURATION	Long term	**H**	**Medium**	**Medium**	**Medium**
	Medium term	**M**	**Low**	**Low**	**Medium**
	Short term	**L**	**Low**	**Low**	**Medium**

SEVERITY = M

DURATION	Long term	**H**	**Medium**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Low**	**Medium**	**Medium**

SEVERITY = H

DURATION	Long term	**H**	**High**	**High**	**High**
	Medium term	**M**	**Medium**	**Medium**	**High**
	Short term	**L**	**Medium**	**Medium**	**High**
			L	**M**	**H**
			Localised Within site boundary	Fairly widespread Beyond site boundary	Widespread Far beyond site boundary

				Site	Local	Regional/ national
				SPATIAL SCALE		
PART C: DETERMINING SIGNIFICANCE						
PROBABILITY (of exposure to impacts)	Definite/ Continuous	**H**		**Medium**	**Medium**	**High**
	Possible/ frequent	**M**		**Medium**	**Medium**	**High**
	Unlikely/ seldom	**L**		**Low**	**Low**	**Medium**
				L	**M**	**H**
				CONSEQUENCE		

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
High	It would influence the decision regardless of any possible mitigation.
Medium	It should have an influence on the decision unless it is mitigated.
Low	It will not have an influence on the decision.

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

The assessment of the significance of the impacts identified for the proposed project are included in in Section 9.1. The extent to which the identified impacts can be reversed, may cause an irreplaceable loss of resources and can be avoided or addressed by the adoption of mitigation measures is also included in Section 9.1.

9.1 ASSESSMENT OF EACH IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK

Potential environmental and socio-economic impacts presented below were identified by SLR, IAPs and regulatory authorities. The impacts are discussed under issue headings in this section.

The assessment below focuses on providing an impact assessment of the preferred alternatives for the smelter complex, access road and powerline routings. Unless specifically stated, the impact assessment for the preferred alternatives holds true for other alternatives considered. The reader is also referred to Section 10 for a summary on the impacts associated with the other alternatives considered for the project.

All identified impacts are considered in a cumulative manner such that the current baseline conditions on site and in the surrounding area are discussed and assessed together. The criteria/methodology used to rate each impact is outlined in section. The potential impacts are rated with the assumption that no mitigation measures are applied and then again with mitigation. An indication of the phases in which the impact will occur including the activity associated with each impact is provided below.

Environmental impacts that will be assessed in this section include the following:

- Loss and sterilisation of a mineral resource (Section 9.1.1)
- Hazardous excavations, infrastructure and surface subsidence (Section 9.1.2)

- Loss of soil resources and land capability through contamination (Section 9.1.3)
- Loss of soil resources and land capability through physical disturbance (Section 9.1.4)
- Physical destruction of biodiversity (Section 9.1.5)
- General disturbance of biodiversity (Section 9.1.6)
- Alteration of natural drainage patterns (Section 9.1.7)
- Contamination of surface water resources (Section 9.1.8)
- Reduction of groundwater levels and availability (Section 9.1.9)
- Contamination of groundwater resources (Section 9.1.10)
- Air pollution (Section 9.1.11)
- Noise pollution (Section 9.1.12)
- Blasting impacts (Section 9.1.13)
- Road disturbance and traffic safety (Section 9.1.14)
- Visual impacts (Section 9.1.15)
- Loss of heritage, cultural and palaeontological resources (Section 9.1.16)
- Inward migration impact (Section 9.1.17)
- Economic impact (Section 9.1.18)
- Land use impact (Section 9.1.19)

GEOLOGY

9.1.1 ISSUE: LOSS AND STERILISATION OF MINERAL RESOURCE

Information in this section was sourced from the project team.

Introduction

Mineral resources can be sterilised and/or lost through the placement of infrastructure and activities in close proximity to mineral resources and thereby preventing access to potential mining areas, and through the disposal of mineral resources onto mineralised waste facilities (slag dump or baghouse slurry facility).

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Transport systems Mineralised waste Placement of infrastructure	Transport systems Mineralised waste Placement of infrastructure	Mineralised waste	Maintenance and aftercare of rehabilitated areas

Rating of impact

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

On the basis of existing information there are no mineral and/or prospecting right holders on the properties required for the preferred project area (smelter complex, access road or powerline alternatives). The 3rd access road alternative is located above a known ore body (chrome) which traverses portion 6 and 7 of Nooitgedacht and portion 3 of Kameelhoek. As described in Section 8.1.15, this mining right is held by BCR Mining. From the point of view of a commercially viable mineral resource, the SCSC project team is aware of this and it would need to be considered if access road alternative 3 was selected as the preferred option for the project.

It follows that if the project (and preferred alternatives) are approved, the only potential sterilisation could be associated with the disposal of mineralised waste in a manner that prohibits future access to material that may in future be regarded as a useable resource.

The severity of sterilising mineral resources is considered to be high because of the associated potential economic value that is lost when sterilisation occurs. In the unmitigated scenario, this may occur in the event that SCSC develops or decommissions infrastructure in a manner that it prohibits the mining of feasible resources, or where it disposes of feasible mineral resources onto the slag dump or baghouse slurry facility which may make it difficult to access these resources in future.

In the mitigated scenario, planning and co-ordination between the project team can help to prevent the unacceptable sterilisation of resources, without compromising safety requirements. The mitigated severity reduces to low.

Duration / Reversibility

If sterilisation of resources occurs it is likely that the related impact will extend beyond the life of the project. This is a long term duration in the unmitigated scenario. With mitigation the duration can be reduced because access to potentially useable minerals in the waste material will be possible.

Spatial scale / Extent

The spatial extent of the physical impact is linked to the spatial extent of the proposed project area. This is a localised spatial extent. If one however considers the economic nature of the impact, it will extend beyond the site into the broader economy.

Consequence

The unmitigated consequence is high. The mitigated consequence is low.

Probability

Without mitigation the probability is high. With the implementation of mitigation measures, planning structures will be in place to avoid infrastructure and development related sterilisation; and to make it possible to access the mineralised waste facilities as relevantwhich reduces the probability to low.

Significance

The unmitigated significance is high. In the mitigated scenario the significance is low.

It is expected that the related impact assessment remains unchanged regardless of the alternative being considered for the location of the smelter or the routing alternative for the powerline. This impact is not relevant for the powerline given that there are no known ore bodiIt is expected that sterilisation related imapcts are expected to be more significant for access road alternative 3 given the location of the known ore body beneath it. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is provided below.

Unmitigated – summary of the rated loss and sterilisation of mineral resources impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operation, decommissioning and closure						
Unmitigated	H	H	M	H	H	H

Mitigated – summary of the rated loss and sterilisation of mineral resources impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operation, decommissioning and closure						
Mitigated	L	M	M	L	L	L

Description of proposed mitigation measures

Mitigation measures are provided below and tabulated in the EMP (Section 26)

Objective

To prevent unacceptable mineral sterilisation.

Actions

SCSC will incorporate cross discipline planning structures for infrastructure developments to avoid mineral sterilisation.

Where feasible, SCSC will make provision for the further processing/resale of slag and baghouse dust material prior to disposal on the waste facilities.

The mineralised waste facilities will be designed in such a way that reprocessing is possible post deposition of waste.

Emergency situations

None identified.

TOPOGRAPHY

9.1.2 ISSUE: HAZARDOUS EXCAVATIONS AND INFRASTRUCTURE

Information in this section was sourced from the project team.

Introduction

Hazardous excavations and infrastructure include all structures into or off which third parties and animals can fall and be harmed. Hazardous excavations and infrastructure occur in all project phases from construction through operation to decommissioning and closure. In the construction and decommissioning phases these hazardous excavations and infrastructure are usually temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term hazardous excavations and infrastructure and the closure phase will present final land forms (for example the slag dump and baghouse slurry facility) that are considered hazardous.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks Civil works	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Support services Rehabilitation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Support services Demolition Rehabilitation	Maintenance and aftercare of rehabilitated areas

Rating of impact

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

In the unmitigated scenario, in all project phases, most of the identified hazardous excavations and infrastructure present a potential risk of injury and/or death to both people and animals for all the proposed project. This is a potential high severity.

In the mitigated scenario the severity reduces to low with the implementation of management measures focused on access control and the design of rehabilitation components to prevent and/or mitigate impacts.

Duration / Reversibility

Death or permanent injury is considered a long term, permanent impact in both the mitigated and unmitigated scenarios.

Spatial scale/ Extent

Direct impacts associated with hazardous infrastructure and excavations will be located within the site boundary in all project phases, with or without mitigation. The potential indirect impacts will however extend beyond the site boundary to the communities to which the injured people and/or animals belong.

Consequence

The consequence is high in the unmitigated scenario, reducing to medium in the mitigated scenario.

Probability

In the unmitigated scenario, without design and management interventions the impact probability is expected to be medium. The mitigation measures will focus on infrastructure safety design and implementation as well as on limiting access to third parties and animals which reduces the probability of the impact occurring.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance of this potential impact is low because there will be a reduction in probability that the impact occurs.

It is expected that the related impact assessment remains unchanged regardless of the alternative being considered for the location of the smelter, the powerline or access road routings. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is provided below.

Unmitigated – summary of the rated hazardous excavations and infrastructure impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	M	H

Mitigated – summary of the rated hazardous excavations and infrastructure impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	H	M	M	L	L

Description of proposed mitigation measures

Mitigation measures are provided below have been tabulated in the EMP (Section 26)

Objectives

The objective is to prevent physical harm to third parties and animals from potentially hazardous excavations and infrastructure.

Actions

Mineralised waste facilities will be designed, constructed, operated and closed in a manner to ensure that stability and related safety risks to third parties and animals are addressed. These issues will be monitored according to a schedule that is deemed relevant to the type of facility by a professional engineer.

SCSC will survey the entire project area and update its surface infrastructure map on a routine basis (as a minimum annually) to ensure that the position and extent of all potential hazardous excavations and infrastructure is known. It will furthermore ensure that appropriate management measures are taken to address the related safety risks to third parties and animals.

During construction and operation the safety risks associated with identified hazardous excavations and infrastructure will be addressed through one or more of the following:

- Fencing, berms, barriers and/or security personnel to prevent unauthorised access.
- Warning signs in the appropriate language(s). Warning pictures are an alternative.

Where SCSC has caused injury or death to third parties and/or animals, as a result of its operations, appropriate compensation will be provided.

During the decommissioning planning, provision will be made to address long term safety risks in the decommissioning and rehabilitation phases.

At closure, the hazardous infrastructure will either have been removed or decommissioned and rehabilitated in a manner that it does not present a long term safety and/or stability risk. If no third party market can be secured for the resale of slag and baghouse dust material these facilities will remain in perpetuity and in this regard will be made safe and rehabilitated.

At closure the hazardous excavations will be dealt with as follows: monitoring and maintenance will take place to observe whether the relevant long term safety objective have been achieved and to identify the need for additional intervention where the objectives have not been met.

Emergency situations

If people or animals fall off or into hazardous excavations or infrastructure causing injury, or if any mineralised waste or water facilities fail causing injury to people or animals, the SCSC Emergency Response Procedure (Section 28.2.2) will be initiated.

SOIL AND LAND CAPABILITY

9.1.3 ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH CONTAMINATION

Information in this section was sourced from the soils, land use and land capability study for the proposed project (Terra Africa, March 2016) included in Appendix E.

Introduction

Soil is a valuable resource that supports a variety of ecological functions. The proposed project has the potential to damage soil resources through physical disturbance and/or contamination. Contamination of soils also has the potential to impact both surface and groundwater resources. Surface and groundwater contamination impacts are discussed in Sections 9.1.8 and 9.1.10 respectively. The loss of soil resources has a direct impact on the potential loss of the natural capability of the land. This section therefore focuses directly on the potential for disturbance and contamination of the soil resources and the effect this has on land capability.

There are a number of sources in all phases that have the potential to pollute soil resources. Limited sources occur during the closure phase. In the decommissioning phase these pollution sources are usually temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term pollution sources. Although the sources are temporary in nature, the potential related pollution can have long term effects.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks Civil works	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Rehabilitation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Support services General site management Demolition Rehabilitation	Maintenance and aftercare of rehabilitated areas

Rating of impacts

<u>Severity / nature/ degree to which impact may cause irreplaceable loss of resources</u>

In the unmitigated scenario, pollution of soils from numerous incidents can result in a loss of land capability as an ecological driver because it can create a toxic environment for vegetation and ecosystems that rely on the soil. It could also negatively impact on the chemistry of the soils such that current growth conditions are impaired. This is a high severity in the unmitigated scenario. In the mitigated scenario the number of pollution events should be significantly less which reduces the potential severity to low.

Duration / Reversibility

In the unmitigated scenario, most pollution impacts and associated loss in land capability will remain long after closure. In the mitigated scenario most of these potential impacts should either be avoided or be remedied within the life of the project, which reduces the duration to low. This will be achieved by the effective reaction time of the clean-up team and the chosen remediation methods.

Spatial scale/ Extent

In both the unmitigated and mitigated scenarios for all phases, the potential loss of soil resources and associated land capability will be restricted to within the site boundary.

Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario the consequence is reduced to low as the severity and duration of the impact is reduced.

Probability

Without any mitigation the probability of impacting on soils and land capability through pollution events is high. With mitigation, the probability will be reduced to medium because emphasis will be placed on preventing pollution events and on quick and effective remediation if pollution events do occur.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance reduces to low because with mitigation the severity, duration and probability associated with the potential the impact all reduce.

It is expected that the related impact assessment remains unchanged regardless of the alternative being considered for the location of the smelter or routing of the powerline. The 1st access road alternative is approximately three times the length of the 2nd and 3rd alternatives and is therefore expected to be associated with more significant soil related impacts. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is provided below.

Unmitigated – summary of the rated loss of soil resources and land capability through contamination impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	L	H	H	H

Mitigated – summary of the rated loss of soil resources and land capability through soil contamination impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	L	L	L	M	L

Description of proposed mitigation measures

Mitigation measures are given below and have been tabulated in the EMP (Section 26).

Objectives

The objective is to prevent soil pollution as a first priority and to remedy any pollution should it occur.

Actions

In the construction, operation and decommissioning phases SCSC will ensure that all hazardous chemicals (new and used), dirty water, mineralised wastes and non-mineralised wastes are transported, handled and stored in a manner that they do not pollute soils. This will be implemented through procedure(s) covering the following:

- Pollution prevention through basic infrastructure design pollution prevention through maintenance of equipment.
- Pollution prevention through education and training of workers (permanent and temporary).
- Pollution prevention through appropriate management of hazardous materials and wastes.
- The required steps to enable fast reaction to contain and remediate pollution incidents. In this regard the remediation options include containment and in-situ treatment or disposal of contaminated soils as hazardous waste. In-situ treatment is generally considered to be the preferred option because with successful in situ remediation the soil resource will be retained in the correct place. The in-situ options include bioremediation at the point of pollution, or removal of soils for washing and/or bio remediation at a designated area after which the soils are returned.
- Specifications for post rehabilitation audit criteria to ascertain whether the remediation of any polluted soils and re-establishment of soil functionality has been successful and if not, to recommend and implement further measures.
- During the rehabilitation and closure phases a land contamination assessment must be conducted. The data presented in Table 52 below can be used as a baseline to measure any variances that may occur as a result of project related activities.

TABLE 52: METAL ANALYSIS OF SOIL SAMPLES AS COMPARED TO SOIL SCREENING VALUES (SSV 1) AS PRESCRIBED IN GN R.331 (TERRA AFRICA, MARCH 2016)

Parameter	Soil (mg/kg)	SCSC samples (mg/kg)					
	SSV 1 All land uses	SY 5	SY6	SY7	SY8	SY9	SY10

	Protective of water resources						
Arsenic (As)	5,8	1.50	1.30	1.40	1.30	1.40	1.30
Cadmium (Cd)	7.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium (III) (Cr)	46 000	160.00	164.00	170.00	173.00	169.00	160.00
Chromium (IV) (Cr)	6.5	-	-	-	-	-	-
Cobalt (Co)	300	38.2	34.00	37.70	37.20	47.50	48.90
Copper (Cu)	16	22.2	224.00	21.20	20.50	34.60	33.90
Lead (Pb)	20	8.4	8.00	8.10	8.30	8.30	7.90
Manganese (Mn)	740	1636.0	1340.0	1649.0	1627.0	1635.0	1656.0
Mercury (Hg)	0.93	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel (Ni)	91	83.00	77.50	81.30	80.80	60.50	55.40
Vanadium (V)	150	91.00	93.70	87.40	88.20	117.00	113.00
Zinc (Zn)	240	31.70	31.30	29.30	28.00	37.90	36.50

The designs of any permanent and potentially polluting structures (mineralised waste facilities) will take account of the requirements for long term soil pollution prevention, land function and confirmatory monitoring.

SCSC will ensure that the handling and disposal of general and hazardous waste is undertaken in accordance with the waste management procedures as outlined in Table 53.

TABLE 53: WASTE MANAGEMENT PROCEDURES FOR NON MINERALISED WASTE

Items to be considered		**Intentions**
General	**Specific**	
Classification and record keeping	General	The waste management procedure for the SCSC project will cover the storage, handling and transportation of waste to and from the project area. SCSC will ensure that the contractors responsible are made aware of these procedures.
	Waste opportunity analysis	In line with DWSs' strategy to eliminate waste streams in the longer term, SCSC will assess each waste type to see whether there are alternative uses for the material. This will be done as a priority before the disposal option.
	Classification	Wastes will be broadly classified in terms of the DWA Minimum Requirements for Waste Disposal (DWA, 1998).
	Inventory of wastes produced	An inventory of wastes will be compiled and will include estimated quantities of waste. The inventory will be kept up to date.
	Disposal record	Written evidence of safe disposal of waste will be kept.
Waste management facilities	Collection points	Designated waste collection points will be established on site. Care will be taken to ensure that there will be sufficient collection points with adequate capacity and that these are serviced frequently.
	General waste	Will be stored in designated skips and removed by an approved contractor for disposal at a licensed facility.
	Scrap metal and building rubble	Care will be taken to ensure that scrap metal and building rubble does not become polluted or mixed with any other waste. The scrap metal will be collected in a designated area for scrap metal (salvage yard). It will be sold to scrap dealers.

Items to be considered		Intentions
General	**Specific**	
	Hazardous wastes	Medical waste, laboratory chemicals, explosives packaging (if required for construction phase blasting), used chemicals and chemical containers will be temporarily stored in sealed containers in a bunded store before removal by an approved waste contractor and disposal in a licensed facility.
	Oil and grease	Oil and grease will be collected in suitable containers at designated collection points. The collection points will be bunded and underlain by impervious materials to ensure that any spills are contained. Notices will be erected at each waste oil point giving instructions on the procedure for waste oil discharge and collection. An approved subcontractor will remove oil from site.
	Any soil polluted by a spill	If remediation of the soil *in situ* is not possible, the soils will be classified as a waste in terms of the Minimum Requirements and will be disposed of at an appropriate permitted waste facility.
	Sewage sludge (relevant in the event that the sewage treatment plant is developed on site)	Sludge (and screenings) produced by the sewage process will be dried on conventional drying beds and when adequately dried, removed. This material will then either (subject to appropriate classification and DWS approval) be composted with other suitable organic material generated on site (wood chips, sawdust, grass & tree cuttings) to provide a suitable composted material for application on rehabilitation areas, or it will be stored in sealed containers and taken to the Northam or Thabazimbi sewage treatment plants.
Disposal	Off-site waste disposal facilities	Waste will be disposed of at appropriate permitted waste disposal facilities as outlined below. For general waste the closest permitted site is in Northam. For hazardous waste the closest permitted site is Holfontein.
Waste transport	Contractor	A qualified waste management subcontractor will undertake the waste transport. The contractor will provide an inventory of each load collected and proof of disposal at a licensed facility.
Banned practices	Long-term stockpiling of waste	Stockpiling of waste is a temporary measure. Waste stockpiling sites must have an impervious floor, be bunded and have a drainage system for collection and containment of water on the site.
	Burying of waste	No wastes other than mineralised waste facilities will be placed on site.
	Burning of waste	Waste may only be burned in legally approved incinerators or destruction bay.

Emergency situations

Major spillage incidents will be handled in accordance with the SCSC Emergency Response Procedure (Section 28.2.2).

9.1.4 ISSUE: LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE

Information in this section was sourced from the soils, land use and land capability study for the proposed project (Terra Africa, March 2016) included in Appendix E.

Introduction

Soil is the key to re-establishing post closure land capability. There are a number of activities/infrastructure in all phases that have the potential to disturb soils and related land capability through removal, compaction and/or erosion. Decommissioning related activities are temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term activities. During the closure phase, even though activities that cause physical disturbance of soil and associated land capability will not occur during the closure phase, final rehabilitated areas may be susceptible to erosion.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Rehabilitation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Support services General site management Demolition Rehabilitation	Maintenance and aftercare of rehabilitated areas

Rating of impact

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

In the unmitigated scenario, physical soil disturbance can result in a loss of soil functionality as an ecological driver. In the case of erosion, the soils will be lost to the area of disturbance, and in the case of compaction the soils functionality will firstly be compromised through a lack of rooting ability and aeration, and secondly the compacted soils are likely to erode because with less inherent functionality there will be little chance for the establishment of vegetation and other matter that naturally protects the soils from erosion. This amounts to a high severity.

In the mitigated scenario, the soils can be conserved and reused which reduces the high unmitigated severity to medium.

Duration / Reversibility

In the unmitigated scenario the loss of soil and related functionality is long term and will continue after the life of the project. In the mitigated scenario, the soil is conserved, replaced and the functionality restored which reduces the duration of the impact to medium.

Spatial scale/ Extent

In both the unmitigated and mitigated scenarios for all phases of the project, the potential loss of soil and land capability through physical disturbance will be restricted to within the site boundary.

Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario the consequence is medium as the severity and duration of the impact is reduced.

Probability

Without any mitigation, the probability of losing soil and related land capability is definite. With mitigation, the probability will be reduced because emphasis will be placed on soil conservation and re-establishment.

Significance

In the unmitigated scenario the impact is high. In the mitigated scenario the significance of this impact is reduced to low as the severity, duration and probability are reduced.

It is expected that the related impact assessment remains unchanged regardless of the alternative being considered for the location of the smelter or powerline routing. The 1st access road alternative is approximately three times the length of the 2nd and 3rd alternative and it is therefore expected that soil disturbance impacts associated therewith would be more significant. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is provided below.

Unmitigated – summary of the rated loss of soil resources and land capability through physical disturbance impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	L	H	H	H

Mitigated – summary of the rated loss of soil resources and land capability through physical disturbance impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	M	L	M	L	L

Description of proposed mitigation measures

Mitigation measures specific to the proposed project are provided below and tabulated in the EMP (Section 26).

Objective

The objective is to minimise the loss of soil resources and related land capability through physical disturbance, erosion and compaction.

Actions

In the construction, operation and decommissioning phases a soil management plan, with the following key components, will be implemented:

- Limit the disturbance of soils to what is absolutely necessary for earthworks, on-going activities, infrastructure footprints and use of vehicles.
- Where soils have to be disturbed the soil will be stripped, stored, maintained and replaced in accordance with the specifications of the soil management principles in Table 54 and the detailed SCSC soils management procedure.

TABLE 54: SOIL MANAGEMENT PRINCIPLES

Steps	Factors to consider	Detail
Delineation of areas to be stripped		Stripping will only occur where soils are to be disturbed by activities and infrastructure that are described in the EIA/EMP report, and where a clearly defined end rehabilitation use for the stripped soil has been identified.
Reference to biodiversity mitigation		All requirements for moving and preserving fauna and flora according to the biodiversity mitigation measures will be adhered to.
Stripping	Topsoil	As a general rule 50cm of topsoil will be stripped.
	Subsoil	Given the nature of the soils, no distinction needs to be made between subsoil and the topsoil.
Delineation of stockpiling areas	Location	The topsoil stockpiling area to the west of the smelter complex has been identified in close proximity to the source of the soil to limit handling and to promote reuse of soils in the correct areas.
	Designation of the areas	Soil stockpiles will be clearly marked to identify both the soil type and the intended area of rehabilitation.
Stockpile management	Vegetation establishment and erosion control	Rapid growth of vegetation on the topsoil stockpiles will be promoted (e.g. by means of watering or fertilisation). The purpose of this exercise will be to encourage vegetation growth on soil stockpiles and to combat erosion by water and wind.
	Storm water controls	Stockpiles will be established with storm water diversion channels to prevent run off erosion.
	Height and slope	Soil stockpiles height will be restricted to avoid compaction and damage to the underlying soils. The ideal stockpile height for storage periods greater than 3 years is 4m. For short-term stockpiles (less than 3 years), the maximum allowable height is 12m but these stockpiles should be benched. Each bench should ideally be 1.5m high and 2m wide. The stockpile side slopes should be 1 vertical: 3 horizontal to promote vegetation growth and reduce run-off related erosion.
	Waste	No waste material will be placed on the soil stockpiles.
	Vehicles	Equipment movement on top of the soil stockpiles will be limited to avoid topsoil compaction and subsequent damage to the soils and seedbank.
Rehabilitation	Placement of soil	As a general rule, a minimum layer of 50cm of topsoil will be replaced.

Steps	Factors to consider	Detail
of disturbed land: restoration of land capability	Fertilisation	A few samples of stripped soils will be analysed to determine the nutrient status of the soil. As a minimum, the following elements will be tested for cation exchange capacity, pH, and phosphate. These elements provide the basis for determining the fertility of soil. Based on the analysis, fertilisers will be applied if necessary.
	Erosion control	Erosion control measures will be implemented to ensure that the topsoil is not washed away and that erosion gulleys do not develop prior to vegetation establishment.
	Land use objective	Rehabilitation initiatives will (where possible) aim to re-establish the pre project agricultural land use capabilities of grazing and/or cultivation.
	Land quality remediation (LQR)	During the rehabilitation and closure phases a land contamination assessment will be conducted. The data presented in Table 52 above will be used as a baseline to measure any variances that may occur as a result of project related activities. If results from the contamination assessment are found to be higher than baseline levels, SCSC will undertake remediation measures to rectify this.
Pollution of soils	In situ remediation	If soil (whether stockpiled or in its undisturbed natural state) is polluted, the first management priority is to treat the pollution by means of in situ bio-remediation at the designated site. The acceptability of this option must be verified by an appropriate soils expert and by DWS, on a case-by-case basis, before it is implemented.
	Off-site disposal	If in situ treatment is not possible or acceptable then the polluted soil will be classified according to the Minimum Requirements for the Handling, Classification, and Disposal of Hazardous Waste (DWAF 1998) and disposed at an appropriate, permitted, off-site waste facility.

To prevent the erosion of topsoils, management measures may include berms, soil traps, hessians and stormwater diversions away from areas susceptible to erosion. It will be ensured that topsoil stockpiles are located outside of any drainage lines and areas susceptible to erosion.

All areas affected by construction should be rehabilitated upon completion of the construction phase of the development. Permanent infrastructure should be suitably re-vegetated, if possible.

Emergency situations

None identified.

BIODIVERSITY

9.1.5 ISSUE: PHYSICAL DESTRUCTION OF BIODIVERSITY

Information in this section was sourced from the biodiversity study undertaken by Scientific Aquatic Services (SAS, August 2016) included in Appendix F.

Introduction

There are a number of activities/infrastructure in all phases that have the potential to destroy biodiversity in the broadest sense. In this regard, the discussion relates to the physical destruction of specific biodiversity areas, of linkages between biodiversity areas and related species which are considered to be significant because of their status, and/or the role that they play in the ecosystem.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks Civil works	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Rehabilitation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services Demolition Rehabilitation	Maintenance and aftercare of rehabilitated areas

Rating of impact

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

Areas of high ecological sensitivity are functioning biodiversity areas with species diversity and associated intrinsic value. In addition, some of these areas host protected species. The linking areas have value because of the role they play in allowing the migration or movement of flora and fauna between the areas which is a key function for the broader ecosystem. The transformation of land for any purpose, including smelter complex and associated activities, increases the destruction of the site specific biodiversity, the fragmentation of habitats, reduces its intrinsic functionality and reduces the linkage role that undeveloped land fulfils between different areas of biodiversity importance.

When considering the surface infrastructure/activities proposed as part of the project, it should be noted that all infrastructure associated with the proposed smelter complex and access road will be located outside of areas of high sensitivity (Figure 16) and mostly on previously transformed land. All powerline routing alternatives will however require river crossings of the Phufane, Brakspruit and two unnamed tributaries thereof as it travels from the Spitzkop substation to the smelter complex and in this regard areas of high sensitivity will not be entirely avoidable. In addition, the preferred routing for the powerline and associated service road will require the removal of some protected species (*Vachellia erioloba* (Camel Thorn) which may not be able to be avoided (Figure 16).

The potential risk of losing ecosystem functionality amounts to a high severity in the unmitigated scenario when taking the above into consideration.

With the correct mitigation measures being put in place, the physical disturbance to biodiversity can be reduced. If the correct mitigation measures are put in place, some of the destruction could be avoided entirely and where such destruction has occurred, rehabilitation could establish a functional ecosystem. This amounts to a mitigated severity of medium.

Duration / Reversibility

In the unmitigated scenario the loss of biodiversity and related functionality is long term and will continue after the life of the project. With mitigation, biodiversity and related functionality may be partially restored during the operational, decommissioning and closure phases. The duration is therefore high in the unmitigated scenario, reducing to medium in the mitigated scenario.

Spatial scale / Extent

Given that biodiversity processes are not confined to the proposed site alternatives area, the spatial scale of impacts will extend beyond this boundary in both the mitigated and unmitigated scenarios. Key related issues are the migration of species and the flow of nutrients. The spatial scale is therefore medium in both the unmitigated and mitigated scenarios.

Consequence

In the unmitigated scenario, the consequence is high and reduces to medium with mitigation.

Probability

Without mitigation the probability is definite. With mitigation, the probability may be reduced to medium with correct management measures and concurrent rehabilitation.

Significance

The significance of this impact is high without mitigation, reducing to medium with the correct mitigation measures.

When considering the alternative locations for the smelter, even though the 1st alternative is located within closer proximity to an area of high sensitivity than alternative 2, no smelter infrastructure development will take place within areas of high sensitivity and the related impact assessment therefore remains unchanged regardless of the alternative being considered for the location of the smelter. All of the powerline routing alternatives will require stream crossings, however powerline alternatives 1 and 3 traverse existing Eskom servitudes (i.e. already disturbed areas) before running along the boundary fence of the SCSC property and it is expected that the impacts associated with these alternatives are therefore less significant than those associated with alternatives 2 and 4 which do not traverse existing disturbance corridors. Given that watercourses are associated with higher biodiversity sensitivity, it is noted that access road alternative 1 is expected to be associated with more significant biodiversity related impacts due to the requirement of several river crossings whereas access road alternatives 2 and 3 would not require any river crossings. Additionally, alternative 3 is approximately three times the length of alternatives 1 and 2. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is provided below.

Unmitigated – summary of the cumulatively rated loss of biodiversity through physical destruction impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	H

Mitigated – summary of the cumulatively rated loss of biodiversity through physical destruction impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	M	M	M	M	M

Description of proposed mitigation measures

Mitigation measures are presented below and tabulated in the EMP (Section 26).

Objective

The objective of the mitigation measures is to prevent the unacceptable loss of biodiversity and related ecosystem functionality through physical destruction.

Actions

Activities and infrastructure will be confined to the infrastructure layout as described and assessed in this EIA and EMP report. This requires that no land disturbance is allowed outside of the infrastructure footprint. Furthermore, the following actions apply:

Development Footprint

- A sensitivity map has been developed for the project area, indicating wetland and riparian features, as well as moderately high terrestrial bushveld habitat considered to be of increased ecological importance. This sensitivity map with the associated buffer zone will be considered during the planning/ pre-construction and construction phases of the project activities to aid in the conservation of ecology within the project area.

- Placement of infrastructure will be as far as possible from the areas of increased ecological sensitivity including buffer zones associated with wetland and riparian areas.
- During the construction phase, access to the construction areas will be limited to existing access roads in order to minimise stream and wetland crossings. No new crossings for access roads be constructed. Access to wetland and riparian areas within the remainder of the SCSC property by site personnel will be prohibited to prevent compaction of soils, loss of vegetation and increased erosion.
- Smelter infrastructure, including contractor laydown areas and areas designated for washing, cutting, mixing, etc. will be placed, as planned, within designated low sensitivity areas as far as possible and well outside of the wetland buffer zones.
- Operational related activities will be kept within the development footprint and designated operational areas.
- The project, particularly road upgrades and stream crossings, will be implemented in a manner that they will not lead to a reduction of stream flow and connectivity of the wetland and riparian features will be maintained.
- No incision and canalisation of the riparian resource takes place as a result of the construction of the powerline.
- Disturbances within the active riparian channels and riverbeds will be minimised as far as possible. In this regard the following key points are highlighted:
    - The powerline will span the entire delineated riparian zone, with no infrastructure apart form the service roads being placed within the active river channels. Placement of the powerline and its support structures will ensure that no upstream ponding and no downstream erosion and scouring occur.
    - The narrowest points in the watercourses will be identified and used as the crossing point and the powerline will not cross the rivers longitudinally, i.e. run within or adjacent to the river for extended lengths, with particular reference to the Phufane River where it exists within the SCSC property.
    - The powerline will cross the rivers at a 90 degree angle to minimise the damage to riparian areas.
    - The powerline will not cross the rivers in any area where the river or active channel makes sharp bends.
- The duration of impacts on the rivers will be minimised as far as possible by ensuring that the duration of time in which flow alteration and sedimentation will take place is minimised.
- Construction will be restricted to the low flow season, during the drier winter months if possible, to avoid further sedimentation of wetland and riparian features in the vicinity of access road or powerline stream crossings and to decrease the potential for erosion and sedimentation within disturbed areas due to rainfall.

Vehicles

- Vehicles willt be limited to travelling only on designated roadways to limit the ecological footprint of the proposed project activities.
- Culverts associated with stream crossings will be de-silted and regularly cleared of any debris.

Soils

- Soils will be managed in accordance with the mitigation measures/actions outlined in Section 9.1.3 and 9.1.4.

Alien Vegetation

- Proliferation of alien and invasive species is expected within any disturbed areas and common agricultural weeds are already present within the smelter footprint area. These species, as well as emerging species will be eradicated and controlled to prevent their spread beyond the project footprint. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, will also be controlled.
- Removal of the alien and weed species will take place in order to comply with existing legislation (NEMBA Alien and Invasive Species Regulations, 2014). Focus will be on the removal of Category 1 alien species and will take place throughout the construction, operational and decommissioning and closure phases.
- Although a moderate diversity of alien floral species occur within the site alternatives area, the majority of species are not listed as declared invaders, with the exception of *Datura ferox, Verbena bonariensis* and *Opuntia ficus-indica,* that are listed as Category 1b invaders that require mandatory eradication. Most alien floral species occur throughout the site alternatives area with the majority being present within the Wetland/ riparian Habitat Unit and within transformed areas.

Rehabilitation

- As much vegetation growth as possible will be promoted within the project area in order to protect soils. In this regard special mention is made of the need to use indigenous vegetation species where hydroseeding, landscaping and rehabilitation are to be implemented.
- After construction has been completed and again prior to closure, suitable reprofiling, reseeding with indigenous grasses and revegetation of any bare or disturbed areas will take place to minimise the potential of sedimentation and erosion of wetland features.
- Any disturbed wetland and riparian areas will be rehabilitated upon decommissioning to ensure that wetland and riparian functions are re-instated to at least pre-development conditions.

Waste

- Waste will be managed in accordance with the Waste Management Prodecure provided in Table 53 and the Soils Management Principles provided in Table 54.

Fire

- Informal fires in the vicinity of development construction areas will be prohibited.

Floral SCC

- Permits will be obtained for the removal/destruction of *V. erioloba* under the National Forests Act (Act 84 of 1998) within the powerline footprint, prior to the construction phase.
- The number of *V. erioloba* removed for construction of the powerline will be kept to a minimum and no trees will be needlessly destroyed.
- Should any other floral SCC, including SANBI RDL species, such as *Crinum macowanii* or *Boophane disticha* be encountered within the project footprint, these species will be relocated and monitoring of relocation success, if undertaken, will take place during the operational phase and during and beyond the decommissioning and closure phases.
- Should any floral species protected under LEMA (Act 7 of 2003), such as *Scadoxus puniceus* or NEMBA (Act 10 of 2004) be encountered within the powerline footprint, authorisation to relocate such species will be obtained from LEDET or DEA respectively.
- Floral SCC are to be handled with care and the relocation of these plant species to nearby suitable similar habitat is to be overseen by a suitably qualified botanist.
- However should any species protected under LEMA or NEM:BA have been overlooked during the field assessment and be encountered within the proposed powerline alignment, authorisation to relocate such species will be obtained from the Limpopo Department of Economic Development, Environment and Tourism (LEDET) or the DEA respectively.

Fauna

- Should any *Pyxicephalus adspersus* (Giant Bullfrog) be encountered within the project area, special care will be taken to catch and relocate such species to similar habitat within or in the vicinity of the SCSC property. Relocation will be done by a suitably qualified person.
- In order to conserve foraging habitat for avifaunal SCC, the cultivated land closest to the Wetland/ Riparian Habitat Unit adjacent to the smelter complex area should ideally remain under cultivation as this will ensure sustained habitat for the avifaunal SCC *Polemaetus bellicosus* (Martial Eagle) and *Pteocles gutturalis* (Yellow-throated Sandgrouse) within the SCSC property. It is however noted that SCSC has no control over the activities on the adjacent cultivated lands and the decision of the adjacent landowners cannot be controlled by this EMP.

Aquatic Monitoring

- Since the aquatic systems within the SCSC property lacked flowing water at the time of the aquatic assessment, a high flow aquatic ecological assessment will be undertaken in the future to provide improved insight on the local aquatic ecological conditions.
- On-going aquatic ecological monitoring will take place on an annual basis in the high flow season by a suitably qualified assessor focusing on aquatic macro-invertebrates, habitat integrity and biota specific water quality.
- Future development planning will ensure that activities do not lead to a reduction of stream flow or dewatering of any aquatic / wetland / riparian areas and connectivity of the aquatic features in the vicinity of the project area should be maintained.

For a period of at least five years after the re-establishment of vegetation, a programme of monitoring and "after care" will be implemented to ensure that vegetation is recovering and that pioneer and alien/invasive species are not becoming an ecological problem. This issue will be revisited as part of the detailed closure planning for the project.

Emergency situations

None identified.

9.1.6 ISSUE: GENERAL DISTURBANCE OF BIODIVERSITY

Information in this section was sourced from the biodiversity study undertaken by Scientific Aquatic Services (SAS, August 2016) included in Appendix F.

Introduction

There are a number of activities/infrastructure that have the potential to directly disturb vegetation, vertebrates and invertebrates in all project phases, particularly in the unmitigated scenario. In the construction and decommissioning phases these activities are temporary in nature, usually existing for a few weeks to a few months. The operational phase will present more long term occurrences that may have pollution potential through long term seepage and/or run-off.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks Civil works	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services Demolition	Maintenance and aftercare of rehabilitated areas

Construction	Operational	Decommissioning	Closure
	Rehabilitation	Rehabilitation	

Rating of impact

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

In the unmitigated scenario, biodiversity may be disturbed in the following ways:

- Lighting can attract large numbers of invertebrates which become easy prey for predators. This can upset the invertebrate population balances.
- People may kill various types of species for food, for sport, for fire wood etc.
- Powerlines can result in bird injuries/deaths.
- People may illegally collect and remove vegetation, vertebrate and invertebrate species.
- Excessive dust fallout from various dust sources may have adverse effects on the growth of some vegetation, and it may cause varying stress on the teeth of vertebrates that have to graze soiled vegetation.
- Noise pollution (from the smelting activities, vehicle movement, materials handling etc.) may scare off vertebrates and invertebrates. In some instances the animals may be deterred from passing close to noisy activities which can effectively block some of their migration paths. In other instances, vertebrates and invertebrates that rely on noise senses to locate for, and hunt, prey may be forced to leave the vicinity of noisy activities.
- The increased presence of vehicles in the area can cause road kills especially if drivers speed
- An increase in pollution emissions and general litter may directly impact on the survival of individual plants, vertebrates and invertebrates.

Taken together, the disturbances will have a high severity in the unmitigated scenario. In the mitigated scenario, many of these disturbances can be prevented or mitigated to acceptable levels, which reduces the severity to low.

Duration / Reversibility

In the unmitigated scenario, the impact is long term because where biodiversity is compromised, killed or removed from the area this impact is likely to exist beyond the life of the project. With mitigation this reduces to medium.

Spatial scale / Extent

Given that biodiversity processes are not confined to the proposed site alternatives area, the spatial scale of general disturbances will extend beyond the site boundary in the unmitigated and mitigated scenarios. Key related issues are the migration of species and linkages between biodiversity areas. This is a medium spatial scale.

Consequence

In the unmitigated scenario, the consequence of this potential impact is high. With mitigation, this reduces to low because the severity and duration reduce.

Probability

Without any mitigation, the probability of negatively impacting on biodiversity through multiple disturbance events is high. With mitigation, the probability can be reduced to low because most of the disturbances can be controlled through implementation and enforcement of practices, policies and procedures.

Significance

In the unmitigated scenario, the significance of this potential impact is high reducing to low with mitigation.

When considering the alternative locations for the smelter, even though the 1st alternative is located within closer proximity to an area of high sensitivity than alternative 2, no smelter infrastructure development will take place within areas of high sensitivity and the related biodiversity disturbance impact assessment therefore remains unchanged regardless of the alternative being considered for the location of the smelter. All of the powerline routing alternatives will require stream crossings (sensitive areas), however powerline alternatives 1 and 3 traverse existing Eskom servitudes (disturbance corridors) before running along the boundary fence of the SCSC property and it is expected that the impacts associated with these alternatives are less significant than those associated with alternatives 2 and 4 which may destroy currently undisturbed biodiversity. Given that watercourses are associated with higher sensitivity, it is noted that access road alternative 1 is expected to be associated with more significant biodiversity related impacts due to the requirement of several river crossings whereas access road alternatives 2 and 3 would not require any river crossings. Additionally, the 1st alternative is approximately three times the length of alternatives 2 and 3. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is provided below.

Unmitigated – summary of the cumulatively rated general disturbance of biodiversity impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	H

Mitigated – summary of the cumulatively rated general disturbance of biodiversity impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	M	M	L	L	L

Description of proposed mitigation measures

Mitigation measures are presented below and tabulated in the EMP (Section 26).

Objective

The objective of the mitigation measures is to prevent the unacceptable loss of biodiversity and related ecosystem functionality through general disturbance.

Actions

Activities and infrastructure will be confined to the infrastructure layout as described and assessed in this EIA and EMP report. This requires that no land disturbance is allowed outside of the infrastructure footprint. The same actions as presented in Section 9.1.5 above apply equally to mitigation associated with the general disturbance of biodiversity. In addition:

- Light pollution will be seriously and carefully considered and kept to a minimum wherever possible. Measures to be considered in the lighting design of the SCSC project are are as described in Section 9.1.15
- No trapping or hunting of fauna is to take place and all staff will be briefed and educated in this regard.
- The collection of plant material for medicinal purposes or collection of firewood will be prohibited.
- Should avifaunal SCC be encountered within the project area during the construction or operational phases of the project, care will be taken not to disturb these species, particularly when foraging.
- Bird flappers will be placed along the powerline, also in areas in close vicinity to remaining cultivated fields in order to minimise collisions of avifaunal species with powerlines.
- Excessive dust fallout will be managed in accordance with mitigation measures/actions decribed Section 9.1.11.
- Noise related impacts will be managed in accordance with mitigation measures/actions decribed Section 9.1.12.
- Traffic safety related impacts will be managed in accordance with mitigation measures/actions decribed in Section 9.1.14.
- Impacts relating to littering will be managed in accordance with mitigation measures/actions described in Section 9.1.17.

Emergency situations

Any injury to animals (for example from project related traffic) is considered an emergency and will be handled in accordance with SCSC's Emergency Response Procedure outlined in Section 28.2.2.1.

SURFACE WATER

9.1.7 ISSUE: ALTERATION OF NATURAL DRAINAGE PATTERNS

Information in this section was sourced from the surface water study (SLR, September 2016) included in Appendix G.

Introduction

Pre-project natural drainage across the study area is via sheet flow and/or preferential flow paths (drainage lines) namely via the Phufane River, Brakspruit River and two unnamed tributaries thereof. Rainfall and surface water run-off will be collected in all project areas that have been designed with water containment infrastructure as required by legislation. The collected run-off will therefore be lost to the catchment and can result in the alteration of drainage patterns. Moreover, stream crossings for the powerline and associated service road have the potential to alter surface flows. It should be noted that the road to be used as a service road is an existing dirt road with existing river crossings and these are expected to remain unchanged.

During the construction, operational and decommissioning phase, these activities will continue until such time as project infrastructure can be removed and/or the project areas are rehabilitated. During the closure phase rehabilitation will allow for the restoration of drainage patterns.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Civil works	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Rehabilitation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services Demolition Rehabilitation	Maintenance and aftercare of rehabilitated areas

Rating of impacts

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

During the construction, operation, decommissioning, and to a lesser extent, the closure phases, rainfall and surface water run-off will be collected in all areas that have been designed with water containment infrastructure. The collected run-off will therefore be lost to the catchment and can result in the alteration of drainage patterns. The total MAR for quaternary catchment A24E is 9.86 million m^3, of which 0.0079 million m^3 (0.0008%) is likely to be generated by the dirty water catchments within the site. If one assumes that all run-off water that is generated in the infrastructure areas is contained then the estimated loss of run-off to the proposed project area is approximately 0.0008% of the total MAR.

In the context of the affected quaternary catchments this is considered to be a low severity because the reduction is negligible and will not result in a substantial deterioration in the water reserve and downstream water uses. The overall low severity rating applies in both the unmitigated (all phases) and mitigated scenarios (prior to closure). After closure, in the mitigated scenario, the proposed project area will be rehabilitated to re-establish landscape functionality and surface water runoff will no longer be contained. The associated severity will remain low.

In the case of the powerline and associated river crossings, the unmitigated severity is expected to be high. With mitigation (i.e. with correct design engineering to ensure that interference with watercourses is limited), this can be reduced to low. It should be noted that the service road required for the powerline will be an already existing dirt road with existing river crossings. It is expected that these river crossings (and associated impacts on drainage patterns) will remain unchanged.

The discharge of any potential treated surplus water (during the wet season) may also alter natural drainage patterns within the project area if discharge is done without proper flow attenuation measures at the discharge point. Likewise uncontrolled discharge from the PCD without flow attenuation measures may also alter drainage patterns on site. Without mitigation this amounts to a high severity. With mitigation (i.e. flow attenuation measures to limit erosion and other related impacts, the severity reduces to low.

Duration / Reversibility

In the unmitigated scenario, the alteration of drainage patterns will extend beyond closure. In the mitigated scenario, the duration of the alterations will mostly be restricted to the phases before closure.

Spatial scale / Extent

In the mitigated and unmitigated scenario the physical alteration of drainage patterns will extend beyond the site boundary as flow reduction impacts (albeit limited) could extend further downstream.

Consequence

In the unmitigated scenario the consequence is high. In the mitigated scenario the consequence is low for all phases (including closure).

Probability

The probability of the alteration of drainage patterns is definite, but the magnitude of the reduced flows is unlikely to result in material deterioration and related flow impacts downstream therefore probability is medium until closure when it is expected to reduce to low.

Significance

The significance is high in all phases without mitigation. With mitigation this reduces to medium, and to low at closure.

It is expected that the related impact assessment remains unchanged regardless of the alternative being considered for the location of the smelter complex and powerline routing. For the access road it is expected that impacts associated with alternative 1 will be more significant due to the requirement of several stream crossings. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is provided below.

Unmitigated – summary of the rated alteration of natural drainage patterns impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	M	H

Mitigated – summary of the rated alteration of natural drainage patterns impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
For construction, operation and decommissioning						
Mitigated	L	M	M	L	M	M
Closure						
Mitigated	L	L	M	L	L	L

Description of proposed mitigation measures

Mitigation measures are provided below and tabulated in the EMP (Section 26).

Objective

The objective of the mitigation measures is to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow.

Actions

In all phases project phases, in order to limit the alteration of natural drainage patterns, infrastructure will be constructed, operated and maintained so as to comply with the provisions of the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) or any future amendments thereto. These include:

- The soil resource will be conserved and managed as detailed in Section 9.1.3 and 9.1.4.
- Prevention of contamination and containment of potential pollution sources will be achieved as described in Section 4.2.2.
- Water management facilities for the control of stormwater and for pollution prevention will be designed to meet the requirements of Regulation 704 (4 June 1999) for water management on mines. Even though the SCSC project is not a mine, these design principles are considered to be good industry practice and are therefore being applied. The five main principles of Regulation 704 that are applicable to the stormwater management of the proposed project include:
  - Condition 4 which defines the area in which, mine workings or associated structures may be located, with reference to a watercourse and associated flooding. Any residue deposit, dam, reservoir together with any associated structure or any other facility should be situated outside the 1:100 year flood-line. Any underground or opencast mining, prospecting or any other operation or activity should be situated or undertaken outside of the 1:50 year flood-line. Where the flood-line is less than 100 m away from the watercourse, then a minimum watercourse buffer distance of 100 m is required for infrastructure and activities.
  - Condition 5 which indicates that no residue or substance which causes or is likely to cause pollution of a water resource may be used in the construction of any dams, impoundments or embankments or any other infrastructure which may cause pollution of a water resource.
  - Condition 6 which describes the capacity requirements of clean and dirty water systems. Clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated to ensure conveyance of flows of a 1:50 year recurrence event. Clean and dirty water systems should not spill into each other more frequently than once in 50 years. Any dirty water dams should have a minimum freeboard of 0.8m above full supply level.
  - Condition 7 which describes the measures which must be taken to protect water resources. All dirty water or substances which may cause pollution should be prevented from entering a water resource (by spillage, seepage, erosion etc.) and ensure that water used in any process is recycled as far as practicable.

- Condition 10 which describes the requirements for operations involving extraction of material from the channel of a watercourse. Measures should be taken to prevent impacts on the stability of the watercourse, prevent scour and erosion resulting from operations, prevent damage to in-stream habitat through erosion, sedimentation, alteration of vegetation and flow characteristics, construct treatment facilities to treat water before returning it to the watercourse, and implement control measures to prevent pollution by oil, grease, fuel and chemicals.

- As part of closure planning, the slag dump and baghouse slurry facility will be designed and stabilised so as to prevent erosion and associated suspended solids. Monitoring of potential seepage from these facilities will be conducted;
- The water balance for the project will be refined on an ongoing basis during the life of the project. Flow meters will be installed in the water circuit to provide actual data on water flows to confirm or amend predictions made in the water balance model. The water balance will be used to check on an on-going basis that the capacity of the dirty water holding facilities is adequate, taking the operational distribution and use of water into account:
- An annual water balance report will be submitted to DWS, providing information on the status of the water balance in the wet and dry season and under conditions of extreme rainfall.
- Water quality monitoring will take place as detailed in Section 27.
- If an incident occurs where water has been contaminated to levels exceeding the maximum acceptable limits agreed to by DWS, SCSC will immediately notify DWS and then identify the source of the contamination and implement measures to prevent further contamination in consultation with DWS

Emergency situations

None identified.

9.1.8 ISSUE: CONTAMINATION OF SURFACE WATER RESOURCES

Information in this section was sourced from the surface water study (SLR, September 2016) included in Appendix G.

Introduction

There are a number of pollution sources in all project phases that have the potential to pollute surface water, particularly in the unmitigated scenario. In the construction and decommissioning phases these potential pollution sources are temporary and diffuse in nature. Although these sources may be temporary, the potential pollution may be long term. The operational and closure phases may present more long term potential sources.

It should be noted that surface water contamination impacts on biodiversity have been assessed in Section 9.1.5 and 9.1.6. The section below therefore assesses only the impacts relating to humans and livestock.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Civil works	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Rehabilitation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services Demolition Rehabilitation	Maintenance and aftercare of rehabilitated areas

Rating of impacts

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

In the unmitigated scenario, surface water may collect contaminants (hydrocarbons, salts, and metals) from numerous sources.

Potential construction and decommissioning phase pollution sources include:

- Sedimentation from erosion.
- Spillage from portable toilets, spillage of construction fuel, lubricants, cement or leaks from vehicles and equipment.

Potential operational phase pollution sources include:

- Spills from sewage treatment plant (if commissioned), spillage of operational fuel, lubricants, cement, chemicals or leaks from vehicles and equipment.
- Contaminated discharges from the dirty water systems including: dirty water dams, dirty water pipelines, and water treatment plant waste stream.
- Contaminated runoff and seepage from mineralised waste facilities and stockpiles.
- Sedimentation from erosion.

At elevated concentrations these contaminants can exceed the relevant surface water quality limits imposed by DWS and can be harmful to humans and livestock if ingested directly and possibly even indirectly through contaminated vegetation, vertebrates and invertebrates. The related unmitigated severity is high.

In the mitigated scenario, clean water will be diverted away from the project area and contaminated run-off and process water will be contained and re-used in the normal course. The severity can therefore be reduced to medium.

Duration / Reversibility

In the unmitigated scenario, the contamination of surface water resources will occur for periods longer than the life of proposed project. With mitigation, pollution can be prevented and/or managed and as such the impacts can be reversed or mitigated within the life of proposed project.

Spatial scale / Extent

In the mitigated and unmitigated scenarios the spatial scale is likely to extend beyond the proposed site alternatives area because contamination is mobile once it reaches flowing water courses. This will be more of an issue in the rainy season because the watercourses are non-perennial.

Consequence

In the unmitigated scenario the consequence is high and in the mitigated scenario it is medium.

Probability

The probability of the impact occurring relies on a causal chain that comprises three main elements:

- Does contamination reach surface water resources?
- Will people and livestock utilise this contaminated water?
- Is the contamination level harmful?

The first element is that contamination reaches the surface water resources within the proposed site alternatives area. Due to the proximity of the proposed infrastructure (particularly the mineralised waste facilities) to the unnamed tributary located closest to the smelter complex area, contaminants could reach surface water resources. It should however be noted that this drainage channel is non-perennial with long periods of no flow.

The second element is that third parties and/or livestock use this contaminated water for drinking purposes. There is a limited possibility that this will occur given that there is very limited reliance on surface water resources in the area, for domestic use or livestock watering.

The third element is that it is likely that only some contaminants will be at a level which is harmful to humans and livestock. This is influenced both by the quality of any discharged water and by the diluting effect of any rainwater particularly in the rainy season.

As a combination, when considering the nature and location of the proposed infrastructure in proximity to the unnamed drainage channel, the unmitigated probability is medium, reducing to low with mitigation.

Significance

In the unmitigated scenario, the significance of this potential impact is high. In the mitigated scenario, the significance is reduced to low because of the reduction in severity, duration and probability.

Both alternatives for the location of the smelter are located outside of relevant floodlines, and the related significance of impacts associated with contamination of surface water is expected to be the same. For the purposes of the powerline, the impact assessment remains the same regardless of the alternative being considered since all powerline routings will require river crossings. The 2nd and 3rd alternative for the access road are expected to be associated with less significant impacts than the 1st alternative given that the 1st alternative requires river crossings which could result in surface water contamination. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is provided below (.

Unmitigated – summary of the rated pollution of water resources impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	M	H

Mitigated – summary of the rated pollution of water resources impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	M	M	M	M	L	L

Description of proposed mitigation measures

Mitigation measures are provided below and specific tabulated in the EMP (Section 26).

Objective

The objective of the mitigation measures is to prevent pollution of surface water resources and related harm to surface water users.

Actions

Management measures will focus on the prevention of pollution, the containment of pollution sources, and the remediation of contamination incidents should they occur.

- The soil resource will be conserved and managed as detailed in Section 9.1.3.

- Prevention of contamination and containment of potential pollution sources will be achieved as described in Section 4.2.2.
- The clean and dirty water systems (as described in Section 4.2.2.) will be designed, implemented and managed in accordance with the provisions of Regulation 704. In this regard:
  - Clean water will be diverted around operational areas.
  - Dirty water will be contained in the dirty water run-off and/or process water system that comprises channels and dams, and from which dirty water will be reused as a priority and/or treated prior to being discharged to the environment.
  - These systems will be routinely inspected to detect possible breaches and implement preventative or corrective action.
- As part of closure planning, mineralised waste facilities will be designed and stabilised so as to prevent erosion and associated suspended solids. Monitoring of potential seepage from these facilities will be conducted.
- The water balance for the project will be refined on an on-going basis during the life of the project. The water balance will be used to check on an on-going basis that the capacity of the dirty water holding facilities is adequate, taking the operational distribution and use of water into account.
- An annual water balance report will be submitted to DWS, providing information on the status of the water balance in the wet and dry season and under conditions of extreme rainfall.
- Surface water quality monitoring will take place as detailed in Section 27.
- If an incident occurs where water has been contaminated to levels exceeding the maximum acceptable limits agreed to by DWS, SCSC will immediately notify DWS and then identify the source of the contamination and implement measures to prevent further contamination in consultation with DWS.

Emergency situations

Any significant pollution incident is considered an emergency situation. In such instances, the Emergency Response Procedure described in Section 28.2.2 will be followed.

GROUNDWATER

9.1.9 ISSUE: REDUCTION OF GROUNDWATER LEVELS AND AVAILABILITY

Information in this section was sourced from the groundwater study (SLR, September 2016) included in Appendix H.

Introduction

The possible abstraction of water from an on-site borehole for the use as potable and/or process water has the potential to cause a lowering of groundwater levels in the construction, operation and decommissioning phases. Lowering of groundwater levels through abstraction may cause a loss in water supply to third party borehole users if they are in the impact zone.

It is important to note that potable and process make-up water for the proposed project will be sourced from the municipal supply scheme, and provision for potential abstraction from an on-site borehole has been made only in case of emergencies when municipal supply is not available and the water within the existing circuit is insufficient. The impacts associated with a reduction in groundwater levels have been assessed to cater for such emergency instances.

Activities and infrastructure - link to project phases

Construction	Operation	Decommissioning	Closure
			N/A
Water supply and use	Smelter plant Water supply and use	Water supply and use	

Rating of impact

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

Based on the results of the groundwater study which simulated abstraction from borehole (SIY-BH02S) at a sustainable pumping rate of 3 L/s for a period of 12 hrs/day, it is not expected that there be any impact on the groundwater levels. It follows that there is also not expected to be any impact on base flow of the Brakspruit tributary as a result of borehole abstraction. It must be noted that this is not only because of the limited impact of abstraction but also because of the fact that the tributary only runs after periods of rainfall. Without mitigation (i.e. exceeding the pumping plan), no impacts on third party users or the base flow of the Brakspruit tributary is expected albeit that the cone of depression would be marginally greater than in the mitigated scenario.

The severity in the unmitigated scenario is medium, reducing to low with mitigation.

Duration / Reversibility

The duration of the impacts is linked to the duration of the abstraction and the recharge time thereafter. It is expected that the duration of abstraction activities (with mitigation) will recover daily and given that water levels will not be affected (i.e. that aquifer recovery time is not applicable) this is a low duration with mitigation. In the unmitigated scenario, if the recommended pumping plan is not followed, the recovery time would be expected to be longer, thereby implying a medium duration.

Spatial scale / Extent

The spatial scale is medium without mitigation, reducing to low with mitigation

Consequence

In the unmitigated scenario, the consequence is medium, reducing to low with mitigation.

Probability

Results indicate that the probability of impacting third party water supply and the Brakspruit tributary base flow is low in both the unmitigated and mitigated scenarios.

Significance

In the unmitigated and mitigated scenario the significance is low.

When considering the alternatives for the location of the smelter, it is expected that the related impact assessment holds true regardless of the alternative being considered. Impacts associated with a reduction of groundwater levels are not relevant for the powerline or access road.

A summary of the above impact assessment is summarised in the table below.

Unmitigated – summary of the rated lowering of groundwater levels impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operation						
Unmitigated	M	M	M	M	L	L

Mitigated – summary of the rated lowering of groundwater levels impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operation						
Mitigated	L	L	L	L	L	L

Description of proposed mitigation measures

Mitigation measures are provided below and tabulated in the EMP (Section 26).

Objective

The objective of the mitigation measures is to prevent water losses to third party water users.

Actions

If an emergency situation arises which requires borehole abstraction, the recommended abstraction plan will be followed. This is limited to pumping at a rate of 3 L/s for a period of 12 hrs/day.

In the unlikely event that any project related loss of water supply is experienced by the surrounding borehole users, SCSC will provide compensation that could include an alternative water supply of equivalent quantity and water quality.

Emergency situations

None identified.

9.1.10 ISSUE: CONTAMINATION OF GROUNDWATER RESOURCES

Information in this section was sourced from the groundwater study (SLR, September 2016) included in Appendix H and the geochemistry study (SLR, August 2016) included in Appendix Q.

Introduction

There are a number of sources in all project phases that have the potential to pollute groundwater and impact surrounding groundwater users. In the construction, decommissioning and closure phases some of these potential pollution sources are temporary and diffuse in nature. Even though the sources are temporary in nature, related potential pollution can be long term. The operational phase will present more long term potential sources.

For the purpose of this assessment, the unmitigated scenario assumes an impaired Class C liner for all three of the main potential pollution sources (the slag dump, baghouse slurry facility as well as the PCD). With mitigation, the baghouse slurry facility and PCD will have a higher specification of liner (i.e. Class A) and less impairments are expected with successful implementation of the liner system during construction and operation. The unmitigated aspect of the impact assessment which follows below is therefore considered to be conservative.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Earthworks Civil works	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Rehabilitation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services Demolition Rehabilitation	Maintenance and aftercare of rehabilitated areas

Rating of impacts

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

Possible sources of groundwater contamination include seepage from various stockpiles, accidental spills and leaks, seepage from the dirty water circuit and mineralised waste facilities (slag dump, baghouse slurry facility and PCD). Groundwater modelling focussed on the most siginificant potential sources including the slag dump, baghouse slurry facility and PCD.

The groundwater model (which conservatively assumed a Class C liner for the slag dump, baghouse slurry facility and PCD) predicts that an Fe (Iron) plume could migrate 216 m from these sources over a period of 100 years. Although the plume shows an increased distance vs. time, it must be noted that the Fe concentrations show a decreasing trend in time, after the termination of the sources (20 years). This plume is not predicted to reach third party boreholes in either the unmitigated or mitigated scenario. In the unmitigated scenario, albeit that the groundwater model shows the maximum plume extent situated marginally before the tributary, there is a possibility that the plume could extend under the Brakspruit tributary which is unlikely to have any implications in the dry season. In the wet season (albeit that there will be a diluting effect) if the unsaturated groundwater zone is contaminated and interacts with the tributary flow there may be limited impacts on the tributary. In the mitigated scenario, given that the baghouse slurry facility and PCD will be lined with Class A liners, no plume is expected to extend in the vicinity of the tributary .

It follows that in the unmitigated scenario the potential groundwater pollution amounts to a medium severity. In the mitigated scenario, the severity can be reduced to low.

Duration / Reversibility

Groundwater contamination is long term in nature, occurring for periods longer than the life of proposed project. This amounts to a high duration in the unmitigated scenario, reducing to medium with mitigation.

Spatial scale / Extent

Given that the potential sources are located immediately adjacent to the property boundary there is a potential for the pollution plume to extend beyond the project area boundary in both the unmitigated and mitigated scenarios even though the actual extent of the plume is limited. With mitigation measures focussed on containing the pollution plume it is expected that the plume can be contained to within the site boundary and the spatial scale can be reduced to low.

Consequence

The consequence is high in the unmitigated scenario reducing to low with mitigation.

Probability

The probability of the impact occurring relies on a causal chain that comprises three main elements:

- Does contamination reach groundwater resources?
- Will people and animals utilise this contaminated water?
- Is the contamination level harmful?

The first element is that contamination reaches the groundwater resources underneath or adjacent to the proposed project area. It is expected that the plume may reach groundwater resources.

The second element is that third parties and/or livestock use this contaminated water for drinking purposes. No third party boreholes are located within the contamination plume zone and it is not expected that the plume should affect the Brakspruit tributary.

The third element is whether contamination is at concentrations which are harmful to users. In the immediate vicinity of the facilities (i.e. the delineated buffer zone) the concentrations could be at levels which are harmful to users, however since there are no users within this zone, it is not expected that there will be associated impacts.

As a combination, the unmitigated and mitigated probability is low in both scenario.

Significance

The unmitigated significance is medium and the mitigated significance is low.

When considering the alternatives for the location of the smelter, it is expected that the related impact assessment holds true regardless of the alternative being considered. Impacts associated with a groundwater contamination are not relevant for the powerline or access road.

A summary of the above impact assessment is summarised in the table below (for the preferred alternatives only).

Unmitigated – summary of the rated contamination of groundwater impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	M	H	M	H	L	M

Mitigated – summary of the rated contamination of groundwater impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	L	M	L	L	L	L

Description of proposed mitigation measures

Mitigation measures are provided below and are tabulated in the EMP (Section 26).

Objective

The objective of the mitigation measures is to prevent pollution of groundwater resources and related harm to water users (people, animals and biodiversity).

Actions

SCSC will comply with both the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) or any future amendments thereto, and the terms and conditions of water authorisations/licenses.

In the construction, operation and decommissioning phases SCSC will ensure that all hazardous chemicals (new and used), incoming raw materials, product, dirty water, mineralised wastes and non-mineralised wastes are handled in a manner that they do not pollute groundwater. This will be implemented through a procedure(s) covering the following:

- Pollution prevention through basic infrastructure design.
- Pollution prevention through maintenance of equipment.
- Pollution prevention through education and training of workers (permanent and temporary).
- Pollution prevention through appropriate management of hazardous chemicals, materials and non-mineralised waste.
- The required steps to enable containment and remediation of pollution incidents.
- Specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures.

Infrastructure that has the potential to cause groundwater contamination will be identified and included in a groundwater pollution management plan which will be implemented as part of the operational phase. This plan has the following principles:

- Map potential pollution sources.
- Track (through groundwater modelling updates every 3 years) the extent of the existing or potential contamination plume.
- Design and implement intervention measures to prevent, eliminate and/or control the pollution plume;

- Monitor (according to Section 27) all existing and potential impact zones to track pollution and mitigation impacts.
- Where monitoring results indicates that third party water supply has been polluted by SCSC, SCSC will ensure that an alternative equivalent water supply will be provided.

Emergency situations

Discharge incidents that may result in pollution of groundwater resources will be handled in accordance with the SCSC Emergency Response Procedure (Section 28.2.2).

AIR QUALITY

9.1.11 ISSUES: AIR POLLUTION

Information in this section was sourced from the air quality assessment report (Airshed, September 2016) and included in Appendix I.

Introduction

There are a number of activities/infrastructure in the construction, operation and decommissioning phases that have the potential to pollute the air. In the construction and decommissioning phases these activities are temporary in nature. The operational phase will present more long term activities. The closure phase will present final rehabilitated areas that may have the potential to pollute the air through long term wind erosion.

The evaluation criteria (National Ambient Air Quality Standards) relevant to the air impact assessment are listed below in Table 55.

TABLE 55: NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS) FOR CRITERIA POLLUTANTS

Pollutant	Averaging Period	Limit value ($\mu g/m^3$)	Limit Value (ppb)	Frequency of exceedance	Compliance date
Benzene	1-year	5	1.6	0	1 Jan 2015
CO	1-hour	30 000	26 000	88	Immediate
NO_2	1-hour	200	106	88	Immediate
	1-year	40	21	0	Immediate
$PM_{2.5}$	24-hour	40	-	4	1 Jan 2016 – 31 Dec 2029
	24-hour	25	-	4	1 Jan 2030
	1-year	20	-	0	1 Jan 2016 – 31 Dec 2029
	1-year	15	-	0	1 Jan 2030
PM_{10}	24-hour	75	-	4	1 Jan 2015

	1-year	40	-	0	1 Jan 2015
SO_2	10-minute	500	191	526	Immediate
	1-hour	350	134	88	Immediate
	24-hour	125	48	4	Immediate
	1-year	50	19	0	Immediate

National Dust Control Regulations (NCDR) were published on the 1st of November 2013 (Government Gazette No. R. 827). Acceptable dust fallout rates according to the Regulation are summarised in Table 56 below.

TABLE 56: ACCEPTABLE DUSTFALL RATES

Restriction areas	Dust fallout rate (D) in mg/m^2-day over a 30 day average	Permitted frequency of exceedance
Residential areas	D < 600	Two within a year, not sequential months.
Non-residential areas	600 < D < 1 200	Two within a year, not sequential months.

Evaluation criteria for DPM, VOC and Cr^{6+} are summarised Table 57 below.

TABLE 57: CHRONIC AND ACUTE INHALATION SCREENING CRITERIS AND CANCER URFS FOR POLLUTANTS RELEVANT TO THE PROJECT (AIRSHED, AUGUST 2016)

Pollutant	Chronic Screening Criteria (µg/m^3)	Inhalation URF (µg/m^3)$^{-1}$
Diesel Exhaust as DPM	5 (US EPA IRIS)	0.000 3 (CAL EPA)
VOC (*Diesel fuel* used as used as indicator)	100 (TCEQ)	Not applicable
Cr^{6+}	0.1 (US EPA IRIS)	0.012 (µg/m^3)$^{-1}$ (US EPA IRIS) 0.04 (µg/m^3)$^{-1}$ (WHO)

Air pollution related impacts on biodiversity are discussed in the biodiversity impact assessment (Section 9.1.5 and 9.1.6) and therefore this section focuses on the potential for human health impacts. This section should be read with reference to the potential air quality receptors presented in Figure 21.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks Civil works Transport systems	Smelter plant Transport systems Power supply and use Mineralised waste Non-mineralised waste Support services General site management Rehabilitation	Smelter plant Transport systems Power supply and use Mineralised waste Non-mineralised waste Support services Demolition Rehabilitation	Maintenance and aftercare of rehabilitated areas

Rating of impact

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

Negative air quality impacts are possible in all four project phases. Both the construction and decommissioning phases have the potential to result in offsite exceedances of dust fallout, PM_{10} and $PM_{2.5}$ even though these phases are associated with a limited set of potential emission sources. In particular, modelling shows that vehicle entrained dust on all access road alternatives (in the construction phase when roads are being constructed and are therefore unpaved) has the potential to result in off-site exceedances of the evaluation criteria particularly in the unmitigated and partially mitigated scenarios. With full mitigation, and given that both of these phases or short term/temporary, the overall severity and consequent significance of these impacts reduces. Similarly, the closure related impacts are expected to be limited given the limited potential sources due to the project design plans for re-use/sale of mineralised waste and/or concurrent rehabilitation. It follows that the phase with the most potential for negative air quality impacts is the operational phase when all of the proposed operational activities will be conducted over a long period. This assessment therefore focuses primarily on the operational phase but the related conclusions regarding mitigation measures, monitoring measures and emission source control apply equally to all four phases

The proposed SCSC project comprises a number of potential air emissions sources. These include:

- Land clearing and topsoil removal activities.
- Materials handling and loading/offloading of product and incoming chrome/concentrate and other raw materials.
- Grading and bulldozing.
- Crushing and screening.
- Wind erosion of mineralised waste facilities.
- Wind erosion of disturbed areas, not yet rehabilitated.
- Vehicle movement along paved (operational phase) and unpaved (construction phase) roads.
- Emissions from stacks (raw materials dust extraction baghouse stack, drier baghouse stacks, clean gas stacks and secondary fume extraction baghouse stacks).

Consideration and assessment of these potential sources by the air quality specialist revealed that the following potential pollutants are not of significant concern: sulphur dioxide (SO_2), volatile organic compounds (VOC) and carbon monoxide (CO) and these are therefore not assessed further. Pollutants of potential concern that are assessed further below are: dust fallout, particulate matter smaller than 10 microns ($PM_{10,}$), particulate matter smaller than 10 microns ($PM_{2.5}$), Chrome 6 (Cr^6), Diesel Particulate Matter (DPM) and nitrogen dioxide (NO_2).

The existing land uses in the region (e.g. the approved and operational Union Section Mine adjacent to the proposed SCSC project) present a number of existing air emission sources which together with the proposed project present the potential for elevated/cumulative impacts. Commentary on both incremental and cumulative impacts is provided below.

Dust Fallout

In the unmitigated scenario, the incremental and cumulative severity for dust fallout exceedances is high. In the mitigated scenario, no incremental or cumulative exceedance of the NDCRs are predicted at any of the potential receptors.

PM_{10}

In the unmitigated scenario, the incremental and cumulative severity for PM_{10} exceedances is medium and high respectively. In the mitigated scenario, predicted PM_{10} concentrations do not exceed the annual and daily evaluation criteria at any of the identified air quality receptors. It follows that the mitigated incremental severity is low and the cumulative severity is medium.

$PM_{2.5}$

In the unmitigated scenario, the incremental and cumulative severity for $PM_{2.5}$ exceedances is medium. In the mitigated scenario, predicted $PM_{2.5}$ concentrations do not exceed the annual and daily evaluation criteria at any of the identified air quality receptors. The mitigated severity is low when considered incrementally or cumulatively.

Cr^6+

In the unmitigated scenario, the incremental severity for Cr^6+ exceedances is expected to be low. In the mitigated scenario, predicted annual average ambient Cr^{6+} concentrations are very low and do not exceed the US EPA IRIS RfC of 0.1 µg/m^3 on-site or off-site. This is associated with a low health risk. Cumulative impacts are not relevant because there are no other known Cr^{6+} contributors in the area.

DPM

In the unmitigated scenario, the incremental and cumulative severity for DPM exceedances is expected to be medium. In the mitigated scenario, predicted annual average ambient DPM concentrations do not exceeded the US EPA IRIS RfC of 5 µg/m^3 at any of the air quality receptors. The related health risk ranges between low and moderate. This amounts to a low severity both when considered incrementally and when considered cumulatively.

NO_2

It should be noted that NO emissions are rapidly converted in the atmosphere into NO_2. In the unmitigated scenario, the incremental and cumulative severity is medium. In the mitigated scenario, predicted NO_2 concentrations do not exceed the annual or one hour evaluation criteria at any of the identified receptors and is therefore low both when considered incrementally and in the cumulative context.

The severity of the impact in the unmitigated operational phase scenario is high, reducing to medium-low with mitigation.

Duration / Reversibility

The duration of air quality impacts will be long term reducing to medium with mitigation.

Spatial scale / Extent

The spatial scale is medium without mitigation, reducing to medium-low with mitigation.

Consequence

The related consequence is high without mitigation, reducing to medium-low with mitigation.

Probability

The probability of impacts occurring is high without mitigation reducing to medium without mitigation.

Significance

The unmitigated significance is high reducing to medium with mitigation.

When considering the alternatives for the location of the smelter, it is expected that the related impact assessment holds true regardless of the alternative being considered. Whilst alternative 1 is upwind of and located closer to Swartklip Mine Village than alternative 2, alternative 2 is located upwind of and closer to air quality receptors 28, 30 and 31 as illustrated on Figure 21. Air quality impacts associated with the powerline routing will be limited to the construction phase only and are expected to be equally significant regardless of which of the four routings are considered. The impacts associated with the 1st and 3rd access road alternatives are expected to be more significant than those associated with alternative 2 given that alternative 1 runs immediately adjacent to and within 150 m of a farmstead and farm worker residences located on portion 9 of the farm Kameelhoek. The 1st access road alternative is considered to be associated with more significant impacts than those associated with alternative 2 given that alternative 1 is routed within close proximity to Anglo's Tiramogo Lodge. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is summarised in the table below (for the preferred alternatives only).

Unmitigated – summary of the cumulatively rated air pollution impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operational						
Unmitigated	H	H	M	H	H	H

Mitigated - summary of the cumulatively rated air pollution impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Operational						
Mitigated	M-L	M	M-L	M-L	M	M

Description of proposed mitigation measures

Mitigation measures are provided below and are tabulated in the EMP (Section 26).

Objective

To manage the generation of air quality impacts such that third party receptors do not experience air pollution exceedances.

Actions

Mitigation measures which will be inherently included as part of the project design includes:

- Water sprays at the crushing and screening plant.
- Dust extraction systems (with an estimated 83 % efficiency) fitted to materials handling areas (rail and road boxes and conveyor transfer points).
- Paved roads (internal haul roads and access road).
- Baghouses fitted to drying stacks and fume extraction stacks (dry scrubber for clean gas stack).

Other mitigation measures specifically required include:

Emissions Control for Vehicle Exhaust

To meet internationally acceptable vehicle emission standards vehicle exhaust emissions will be reduced through the following methods:

- Diesel particulate filters (DPF) and selective catalytic reduction (SCR) or other similar tailpipe technologies.
- Use of better quality diesel.
- Inspection and maintenance programs.

Effective inspection and maintenance programs will ensure new vehicles remain in good condition and reduce emissions from old vehicles. Vehicles will be fitted with DPFs and SCR technologies. Regular maintenance and emission testing will be done on all mobile diesel combustion sources. Use will also be made of low sulphur fuel (50 ppm better).

Dust Control Options for Paved Roads

In selecting a suitable sweeper, close attention will be paid to the PM_{10} collection efficiency of the machine. Factors in addition to PM_{10} control efficiency to will be taken into account in selecting an appropriate sweeper include: the extent of the sweeping path, hopper capacity, water capacity, travel speed, drive-by noise levels and maneuverability. Large hopper, water and sweep path capacities allow for extended sweeping time and maximum productivity.

Source Monitoring

Under Section 21 of the NEM: AQA it is compulsory to measure and report annually, Cr^{6+} emissions from the primary fume capture systems of ferrochrome furnaces. It further requires the holder of an AEL to submit an emission report in the format specified by the National Air Quality Officer or Licensing Authority on an annual basis. Annual emission testing for PM, SO_2 and NO_x will be conducted on an annual basis. See Table 58 below for recommended stack emissions testing.

It should however be noted that stack emissions testing on cleaned/raw furnace off-gas before is impractical and dangerous due to the high CO content. If flared, emissions from primary furnace off gas will rather be estimated from emission factors, limits and or mass balance methods. Since it is likely that cleaned furnace off gas will be combusted and utilised for drying and preheating emission testing at the outlet of these process can be sampled safely.

TABLE 58: RECOMMENDED STACK EMISSIONS TESTING (AIRSHED, SEPTEMBER 2016)

Source	Annual emission testing	Pollutants
Raw materials dust extraction baghouse stack	Yes	PM
Reductant/flux drier baghouse stack	Yes	PM, SO_2 and NO_x (Cr^{6+} to be included if furnace off gas is used as an energy source)
Concentrate drier baghouse stack	Yes	PM, SO_2 and NO_x (Cr^{6+} to be included if furnace off gas is used as an energy source)
Secondary furnace fume extraction baghouse stacks	Yes	PM, Cr^{6+}, SO_2 and NO_x
Pre-heater stack(s) if applicable	Yes	PM, Cr^{6+}, SO_2 and NO_x
Clean gas furnace flare stacks	No	-

Raw gas furnace flare stacks	No	-

Exhaust emissions testing must be done on all mobile and stationary diesel combustion sources as part of equipment maintenance schedules.

Should the abovementioned source monitoring be implemented the suggested IFC General EHS guidelines (IFC, 2007) for source monitoring will also be satisfied.

Ambient Air Quality Monitoring

As a minimum continuous dust fallout, PM_{10}, $PM_{2.5}$ sampling will be conducted as part of the project's air quality management plan. A short sampling campaign after commencement of operations for NO_2, SO_2 and VOCs will be conducted to determine if the operations are compliant with the NAAQSs. Recommended monitoring locations are shown in Figure 27 and monitoring requirements are described in Section 28.2.1

The same methods currently employed for baseline/pre-development sampling are recommended. These include:

- For dust fallout, the NDCR specifies that the method to be used for measuring dust fallout and the guideline for locating sampling points shall be ASTM D1739 (1970), or equivalent method approved by any internationally recognized body.
- For PM_{10} and $PM_{2.5}$ the method as set out by British Standards (BS EN 12341).
- Radiello® passive/diffusive samplers for NO_2, SO_2 and VOC sampling.

Should the discussed ambient monitoring be implemented the suggested IFC General EHS guidelines (IFC, 2007) for ambient monitoring will mostly be satisfied. Based on the IFC General EHS guidelines for ambient monitoring, the installation of a weather station is also recommended.

Emergency situations

Emergency situations will be handled in accordance with the SCSC Emergency Response Procedure (Section 28.2.2).

NOISE

9.1.12 ISSUES: NOISE POLLUTION

Information in this section was sourced from the noise specialist study undertaken by Airshed Planning Professionals (Airshed, August 2016) for the proposed project and included in Appendix J.

Introduction

Two types of noise are distinguished: noise disturbance and noise nuisance. The former is noise that can be registered as a discernible reading on a sound level meter and the latter, although it may not register as a discernible reading on a sound level meter, may cause nuisance because of its tonal character (e.g. distant humming noises).

Proposed activities/infrastructure present the possibility of generating both noise disturbances and noise nuisance in the project phases prior to closure. Refer to the biodiversity assessment (Section 9.1.5 and 9.1.6) for the potential noise impacts on biodiversity. This section will only focus on the potential human related noise impacts.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
			N/A
Site preparation Earthworks Civil works	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Rehabilitation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services Demolition Rehabilitation	

Rating of impact

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

During the day (06:00 to 22:00), operational phase related noise is not expected to exceed the day-time guideline of 55 dBA at potential noise receptors. Although low, the highest day-time impact is expected at Swartklip Mine Village located immediately adjacent to Union Section Mine (Figure 21) with an increase above the baseline of 3 dBA. For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. According to SANS 10103 (2008), ‘little’ reaction with ‘sporadic complaints’ may be expected from the community.

As a result of atmospheric conditions less conducive to noise attenuation and stricter guidelines, night-time noise impacts (22:00 to 06:00) are generally more notable. The night-time guideline of 45 dBA is expected to be exceeded only at the Swartklip Mine Village located immediately adjacent to the existing Union Section Mine (Figure 21). Proposed project activities are expected to result in a $L_{Req,n}$ of 45.5 dBA and an increase of 4.4 dBA above the baseline at the Swartklip Mine Village. This is in exceedance of the IFC 3 dBA guideline and, according to SANS 10103 (2008), ‘little’ reaction with ‘sporadic complaints’ can be expected.

Over 24-hours, the guideline of 55 dBA will not be exceeded at potential noise receptors. An increase of 4.0 dBA above the baseline, which is more than the 3 dBA limit recommended by the IFC, is expected at the Swartklip Mine Village. According to SANS 10103 (2008), 'little' reaction with 'sporadic complaints' from residents of- or visitors to the area are likely.

Taking the above into consideration, it is predicted there will be noise increases and these will be medium severity without mitigation reducing to low with mitigation.

Duration / Reversibility

In both the unmitigated and mitigated scenarios the noise pollution impacts will generally occur until the closure phase of the smelter when the noise generating activities are stopped. This is a medium duration.

Spatial scale / Extent

In both the unmitigated and mitigated scenarios the noise impacts will extend beyond the site boundary. This is a medium spatial scale.

Consequence

The unmitigated consequence is medium and the mitigated consequence is low.

Probability

The unmitigated probability of the predicted noise increases causing a noise related disturbance at the nearest receptors is considered to be medium without mitigation. With mitigation the probability reduces to low.

Significance

The unmitigated significance is medium, reducing to low with mitigation..

When considering the smelter alternatives, it follows that noise related impacts are expected to be the same regardless of which alternative is considered. Noise impacts associated with the powerline will be relevant only during the construction phase and it is expected that the related assessment will be the same regardless of the alternative being considered. Noise related impacts associated with access road alternative 2 are expected to be less significant than those associated with alternative 1 and 3 given that the 1st alternative would bypass Anglo's Tiramogo Lodge and the 3rd alternative runs immediately adjacent to and within 150 m of a farmstead and farm worker residences located on portion 9 of the farm Kameelhoek. Moreover, the length of access road alternative 1 (over which noise from vehicles would be generated) is approximately three times the length of alternatives 2 and 3. In this regard, alternative 2 is preferred, followed by alternative 1 and then alternative 3 as the least preferred option. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is provided below.

Unmitigated – summary of the rated noise pollution impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Unmitigated	M	M	M	M	M	M

Mitigated – summary of the rated noise pollution impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	L	M	M	L	L	L

Description of proposed mitigation measures

Mitigation measures are provided below and tabulated in the EMP (Section 26).

Objective

To prevent public exposure to disturbing noise. In general, this limit is considered an increase of 5dB, but this may be as low as 3dB depending on the nature of the receptor.

Actions

Engineering and operational practices

- All diesel powered equipment and plant vehicles will be kept at a high level of maintenance. This will particularly include the regular inspection and, if necessary, replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment will serve as trigger for withdrawing it for maintenance.
- To minimise noise generation, vendors will be required to guarantee optimised equipment design noise levels.
- Vibration isolators will be installed to reduce noise and vibration from crushers and screens.
- A mechanism to monitor noise levels, record and respond to complaints and mitigate impacts will be developed.

Traffic

The following general factors are considered the most significant with respect to road traffic noise generation. In managing transport noise specifically related to trucks, efforts will be directed at:

- Minimizing individual vehicle engine, transmission and body noise/vibration. This is achieved through the implementation of an equipment maintenance program.
- Minimize slopes by managing and planning road gradients to avoid the need for excessive acceleration/deceleration.
- Maintain road surface regularly to avoid corrugations, potholes etc.
- Avoid unnecessary idling times.
- Minimizing the need for trucks/equipment to reverse. This will reduce the frequency at which disturbing but necessary reverse warnings will occur. Alternatives to the traditional reverse 'beeper' alarm such as a 'self-adjusting' or 'smart' alarm will be considered. These alarms include a mechanism to detect the local noise level and automatically adjust the output of the alarm is so that it is 5 to 10 dB above the noise level in the vicinity of the moving equipment. The promotional material for some smart alarms does state that the ability to adjust the level of the alarm is of advantage to those sites 'with low ambient noise level' (Burgess & McCarty, 2009).

Operational hours

As per the project description, crushing and screening activities will be limited to day-time hours. Where possible, the more noisy activities as associated with construction and decommissioning will also be limited to day-time hours.

Monitoring

In the event that noise related complaints are received short term (24-hour) ambient noise measurements are a possible tool that could be conducted as part of investigating the complaints. The results of the measurements can be used to inform any follow up interventions. Complaints can however be addressed without the need for monitoring

Emergency situations

None identified.

BLASTING

9.1.13 ISSUE: BLASTING IMPACTS

Information in this section was sourced from the project team.

Introduction

Blasting activities have the potential to impact on people, animals and structures located in the vicinity of the proposed smelter complex area. It should be noted that if blasting is required it will be limited in scope and only be undertaken during the construction phase for the purposes of site foundations preparation.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
	N/A	N/A	N/A
Site preparation Earthworks Civil works	-	-	-

Rating of impact

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

Blasting hazards include ground vibration, air blast and fly rock which can cause damage to buildings and/or harm people and animals.

Ground vibrations travel directly through the ground and have the potential to cause damage to buildings and can be disturbing to people. The intensity of ground vibrations is influenced by the charge mass (number of holes fired together). In this regard, the ground vibration levels increase with an increase in charge mass. The US Bureau of Mines (USBM) indicates that the threshold limit for ground vibrations for private property is 12.7mm/s. In the unmitigated scenario, third party infrastructure could be impacted. In the mitigated scenario, third party buildings should not be damaged if ground vibration levels remain below the 12.7mm/s threshold. As a result, the construction related blast design must be specific to manage impacts on surrounding structures and given that limited charges are used for the purposes of foundation preparation (if required at all) this will be achievable.

Airblast is an air pressure pulse that has both a high frequency audible sound and a low frequency inaudible concussion. If the pressure is great enough damage can be caused to structures. If the airblast is contained to 130 dB or less, then damage should not be caused to surrounding structures. In the unmitigated scenario, a limited number of third party structures could be at risk outside where airblast greater than 130 dB is generated by blasting. In the mitigated scenario, assuming that the blast design will consistently result in airblast of 130 dB or below, third party structures should not be damaged. As a result, the construction phase blast design must be specific to manage impacts on surrounding structures.

Fly rock generation is related to the energy or mass of explosives and the containment of the energy on all sides of the blast area. In general, larger blast holes tend both to throw larger rocks over greater distances. Containment of fly rock is important because it has the potential to cause injury and death to people and animals. It can also damage structures. In unmitigated scenario fly rock can extend more than 500m (safe distance) from the blast site. This could harm or kill people, animals and/or structures. In the mitigated scenario, this can be kept within a range of less than 500m.

In the unmitigated scenario, blasting impacts could damage third party infrastructure and cause injury to third parties and livestock. This is a high severity in the unmitigated scenario. In the mitigated scenario, the severity can be reduced to low.

Duration / Reversibility

While damage to infrastructure can be repaired in the short term, injury or death is considered to be long term in nature. Therefore the unmitigated and mitigated impact duration is high.

Spatial scale / Extent

Table 59 below outlines the structures and residential areas within 2.5 km of the proposed smelter complex area where construction phase blasting would typically be undertaken. In the unmitigated scenario the impacts may beyond the site boundary. This is a medium spatial scale. With mitigation this can be reduced to low.

TABLE 59: INFRASTRUCTURE/RESIDENTIAL AREAS WITHIN PROXIMITY TO THE PREFERRED SMELTER ALTERNATIVE

Infrastructure	Distance from preferred smelter complex alternative
Swartklip Mine Village	Approximately 600 m west from the proposed smelter complex area
Union Section Railway line	Approximately 700 m west from the proposed smelter complex area
Farm residence on portion 2 of Grootkuil infrastructure area (point 1 on Figure 24.	Approximately 2 km north of the proposed smelter complex area
Farm residence (and farm worker residences) on portion 3 and 9 of the farm Kameelhoek (points 30 and 31 on Figure 24).	Approximately 2.5 km north-west of the proposed smelter complex area
D869 Road/Dwaalboom Road and Transnet railway line	Approximately 2.5 km north of the proposed smelter complex area

Consequence

The consequence is high in the unmitigated scenario, reducing to medium with mitigation.

Probability

Due to the fact that blasting on surface may not take place at all, and in the event that it does it will be limited to the construction phase only, the likelihood of this impact occurring is seldom and as such the probability is low in both the unmitigated and mitigated scenarios.

Significance

The significance has been rated as medium in the unmitigated scenario. This can be mitigated to low.

The related impact assessment remains unchanged regardless of which smelter complex alternative is being considered given proximity to third party infrastructure from both alternatives. Blasting is not relevant for the construction of the powerline or access road. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is summarised below.

Unmitigated – summary of the rated blasting impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction						
Unmitigated	H	H	M	H	L	M

Mitigated – summary of the rated blasting impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction						
Mitigated	L	H	L	M	L	L

Description of proposed mitigation measures

Mitigation measures are provided below and tabulated in the EMP (Section 26).

Objectives

The objective of the management measures is to prevent harm to people, animals and structures.

Actions

The following specific actions are required in addition to compliance with the relevant blasting and explosives legislation including the Explosives Act.

The blast design will, as a minimum standard, ensure that the peak particle velocity from all blasts is less than 12mm/s at all vulnerable third party structures, that flyrock is contained within 500 m of each blast and that the airblast is less than 130 dB at third party structures for all blasts. Monitoring of these three aspects (fly rock, airblast and ground vibration) will be undertaken to determine whether the blasts are within compliance.

All potentially vulnerable structures that are within 1000 m of the blast will be marked on a site plan and surveyed photographically in the presence of the owner before blasting takes place. If surrounding property owners have vulnerable structures outside of this zone, they can request SCSC to have them included in the pre blast survey. All parties that exist and/or that have property and/or that provide services within 3000 m of the blast sites will be informed, prior to blasting, about the blast programme and associated safety precautions.

For each blast, SCSC will observe the following procedural safety steps:

- The fly rock danger zone associated with each blast is delineated and people and animals are cleared from this zone before every blast.
- An audible warning is given at least three minutes before the blast is fired.

SCSC will respond immediately to any blast related complaints. These complaints and the follow up actions will be dated, documented, and kept as records for the life of the project. Where SCSC has caused blast related damage it will provide appropriate compensation.

Emergency situations

Any significant damage or death from flyrock is considered an emergency situation. In such instances the Emergency Response Procedure included in Section 28.2.2 will be followed.

TRAFFIC

9.1.14 ISSUE: ROAD DISTURBANCE AND TRAFFIC SAFETY

Information was sourced from the traffic specialist study (Siyazi, February 2016) included in Appendix L.

Introduction

Traffic impacts are expected from construction through to the end of the decommissioning phases when trucks, buses, and private vehicles make use of the private and public transport network in and adjacent to the proposed site alternatives area. The key potential traffic related impacts are on road capacity and public safety.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
			N/A
Transport system	Transport system	Transport system	

Rating of impact

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

Existing traffic volumes comprising public traffic and traffic from nearby mines that utilise the D869 are associated with an inadequate level of service in the context of the existing public and private road infrastructure. The proposed project will generate higher volumes of traffic along the D869 and the R510 as a result of the transportation of people and materials. It should be noted that intersection improvements/upgrades are proposed regardless of whether the project is developed or not. In this regard, the following safety risks which could be associated with the increased project related traffic apply already regardless of whether additional traffic associated with the proposed project is added to the transport network:

- Pedestrian accidents.
- Vehicle accidents.

In the unmitigated scenario the severity is high. In the mitigated scenario the severity reduces to medium because the frequency of potential accidents is expected to reduce.

Duration / Reversibility

Any serious injury or death is a long term impact in both the unmitigated and mitigated scenarios.

Spatial scale / Extent

Possible accident sites could be located within or outside the proposed project given that both private and public roads are and will continue to be used for the transport of materials and personnel. Any indirect impacts associated with any injuries or fatalities will extend to the communities to which the injured people/animals belong. This is a medium spatial scale both with and without mitigation.

Consequence

The consequence is high in both the unmitigated and mitigated scenario.

Probability

In the unmitigated scenario, the probability of accidents occurring as a result of the proposed project is medium because although there is a possibility that traffic accidents could occur these are not expected to occur on a continuous basis. With mitigation this reduces to low.

Significance

Without mitigation, the significance is high. With mitigation, this reduces to medium. Even in the event that rail capacity is temporarily unavailable the conclusion is acceptable because the the option of excluding rail (i.e. using only road) was considered by the traffic specialist.

When considering the location of smelter alternatives, the related impact assessment remains unchanged regardless of the alternative being considered. When considering the powerline routing alternatives, traffic safety related impacts are not seen to be relevant. It is however noted that access road alternative 3 is expected to be associated with more significant road disturbance and traffic safety impacts due to the proximity of the farmstead on portion 9 of Kameelhoek to the intersection that would be required for the access road. Access road alternative 1 is also considered to be associated with more significant impacts given that this road is approximately three times the length of alternatives 2 and 3. It follows that alternative 2 is expected to have the least significant impacts. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is provided below.

Unmitigated – summary of the cumulatively rated road disturbance and traffic safety impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Unmitigated	H	H	M	H	M	H

Mitigated – summary of the cumulatively rated road disturbance and traffic safety impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M	H	M	H	L	M

Description of proposed mitigation measures

Mitigation measures are provided below and tabulated in the EMP (Section 26).

Objective

The objective of the mitigation measures is to prevent transport related accidents and/or injury to people and livestock.

Actions

The following actions will be taken by SCSC in order to reduce the impact of the project on surrounding traffic:

- The proposed access road intersection (with the D869) will be upgraded to include additional slip lanes. This will include two 60 m slip lanes for vehicles turning onto the D680 (one in each direction), as well as a slip lane for vehicles entering the site from the east (Northam) and another slip lane for

vehicles entering the site from the west (Swartklip). This intersection will be stop-controlled where the project access road meets the main D869. Free-flow on the D869 will continue.
- Pedestrian walk ways will be developed at the proposed intersection.
- SCSC will make use of high passenger capacity busses and taxis for staff transport.
- SCSC will co-operate with surrounding mines, industry and the provincial roads department with regards to service levels and safety of the broader road network used by project related traffic.

- SCSC drivers and those of sub contractors will receive awareness training on the safety related dangers associated with traffic and road use in and around the proposed project.

The following actions should be taken by the relevant roads authority (irrespective of the proposed project) in order to reduce the impact of the project on surrounding traffic:
- Detailed investigations should be conducted in conjunction with the relevant road authority in terms of the existing quality and potential life span of the existing road surface layers of the roads where processed product, incoming ore and raw materials, consumables and workers might be transported.
- A road maintenance plan should be prepared in conjunction with the relevant road authority and other major road using stakeholders on public roads where trucks will operate as soon as the project has been approved in order to ensure that the processed product, incoming ore and raw materials, consumables and workers can be transported at all times.
- The intersection of the D869 and R510 should be upgraded
- The intersection of the Swartklip Road and D869 should be upgraded to include a 60 m slip lane for vehicles entering from the west and an additional slip lane for vehicles entering from the east. This intersection should be stop-controlled

Emergency situations

Any road accident involving or caused by project related traffic will be handled in accordance with the SCSC Emergency Response Procedure in Section 28.2.2.

VISUAL

9.1.15 ISSUE: NEGATIVE VISUAL IMPACTS

Information in this section was sourced from the Visual Impact Assessment undertaken by Newtown Landscape Architects (NLA, August 2016)

Introduction

Visual impacts on this receiving environment may be caused by activities and infrastructure in all project phases. The more significant visual impacts relate to the larger infrastructure components (such as the smelter plant and mineralised waste facilities). After closure the infrastructure should be removed as far as possible and the project area rehabilitated.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks Civil works	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Rehabilitation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Demolition Rehabilitation	Maintenance and aftercare of rehabilitated areas

RATING OF IMPACTS

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

The severity of visual impacts is determined by assessing the change to the visual landscape as a result of project related infrastructure and activities.

As discussed in Section 8.1.11, the visual landscape is determined by considering: landscape character, sense of place, scenic quality, sensitivity of the visual resource and sensitive views. In this regard, the proposed site alternatives area is in a flat, open area characterised by bushveld vegetation and non-perennial drainage lines. Immediately south-west of the site alternatives area, is the Union Section Mine and associated infrastructure (including railway line and Swartklip Mine Village) which physically dominates the area and determines the landscape character associated therewith. East of the site, approximately 8 km away, is the town of Northam. Crop and game farms and associated isolated farmsteads are typical of the region in addition to isolated communities (such as Sefikile located approximately 6.5 km south of the site alternatives area). The D869 and Transnet railway line are located to the north of the site alternatives area and Eskom lines traverse the site alternatives area (Figure 24).

When considering the potential change to the visual landscape the key issues are: visual exposure, visual intrusion, and sensitivity of receptors.

The severity in the unmitigated scenario is moderate when considered in the context of existing mining operations located within proximity to the site alternatives area and when considering that the Swartklip

Mine Village is located within immediate proximity to an existing mine. The severity is unlikely to reduce with mitigation until the closure phase when the site has been rehabilitated (in the mitigated scenario).

Duration / Reversibility

In the unmitigated scenario the duration is high because the impacts will continue post closure. In the mitigated scenario the impacts are unlikely to extend post closure because the project area will have been rehabilitated.

Spatial scale / Extent

In all phases visual impacts are likely to extend beyond the proposed site alternatives area. This is a medium spatial scale.

Consequence

The unmitigated consequence is high. With mitigation, prior to closure, this reduces to medium. After closure the consequence reduces to low.

Probability

In the unmitigated scenario and mitigated scenario the probability of visual impacts occurring as a result of the proposed project is medium because of the nature of the existing landscape. At closure when the project area has been rehabilitated, the probability will be reduced to low.

Significance

The unmitigated significance is high, reducing to medium with mitigation. The mitigated significance reduces to low at closure.

When considering the alternatives for the location of the smelter, it should be noted that the related impact assessment holds true for both alternatives. Even though alternative 2 is located further from the Swartklip Mine Village, it is still visible from the D869 road to the north. The 1st and 3rd alternative for the routing of the powerline are expected to be associated with less significant visual impacts given that these routes traverse existing Eskom servitudes as far as possible rather than traversing the Anlgo game farm. Access road alternative 1 and 3 are expected to be associated with more significant visual impacts due to the proximity of Anglo's Tiramogo Lodge and the homestead and farm worker's residences on portion 9 of Kameelhoek (immediately adjacent) respectively. It follows that access road alternative 2 is associated with the least significant visual impacts. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is provided below.

Unmitigated – summary of the rated visual impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	M	H	M	H	M	H

Mitigated – summary of the rated visual impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M	M	M	M	M	M
Closure						
Mitigated	L	L	M	L	L	L

Description of proposed mitigation measures

Mitigation measures are provided below and tabulated in the EMP (Section 26).

Objective

The objective of the mitigation measures is to limit negative visual impacts.

Actions

Planning and site development

With the construction of the smelter and its associated infrastructure, the minimum amount of existing vegetation and topsoil must be removed. All natural vegetation will be retained and incorporated into the site rehabilitation especially in line of sight from viewers to the south-west and north-east of the project area. All topsoil that occurs within the proposed footprint of an activity will be removed and stockpiled for later use. The stockpile will be vegetated and used as a screening berm for views from the west.

Earthworks

Earthworks will be executed in such a way that only the footprint and a small 'construction buffer zone' around the activities are exposed. In all other areas, the natural occurring vegetation (more importantly the indigenous vegetation) will be retained, especially along the periphery of the site. Dust suppression techniques will be in place at all times during all phases of the project, where required.

Landscaping and ecological approach

Indigenous vegetation will be introduced to complement existing vegetation and to screen nearby receptors as mentioned above. An ecological approach to rehabilitation and vegetative screening measures, as opposed to a horticultural approach to landscaping will be adopted.

Smelter plant and associated infrastructure

SCSC will (where possible and/or feasible) paint buildings and structures with colours that reflect and compliment the natural colours of the surrounding landscape. To further reduce the potential of glare, the external surfaces of buildings and structures will (where possible and/or feasible) be articulated or textured to create interplay of light and shade.

Lighting

Light pollution will be seriously and carefully considered and kept to a minimum wherever possible. The following are measures that will be considered in the lighting design of the SCSC project are as follows:

- Install light fixtures that provide precisely directed illumination to reduce light “spillage” beyond the immediate surrounds of the project area.
- Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on illegal entry to the project area.
- Minimise the amount of light fixtures to the bare minimum, including security lighting.
- With the construction of the proposed mineralised waste facilities security lighting will only be used where absolutely necessary and carefully directed, preferably away from sensitive viewing areas.
- Lights will be directed downwards so as to avoid illuminating the sky.
- Install a ‘baffle’ (where possible and/or feasible) at the top of the stacks and around the flares to screen the flame form views.
- At closure, mineralised waste facilities will be rehabilitated (as far as is practically possible) in a manner which reduces the visual impacts associated therewith.

Emergency situations

None identified.

HERITAGE/CULTURAL AND PALAEONTOLOGICAL RESOURCES

9.1.16 ISSUE: LOSS OF HERITAGE/CULTURAL AND PALAEONTOLOGICAL RESOURCES

Information was sourced from the Heritage Impact Assessment (Julius Pistorius cc, August 2016) and desktop Palaeontological Impact Assessment (Bruce Rubidge, December 2015) studies undertaken for the purposes of the project. These studies have been included in Appendix M and Appendix N respectively.

Introduction

There is a number of activities/infrastructure in all phases prior to closure that have the potential to damage heritage and cultural resources, either directly or indirectly, and result in the loss of the resource for future generations. Heritage and cultural resources include sites of archaeological, cultural or historical importance.

The Phase I HIA study did not reveal any of the types and ranges of heritage resources as outlined in Section 38 of the National Heritage Resources Act (No 25 of 1999). With regards to palaeontological resources, as the rocks underlying the site alternatives area are of the Bushveld Complex are of igneous origin there is no possibility of fossils being present. There is a slight, but very unlikely, possibility that fossils could be present in Quaternary alluvial deposits present in low-lying areas.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks Civil works	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Rehabilitation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Demolition Rehabilitation	Maintenance and aftercare of rehabilitated areas

Rating of impact

<u>Severity / nature/ degree to which impact may cause irreplaceable loss of resources</u>

No heritage or palaeontological resources were found to occur within the site alternatives area. Should any chance finds occur, it follows that in the unmitigated scenario, the severity could be medium. With mitigation, the site would be protected and will remain undisturbed which reduces the severity to low.

<u>Duration / Reversibility</u>

If the heritage or palaeontological resources are removed, damaged or destroyed the impact duration is long term. In the mitigated scenario the duration reduces to less than the project life.

<u>Spatial scale / Extent</u>

The spatial scale is low both with or without mitigation.

<u>Consequence</u>

The unmitigated scenario the consequence is medium. In the mitigated scenario the consequence reduces to low as the spatial scale, duration and severity is reduced.

Probability

The unmitigated probability is medium, reducing to low with mitigation.

Significance

The unmitigated significance is medium and the mitigated significance is low.

It is expected that the related impact assessment holds true regardless of what alternative is considered for the location of the smelter, access road or powerline routing. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is provided below.

Unmitigated – summary of the cumulatively rated heritage resources impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases prior to closure						
Unmitigated	M	H	L	M	M	M

Mitigated – summary of the cumulatively rated heritage resources impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases prior to closure						
Mitigated	M	L	L	L	L	L

Description of proposed mitigation measures

Mitigation measures are provided below and are tabulated in the EMP (Section 26).

Objective

The objective of the mitigation measures is to prevent the loss of heritage and palaentological resources that may be caused by project related activities.

Actions

Although the potential impacts on heritage and palaeontological resources has not been identified as an issue, for purposes of completeness, mitigation measures relating thereto have been included below.

Project infrastructure, activities and related disturbance will be limited to those specifically identified and described in this report. Where future plans require a change in project footprint, a project specific heritage and palaeontological study will be done to identify any project specific heritage and cultural resources that may be affected and to detail the mitigation plan where required. If removal or damage to resources is unavoidable, the necessary authorisations will be obtained from SAHRA prior to the removal or damage occurring.

In the event that new heritage and/or palaeontologcal resources are discovered during the construction, operation and decommissioning phases, SCSC will follow a chance find emergency procedure prior to damaging or moving these, which includes the following:

- Work at the find will be stopped to prevent damage.
- An appropriate heritage specialist will be appointed to assess the find and related impacts.
- Permitting applications will be made to SAHRA, if required.

In the event that any graves are discovered during the construction, operational or decommissioning phases, prior to damaging or destroying any identified graves, permission for the exhumation and relocation of graves will be obtained from the relevant descendants (if known) and the relevant local and provincial authorities.

Emergency situations

If there are any chance finds of heritage and/or palaeontological sites, SCSC will follow its Emergency Response Procedure contained in Section 28.2.2.

SOCIO-ECONOMIC

9.1.17 ISSUE: INWARD MIGRATION AND NEGATIVE SOCIAL IMPACTS

Information in this section was sourced from the social impact assessment undertaken Synergistics (August 2016) and included in Appendix P.

Introduction

Smelter projects tend to bring with them an expectation of employment in all project phases prior to closure. This expectation can lead to the influx of job seekers to an area which in turn increases pressure on existing communities, housing, basic service delivery and raises concerns around safety and security. In addition it can lead to an increase in social ills associated with an influx of job seekers into an area. This section focuses on the potential for the inward migration and associated social issues.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks Civil works	Smelter plant Transport systems Power supply and use	Smelter plant Transport systems Power supply and use	N/A

Construction	Operational	Decommissioning	Closure
	Water supply and use Mineralised waste Non-mineralised waste Support services General site management Rehabilitation	Water supply and use Mineralised waste Non-mineralised waste Support services General site management Demolition Rehabilitation	

Rating of impact

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

The effects of inward migration can be significant. These effects could include, but not be limited to:

- Potential establishment or expansion of informal settlements.
- Increased pressure on housing, water supply infrastructure, sanitation and waste management. systems and infrastructure, health care and community services and infrastructure.
- Potential for increased pressure on natural resources such as water, fauna, flora and soils.
- Increase in crime.
- Spread of disease, most notably HIV/Aids and tuberculosis.

It is not possible to predict how significant the inward migration and associated impacts as described above may be, however this impact severity has been rated as high in line with the precautionary approach and given that when considered cumulatively (in the context of other operations in the area and associated impacts) the severity is expected to be high. It may be possible to mitigate this impact by managing expectations with regard to employment.

Duration / Reversibility

In the normal course, social impacts associated with each phase of the project will occur for the life of the project, but negative social issues associated with inward migration as described above can continue beyond the closure of the project, particularly in the unmitigated scenario.

Spatial scale / Extent

In both the unmitigated and mitigated scenarios, the impacts of inward migration could extend beyond the proposed site alternatives area and into surrounding communities.

Consequence

In the unmitigated scenario the consequence associated with inward migration is high. In the mitigated scenario, the consequence is reduced to medium.

Probability

In the unmitigated scenario the impact is considered to be possible because this type of pressure has been experienced in the communities around other similar operations. With mitigation, probability reduces to low.

Significance

In the unmitigated scenario, the significance of this potential impact is high. With mitigation this may reduce to medium.

It is expected that the related impact assessment holds true regardless of which alternative is being considered for the location of the smelter, access road or powerline routing. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is provided below.

Unmitigated – summary of the rated inward migration impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation, decommissioning						
Unmitigated	H	H	M	H	M	H

Mitigated – summary of the rated inward migration impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M	H	M	H	L	M

Description of proposed mitigation measures

Mitigation measures are provided below and tabulated in the EMP (Section 26).

Objective

The objective of the mitigation measures is to limit inward migration and related social impacts.

Actions

Recruitment procedures to enhance local employment

- SCSC will advertise the number and details of available positions, as well as the minimum requirements to qualify for jobs. Adverts will state that preference will be given to people originating from local municipalities.

- Communication about employment needs and the criteria for employment will be undertaken well in advance of the construction and operation phases. SCSC to prepare a fact sheet for use by all those engaging with stakeholders. Sharing of this information can take many forms (eg. formal and informal engagement activities, radio interviews/ adverts, printed media/ adverts, amongst others).
- Local employment will be maximised to reduce the extent of influx. SCSC will confirm the percentage commitment to local employment (this figure will be as high as possible). The company's commitment to employing local people will be communicated in all advertisements and public meetings.
- No hiring will take place 'at the gate', only formal recruitment channels will be followed. SCSC to identify and use suitable local and national recruitment channels.
- Contractors will be required to apply the same recruitment measures to maximise the employment of local people.
- All recruitment procedures to be undertaken in accordance with South African relevant legislative requirements and IFC Performance Standard 2 of Labour and Working Conditions (2012).

Planning and partnering to alleviate pressure

- SCSC will engage with all relevant government departments to confirm the needs and constraints, and to establish the areas in which direct and indirect proposed Project activities will increase pressure to an extent that the municipalities are unable to accommodate. To date these have been identified as water, sewage, roads, electricity, healthcare and policing, however these will be confirmed.
- SCSC will engage with relevant authorities and planners in both Project affected municipalities to discuss the housing situation and establish whether the proposed Project will place additional pressure on housing capacity (directly and indirectly).
- Based on the outcome of interactions with the authorities, plans will be established that aim to minimise the growth of informal settlements. SCSC will focus on initiatives that will support construction and operation phase workers. SCSC to implement and monitor these plans.
- SCSC will develop a strategy and associated implementation plans to address the identified areas of need. These will be developed in consultation with the relevant government departments and businesses and aligned with the Integrated Development Plans (IDPs) and other relevant plans. The plans will outline objectives, specific commitments, partnerships and monitoring procedures. The strategy and the plans will:
  - Define objectives that commit to making contributions that strive for sustainability
  - Define a process for selecting projects
  - Outline processes for consulting with relevant stakeholders to identify key needs
  - Present accurate budgets and identify additional resource requirements
  - Outline a project implementation schedule in agreement with the authorities and other partners

- Specify planned partnerships, including roles and responsibilities (can be in the form of signed Memorandums of Understanding)
- Identify how the plan will be communicated to beneficiaries as a way of managing expectations
- Describe monitoring measures for all interventions.

- SCSC will update these plans on an annual basis and make them available to the authorities for their input and final approval.
- SCSC to participate in existing and future working groups and task teams initiated by government or other businesses that address infrastructure and service constraints. These should be identified in consultation with authorities and potential partners. One known forum is the Northam Sewage and Waterworks Task Team.
- SCSC will clearly communicate with communities the ambit of SCSC responsibilities versus those of government and other business.
- SCSC will keep records of all meetings, commitments and results.

Corporate Social Investment/ Local Economic Development

- SCSC to identify corporate social investment (CSI)/ local economic development (LED) opportunities that strive to improve infrastructure and services available in the project area. These are to be identified in collaboration with the relevant authorities and the IDPs.
- Detailed implementation plans to be developed to guide implementation activities, schedules, resource needs, monitoring activities, and communication with relevant stakeholders. SCSC to implement the projects identified in a manner that maximises efficiencies and benefits.
- SCSC to commit resources, financial and other (as required) to undertake these Projects.

Ongoing engagement and grievance management

- SCSC to develop a Stakeholder Engagement Plan (SEP) that is revised and updated on an annual basis. The SEP should be aligned with the requirements of the Equator Principles (2013) and the IFC Performance Standards (2012). The plan should cover (but not be limited to) the following:
  - Outline the aim and objectives of ongoing engagement
  - Describe all internal and external stakeholder groups (including levels of support and influence)
  - Describe all stakeholder issues and concerns as known currently (this will require exploratory
  - Meetings with each stakeholder group)
  - Define engagement techniques and protocols for each stakeholder group
  - Present a schedule that includes all identified stakeholders and topics
  - Outline resources required for implementation, timeframes, responsible people, monitoring
  - mechanisms; and
  - Layout process for undertaking and documenting engagement, including a clear process for
  - Registering and responding to issues and concerns raised.

- SCSC to implement a grievance procedure that is easily accessible, culturally appropriate and scaled to the potential risks and impacts of the project, through which complaints related to contractor or employee behaviour can be lodged and addressed. SCSC would respond to all such complaints. The grievance procedure should be aligned with the requirements of the Equator Principles, 2013 and the IFC Performance Standards, 2012. Key steps of the grievance mechanism include:
  - Circulation of contact details of 'grievance officer' or other key contact
  - Awareness raising among stakeholders regarding the grievance procedure and how it works.
  - Establishment of an electronic grievance register which SCSC will update, including all escalation actions, responses and response times.

Workforce support

Following discussions with the authorities, SCSC to develop and implement a local housing strategy and plan that aims to provide some support to its direct project workers. The purpose of the plan should be to limit the likelihood of SCSC workers constructing and living in informal dwellings.

Workforce and security management

- There will be one access point to the site where entry and exit procedures are strictly adhered to. The access point should be located as far away as possible from neighbouring properties.
- The site will be fenced to ensure that no unauthorised access will be possible at any point other than the security controlled access point.
- SCSC and its appointed contractors to develop an induction programme, including a Code of Conduct, for all workers (SCSC and contractor's workers) directly related to the Project. A copy of the Code of Conduct (CoC) will be presented to all workers and signed by each person. The CoC will address the following aspects:
  - Respect for local residents
  - Respect for farm infrastructure and agricultural activities
  - No trespassing on private properties;
  - No hunting or unauthorised taking of products or livestock
  - Zero tolerance of illegal activities by workers including: littering, unlicensed prostitution; illegal sale or purchase of alcohol; sale, purchase or consumption of drugs; illegal gambling or fighting
  - Compliance with the Traffic Management Plan and all road regulations
  - Description of disciplinary measures for infringement of the Code and company rules.
- If workers are found to be in contravention of the CoC, which they signed at the commencement of their contract, they will face disciplinary procedures that could result in dismissal. Stock theft will be noted as a dismissible offence.

- SCSC and its contractors will develop and implement an HIV/AIDS policy and information document for all workers directly related to the proposed project. The information document will address factual health issues as well as behaviour change issues around the transmission and infection of HIV/AIDS.
- SCSC will make condoms available to employees and all contractors.

Emergency situations

If an informal settlement starts to develop, this is considered and emergency situation and will be handled in accordance with the Emergency Response Procedure contained in Section 28.2.2.

9.1.18 ISSUE: ECONOMIC IMPACT

Information in this section was sourced from the economic study undertaken by Mercury Financial Consultants (Mercury, August 2015) and included in Appendix O.

Introduction

In the broadest sense, all activities associated with the project contribute towards aneconomic impact in operation, decommissioning and closure phase.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation Earthworks Civil works	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Rehabilitation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Demolition Rehabilitation	Maintenance and aftercare of rehabilitated areas

Rating of impact

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

The project has a positive economic impact on the national, local and regional economy. Direct benefits are derived from wages, taxes and profits. Indirect benefits are derived through the procurement of goods and services, and the increased spending power of employees. The following positive and negative aspects apply (Mercury, August 2016):

- The proposed project will result in the loss of grazing and cropping land which is estimated to be valued at R19 445 per hectare (it should be noted that this figure is based on the purchase price paid for the SCSC property. The price of land/ha in the area is estimated to be approximately R8000 to R15000 per hectare and therefore the purchase price of portion 3 of Grootkuil was higher than expected for the area and is an indication of how projects can positively influence land value). Considering that the proposed project will disturb approximately 140 ha of the 626 ha property, this equates to a loss of grazing and cropping land to a value of R2 722 300.

- Over a 32 year period (30 years for the life of the project plus an additional 2 years for construction), the present value that could potentially be generated over the life of project for commercial cattle was estimated at R5.3 million, whilst sunflower farming would yield approximately R51.4 million.
- It is calculated that the proposed project will contribute R188.8 billion towards the national economy during its life (this figure was based on an initial capital investment of R2.83 billion and present value of life of operational revenue of R186 billion).
- In its current state, the SCSC property does not provide any form of employment. It is expected that cattle/crop farming could however create employment opportunities for five people at a present value of R2.4 million over the 32 year period.
- The project will create 700 jobs in the first two years, and 280 jobs thereafter for the life of the project. This equates to R1.1 billion in present value over the life of the project.

It follows that without mitigation the economic contribution from the proposed project is high and the potential loss to agriculture is relatively low so the net impact severity is high positive. With mitigation, SCSC could identify alternative projects that would increase the net positive severity even further to benefit the region. It must be noted further that agricultural activies could continue on the land to the east of the smelter site and after the project is decommissioned agricultural activites can also be performed on some of the rehabilitated site.

<u>Duration / Reversibility</u>

In the normal course, the direct positive and negative economic impacts associated with the proposed project will occur for the life of the project. Post closure, in the unmitigated scenario, the scale of the impacts will be reduced. Furthermore, the proposed project will have contributed to income creation, and a better skilled workforce is expected to continue beyond the life of the project. Quantitatively assessing the post closure impacts is not possible because there are a number of important unknown factors such as the general state of the future economy (local, national and world wide) and the future state of the smelting/mineral beneficiation subsector in particular. There may also still be some negative impacts due to an un-rehabilitated site (in the unmitigated scenario only).

<u>Spatial scale / Extent</u>

In both the mitigated and unmitigated scenarios, the spatial scale of the impact is high because it will extend far beyond the proposed project area on a regional and national scale.

Consequence

In both the unmitigated and mitigated scenarios the consequence is high and positive.

Probability

In the normal course of economic activity the net positive impacts will definitely occur.

Significance

In the unmitigated scenario, the significance of this potential impact is high positive. In the mitigated scenario, the significance is further increased.

It is expected that the related positive economic impacts will be realised regardless of which alternative is being considered for the location of the smelter, access road or powerline routing. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is provided below.

Unmitigated – summary of the rated economic impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H+	H	H	H+	H	H+

Mitigated – summary of the rated economic impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Mitigated	H+	H	H	H+	H	H+

Description of proposed mitigation measures

Mitigation measures are provided below and are tabulated in the EMP (Section 26).

Objective

To enhance the positive economic impacts and limit the negative economic impacts. Part of this objective is to enhance the contribution to the local economy in particular.

Actions

- Siyanda will implement the commitments in the EMP to avoid/mitigate/manage all environmental, social and economic impacts. In so doing the potential negative impact on surrounding land use and values will be limited.

- Prior to construction, a base case valuation of land surrounding the project area will be done by an independent valuator. This valuation will provide a basis for future compensation negotiations if landowners are of the view that SCSC related impacts have caused a decrease in land value.
- Specifically, during all project phases, SCSC will ensure the following mitigation measures are implemented to minimise potential negative economic impacts and to optimise positive economic impact that may result from the proposed project:
  - Where possible, hire local people from the closest communities.
  - Extend formal bursary and skills development programmes to the closest communities to increase the number of local skilled people and thereby increase the potential local employee base.
  - Where possible, ensure procurement of local goods and services from the closest communities.
  - Implement a procurement mentorship programme which provides support to local businesses from the enquiry to project delivery stages.
  - Include the incorporation of economic considerations into closure planning from the outset.
  - Closure planning considerations should cover the skilling of employees for the downscaling, early closure and long term closure scenarios.
  - Identify and develop sustainable business opportunities and skills, independent from the project for members of the local communities to ensure continued economic prosperity beyond the life of project.

Emergency situations

None identified.

LAND USE

9.1.19 ISSUE: LAND USE IMPACT

Information in this section was sourced from on-site observations and the project team as well as from the economic study (Mercury Financial Consults, August 2016) included in Appendix O and the social impact assessment (Synergistics, August 2016) included in Appendix P.

Introduction

There are project related activities and infrastructure that may have an impact on other land uses in the proposed project areas in all project phases.

Project phase and link to activities/infrastructure

Construction	Operational	Decommissioning	Closure
Site preparation	Smelter plant	Smelter plant	Maintenance and aftercare

Construction	Operational	Decommissioning	Closure
Earthworks Civil works	Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Rehabilitation	Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Demolition Rehabilitation	of rehabilitated areas

Rating of impact

Severity / nature/ degree to which impact may cause irreplaceable loss of resources

There is currently no alternative land use taking place on the SCSC property and it follows that no on-site third party land use will be physically impacted, albeit that the current agricultural zoning requires amendment. Prior to SCSC's purchase of the property the land was used for informal sunflower cropping and grazing activities, however these activities have since been discontinued.

Land uses surrounding the proposed site alternatives area include: mining, residential, powerlines, rail, road infrastructure and agriculture (cropping, livestock grazing and game farming) (Figure 24).

These land uses within and surrounding the proposed site alternatives area may be affected by one or more of the following environmental and social impacts:

- Hazardous infrastructure and excavations.
- Land clearing (vegetation and soil) for infrastructure and activities.
- Biodiversity impacts.
- Surface and groundwater quality and quantity.
- Noise pollution.
- Air pollution.
- Traffic related safety impacts.
- Blasting impacts.
- Visual impacts.
- Social and inward migration impacts.

In the unmitigated scenario the cumulative severity could be high. This can be reduced to medium/low with mitigation that is focussed on prevention and/or controls for each environmental and social impact type.

Duration / Reversibility

In the unmitigated scenario the impact on land use will extend beyond project closure. With mitigation the majority of the land use impacts are expected to be limited to the phases prior to closure.

Spatial scale / Extent

The spatial scale extends beyond the proposed site alternatives area in both the mitigated and unmitigated scenario.

Consequence

The unmitigated consequence is high in all project phases. The mitigated consequence is low.

Probability

In the unmitigated scenario, where environmental and social impacts are uncontrolled, the probability that land uses will be impacted by the project is definite. With mitigation, the probability reduces to medium prior to closure and low post closure.

Significance

The unmitigated significance is high in all project phases. With mitigation this reduces to medium prior to closure and to low post closure.

When considering the smelter alternatives, it follows that the 1st alternative is associated with less significant impacts since no loss of land use would result if the smelter is developed there (cropping activities ceased when SCSC purchased this land), whereas the area identified for the 2nd alternative is still used for cropping activities which would be displaced if the smelter were to be developed there. For the purposes of the powerline routing, it follows that alternatives 1 and 3 are associated with less significant land use impacts given that these routes follow existing Eskom servitudes as far as possible (and thereafter follow the SCSC boundary fence) whereas alternatives 2 and 4 traverse the Anglo game farm which would compromise existing land uses within this area. From the perspective of the access road, is is anticipated that the 1st and 3rd alternative will have more significant impacts on existing land uses than the 2nd alternative. For further information on the impact assessment associated with the alternatives refer to Section 10.

A summary of the above impact assessment is provided below.

Unmitigated – summary of the rated land use impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
All phases						
Unmitigated	H	H	M	H	H	H

Mitigated – summary of the rated land use impact per phase of the project

Management	Severity / nature	Duration	Spatial scale / extent	Consequence	Probability of Occurrence	Significance
Construction, operation and decommissioning						
Mitigated	M-L	M	M	L	M	M
Closure						
Mitigated	M-L	L	M	L	L	L

Description of proposed mitigation measures

Mitigation measures are provided below and tabulated in the EMP (Section 26).

Objective

The objective of the mitigation measures is to prevent unacceptable negative impacts on surrounding land uses.

Actions

SCSC will implement mitigation measures as laid out from sections 9.1.1 to 9.1.18 so as to minimise the environmental and social impacts.

Managing impacts on land users requires both communication and collaboration between the project team and land users. In this regard, SCSC will hold quarterly stakeholder meetings for landowners and other relevant stakeholders in addition to the stakeholder management measures set out in Section 9.1.17

Emergency situations

Major spillage incidents will be handled in accordance with the SCSC Emergency Response Procedure (Section 28.2.2).

10 ALTERNATIVES

10.1 DESCRIPTION OF THE ALTERNATIVE ASSESSMENT PROCESS

This section describes the identification and comparative assessment of project alternatives related to the layout and technical options.

The preferred development layout/footprint was determined through an assessment of baseline conditions within the site alternatives area (Section 8.1), a review of specialist findings (Appendix E to Appendix T of this report) as well as input from regulatory authorities and IAPs (Section 7 and Appendix C). The process followed to reach the preferred alternative for the smelter complex, powerline and access road is discussed in Section 10 below.

Smelter complex site location and layout

The footprint determination process began with a site selection for the proposed smelter complex. The configuration of the infrastructure within the smelter complex is fixed given that it is determined by the directional flow of materials (process flow from west to east) and in order to reduce the carbon footprint, reduce energy use, limit haulage costs and to optimise efficiency, infrastructure is placed in close proximity to the incoming primary source of chrome concentrate (i.e. Union Section Mine). Two sites for the smelter were however considered (Figure 25).

In summary, the preferred smelter complex infrastructure area (alternative 1) was selected for the following reasons:

- It is owned by SCSC which is important for site access.
- It is close to chrome concentrate sources on surrounding mines (one source of which will be the immediately adjacent Union Section Mine).
- By being immediately adjacent to Union Section Mine, the potential impact footprint associated with the project is contained in as close proximity as possible to the existing impact footprint associated with the mine.
- It is close to rail and road infrastructure for the transport of incoming raw materials and outgoing product.
- It is close to viable water and power sources.
- It has already been heavily disturbed by existing and historic agricultural activities which reduces the biophysical sensitivity.

Configuration/layout options were considered in response to feedback received from the DEA Waste Directorate in which it was recommended that waste types (slag and baghouse dust) be kept separate. In this regard the SCSC team revised its thinking on waste co-disposal and agreed to develop two separate mineralised waste facilities, one for the disposal of slag and the other for the disposal of baghouse dust. The location of the separate mineralised waste facilities is illustrated in Figure 3.

Further detail on the full process undertaken to reach the preferred smelter location alternative is provided in Section 10.2 below.

Powerline routing alternatives

With the location of the smelter complex determined (as above), the routing alternatives considered for the powerline would need to originate from the Spitzkop substation (to the south-east of the smelter complex) and travel in a north-westerly direction towards the smelter complex. In this regard, four powerline routing alternatives were considered (Figure 25). Input from Anglo Union Section Mine (landowner of portions 4 and 5 of Grootkuil through which powerline routing alternatives 2, 3 and 4 run) suggested that it would be preferable for the powerline to follow an existing servitude. In this regard, powerline routing alternative 1 was chosen as the preferred alternative given that it follows an existing powerline servitude whereafter it is restricted to the SCSC property (not third party property) and follows the boundary fence. In summary, the preferred powerline alternative (alternative 1) was selected for the following reasons:

- It traverses existing corridors of disturbance (and parallel to existing Eskom servitudes) as far as is practically possible.
- It traverses SCSC property as far as possible.
- It avoids the functional areas of the Anglo American Game Farm (Portions 4 and 5 of the Farm Grootkuil 409 KQ) (Figure 24).

Further detail on the full process undertaken to reach the preferred powerline routing alternative is provided in Section 10.3 below.

Access road routing alternatives

With the location of the smelter complex determined (as above), the routing alternatives considered for the access road would need to originate from the D869 (Dwaalboom road) to the north and provide access to the smelter complex area south of the road. In this regard, three access road alternatives were considered (Figure 25). Alternatives 2 and 3 were considered in response to IAP concerns regarding alternative 1. In addition, the relative length of alternative 1 (when compared to alternatives 2 and 3) suggested that this road would have a larger footprint. Alternative 1 was therefore not considered further. Alternative 2 is considered the preferred alternative, however the development of this access road will depend on third party land access as well as agreement from Transnet in support of a new level crossing (with the railway line) required. In summary, the preferred access road alternative (alternative 2) was selected for the following reasons:

- The length of the preferred access road (regardless of the routing within the access road corridor) will be approximately one third of the length of alternative 1, thereby reducing the environmental footprint, reducing haulage distances (thereby allowing greater project efficiencies to be realised).
- The preferred access road will follow an existing disturbance corridor (as far as practically possible) given that it will run parallel to the Union Section Mine railway. In addition this routing will not be in the immediate vicinity of any receptors as is the case with alternative 3 passing within 150 m of a farm homestead on portion 9 of Kameelhoek and alternative 1 being located in close proximity to Anglo's Tiramogo Lodge.
- Several IAP concerns were raised regarding air quality (health), noise, visual, and security/access issues associated with road alternatives 1 and 3 (Appendix C), and in this regard, alternative 2 (the access road corridor) is considered preferable from the perspective of IAP concerns. In addition, alternative 3 is associated with potential sterilisation of a mineable ore body located beneath it.

Further detail on the full process undertaken to reach the preferred access road alternative is provided in Section 10.4 below.

A concluding statement on the site layout/footprint alternatives (smelter, powerline and access road) is included in Section 10.5.

10.2 SMELTER COMPLEX

10.2.1 ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE ALTERNATIVES (BASELINE CONSIDERATIONS)

GEOLOGY

A detailed description of the baseline geological environment for the entire site alternatives area is included in Section 8.1.1. Baseline conditions do not differ between the two alternative sites for the location of the smelter complex. No known mineable ore bodies are located beneath either alternative.

TOPOGRAPHY

A detailed description of the baseline topography for the entire site alternatives area is included in Section 8.1.2. Baseline conditions do not differ between the two alternative sites for the location of the smelter complex. The topography of both alternative sites has been disturbed due to cropping activities.

CLIMATE

A detailed description of the baseline climatic environment for the site alternatives area is included in Section 8.1.3. Baseline climatic conditions described are relevant for both smelter location alternatives.

SOILS

A detailed description of the baseline soils environment for the site alternatives area is included in Section 8.1.4. Soil type Arcadia is found to occur within the area identified for the 1st smelter alternative and it is expected that the soil types between the two smelter alternative locations are uniform since identical cropping activities are found to occur at both alternatives.

LAND CAPABILITY

A detailed description of the baseline land capability for the site alternatives area is included in Section 8.1.5. The soil types within the 1st alternative for the smelter have an “arable” land capability. Given the expected uniformity of soil types between the two alternatives for the location of the smelter, it is expected that land capability within the 2nd smelter alternative would also be “arable”.

BIODIVERSITY

A detailed description of the baseline biodiversity for the site alternatives area is included in Section 8.1.6. Baseline conditions between both alternative locations are expected to be the same and both areas have been disturbed by extensive cropping activities. Both smelter complex alternatives are located outside of areas of high sensitivity.

SURFACE WATER

A detailed description of the baseline hydrology for the site alternatives area is included in Section 8.1.7. Baseline hydrology conditions between the alternatives are expected to be the same and both areas have been disturbed by extensive cropping activities which has affected natural drainage across the site. Both the smelter complex alternatives are located outside of the floodlines of an unnamed tributary (tributary of the Brakspruit river).

GROUNDWATER

A detailed description of the baseline geohydrology for the site alternatives area is included in Section 8.1.8. Baseline geohydrology conditions between the alternatives are expected to be the same.

AIR QUALITY

A detailed description of the baseline air quality conditions for the site alternatives area (including potential air quality receptors) is included in Section 8.1.9. Both alternatives are surrounded by activities and infrastructure that contribute towards sources of emissions such as dust fallout and PM_{10}. Given that the alternative locations are immediately adjacent to one another, baseline air quality conditions between the alternatives are not expected to be materially different.

NOISE

A detailed description of the baseline noise environment for the site alternatives area (including potential noise receptors) is included in Section 8.1.10. Despite the fact that the preferred alternative is located within closer proximity to noise sources associated with the Union Section Mine, and the 2nd alternative is located within closer proximity to noise sources such as the D869 road (to the north), given that the alternatives are immediately adjacent to one another, baseline noise conditions between the alternatives are not expected to be materially different.

VISUAL

A detailed description of the baseline visual environment for the site alternatives area is included in Section 8.1.11. Visual baseline conditions are not expected to be materially different between the two alternative sites for the smelter. It should however be noted that the 1st alternative for the location of the smelter is located within closer proximity to the existing Swartklip Mine Village (immediately adjacent to the Union Section Mine) whereas the 2nd alternative is located within closer proximity to the D869 road to the north.

TRAFFIC

A detailed description of the baseline traffic environment for the site alternatives area is included in Section 8.1.12. Traffic baseline conditions are the same regardless of which alternative is being considered for the location of the smelter.

HERITAGE/PALAEONTOLOGICAL RESOURCES

A detailed description of the baseline heritage/palaeontological environment for the site alternatives area is included in Section 8.1.13. Baseline conditions are the same (i.e. no resources are expected to occur) within either site identified as alternatives for the location of the smelter.

SOCIO-ECONOMIC

A detailed description of the socio-economic baseline environment for the site alternatives area is included in Section 8.1.14. Baseline socio-economic conditions are the same regardless of the alternative being considered for the location of the smelter.

LAND USE

A detailed description of the baseline land use environment for the site alternatives area is included in Section 8.1.15. The 1st alternative location for the smelter was previously utilised for cropping activities (until purchased by SCSC) and the 2nd alternative is still utilised for cropping. The 1st alternative is located on land owned by SCSC, whereas the 2nd alternative is located on third party land.

10.2.2 SUMMARY OF ISSUES RAISED BY IAPS AND THE MANNER IN WHICH THEY INFLUENCED THE ALTERNATIVES

No issues relating to the alternative locations for the smelter complex have been raised by IAPs to date. There were therefore no IAP concerns which influenced the decision as to which alternative site was preferred.

10.2.3 ASSESSMENT OF IMPACTS ASSOCIATED WITH ALTERNATIVES

The detailed impact assessment has been included in Section 9.1 and summarised (for each potential impact) below.

LOSS AND STERILISATION OF MINERAL RESOURCES

The potential impacts associated with the loss and sterilisation of mineral resources are expected to be the same for both smelter location alternatives. Furthermore no known mineable ore resources are expected to occur beneath the smelter locations. For further detail see Section 9.1.1.

HAZARDOUS EXCAVATIONS AND INFRASTRUCTURE

The potential impacts associated with hazardous excavations and infrastructure are expected to be the same for both smelter location alternatives. For further detail see Section 9.1.2.

LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH CONTAMINATION

The potential impacts associated with loss of soils and land capability through contamination are expected to be the same for both smelter location alternatives. For further detail see Section 9.1.3.

LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE

The potential impacts associated with loss of soils and land capability through physical disturbance are expected to be the same for both smelter location alternatives. For further detail see Section 9.1.4.

PHYSICAL DESTRUCTION OF BIODIVERSITY

The potential impacts associated with the physical destruction of biodiversity are expected to be the same for both smelter location alternatives. In addition no sensitive/protected species would need to be removed for either alternative given that they are located almost entirely in already disturbed cropping fields. For further detail see Section 9.1.5.

GENERAL DISTURBANCE OF BIODIVERSITY

Even though the preferred alternative is located within proximity to a high sensitivity area, it should be noted that the complex and related infrastructure will be developed outside of the associated floodlines and the related biodiversity disturbance impacts are therefore considered to be the same for both smelter location alternatives. In addition no sensitive/protected species would need to be removed for either alternative. For further detail see Section 9.1.6.

ALTERATION OF NATURAL DRAINAGE PATTERNS

The potential impacts associated the alteration of natural drainage patterns are expected to be the same for both smelter location alternatives. For further detail see Section 9.1.7.

CONTAMINATION OF SURFACE WATER RESOURCES

The potential impacts associated with the potential contamination of surface water resources are expected to be the same for both smelter location alternatives given that both alternatives are in proximity to the tributary of the Brakspruit river. For further detail see Section 9.1.8.

REDUCTION IN GROUNDWATER LEVELS AND AVAILABILITY

The potential impacts associated with the reduction of groundwater levels are expected to be the same for both smelter location alternatives. For further detail see Section 9.1.9.

CONTAMINATION OF GOUNDWATER RESOURCES

The potential impacts associated with the potential contamination of groundwater are expected to be the same for both smelter location alternatives. For further detail see Section 9.1.10.

AIR POLLUTION

When considering the alternatives for the location of the smelter, it is expected that the related impact assessment holds true regardless of the alternative being considered because both sites are in similar proximity to potential third party air quality receptors. For further detail see Section 9.1.11.

NOISE POLLUTION

When considering the alternatives for the location of the smelter, it is expected that the related impact assessment holds true regardless of the alternative being considered because both sites are in similar proximity to potential third party air quality receptors. For further detail see Section 9.1.12.

BLASTING IMPACTS

Should blasting be required, it will be undertaken for the duration of the construction phase only. Related impacts are expected to be the same for both alternatives given that both smelter alternative locations are located within proximity to third party infrastructure. For further detail see Section 9.1.13.

ROAD DISTURBANCE AND TRAFFIC SAFETY

The potential impacts associated with road disturbance and traffic safety are expected to be the same for both smelter location alternatives. For further detail see Section 9.1.14.

NEGATIVE VISUAL IMPACTS

The potential visual impacts are expected to be the same for both smelter location alternatives. Even though the 2nd alternative is more detached from Swartklip Mine village it is not completely isolated and would be visible from the D869 to the north. For further detail see Section 9.1.15.

LOSS OF HERITAGE/CULTURAL AND PALAEONTOLOGICAL RESOURCES

The potential for loss of heritage/cultural and palaeontological resources is expected to be the same for both smelter location alternatives. For further detail see Section 9.1.16.

INWARD MIGRATION IMPACT

The potential for inward migration and associated impacts is expected to be the same for both smelter location alternatives. For further detail see Section 9.1.17.

ECONOMIC IMPACT

The potential for positive economic impacts to be realised is expected to be the same for both smelter location alternatives. For further detail see Section 9.1.18.

LAND USE IMPACT

It should be noted that the 2nd alternative is located on 3rd party land where cropping activities take place (and these activities would be displaced/discontinued if the smelter were to be developed in this area) whereas the 1st alternative is located on SCSC owned land on which no alternative land use currently takes place (historical cropping activities ceased when SCSC purchased this land). It follows that the land use impacts are expected to be more significant for alternative 2 than for alternative 1. The impacts on land uses adjacent to the alternatives is however expected to be similar regardless of the alternative being considered. For further detail see Section 9.1.19.

10.2.4 METHODOLOGY USED IN THE ASSESSMENT OF IMPACTS

The methodology used in the assessment of impacts is included in Section 9. The core impact assessment in Section 9 uses this methodology and includes a discussion on the severity/nature/degree to which impact may cause irreplaceable loss of resources, significance, consequence, spatial scale/extent, duration/reversibility, probability, whether or not there may be an irreplaceable loss of resources caused and whether the impact can be avoided, managed or mitigated. The consideration of the impacts of alternatives in Section 10 draws from the core assessment in Section 9 by focusing on impacts which differ when considering the two smelter alternatives against one another. Where there is no material difference in impacts this has been indicated.

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

A summary of the positive and negative impacts associated with both smelter alternatives is presented in Table 60 and discussed above in Section 10. The detailed assessment is included in Section 9.

10.2.6 POSSIBLE MITIGATION MEASURES AND RESIDUAL LEVEL OF RISK/MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT WITHIN THE SITE

The residual level of risk including the corresponding mitigation measures are included in Section 9 and summarised in Table 64 to Table 82.

10.3 POWERLINE ROUTING

10.3.1 ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE ALTERNATIVES (BASELINE CONSIDERATIONS)

GEOLOGY

A detailed description of the baseline geological environment for the entire site alternatives area is included in Section 8.1.1. Baseline conditions do not differ between the four alternative sites for the routing of the powerline. No known mineable ore resources are expected to occur beneath the alternatives for the routing of the powerline.

TOPOGRAPHY

A detailed description of the baseline topography for the entire site alternatives area is included in Section 8.1.2. Baseline conditions do not differ between the four alternatives for the routing of the powerline since all alternatives are associated with the non-perennial Phufane and Brakspruit rivers, and tributaries thereof.

CLIMATE

A detailed description of the baseline climatic environment for the site alternatives area is included in Section 8.1.3. Baseline climatic conditions described are relevant for all four powerline routing alternatives.

SOILS

A detailed description of the baseline soils environment for the site alternatives area is included in Section 8.1.4. Soil types Bonheim and Hutton are found to occur within the area identified for all of the powerline routing alternatives.

LAND CAPABILITY

A detailed description of the baseline land capability for the site alternatives area is included in Section 8.1.5. The soil types within the routes identified for all four powerline alternatives have an “arable” land capability.

BIODIVERSITY

A detailed description of the baseline biodiversity for the site alternatives area is included in Section 8.1.6. Baseline conditions between the four routing alternatives for the powerline are expected to be similar although routing alternatives 1 and 3 are associated with existing servitudes (therefore already disturbed) whereas routing alternative 2 and 4 pass through the Anglo game farm which is undisturbed. The watercourses (over which all four powerline routes will cross) are associated with higher sensitivity. In addition, protected species *Vachellia erioloba* (Camel thorn) is expected to occur within the routings of all alternatives.

SURFACE WATER

A detailed description of the baseline hydrology for the site alternatives area is included in Section 8.1.7. Baseline conditions are not expected to differ between the four alternatives for the routing of the powerline since all alternatives are associated with the non-perennial Phufane and Brakspruit rivers, and tributaries thereof.

GROUNDWATER

A detailed description of the baseline geohydrology for the site alternatives area is included in Section 8.1.8. Baseline conditions are not expected to differ between the four alternatives for the routing of the powerline.

AIR QUALITY

A detailed description of the baseline air quality conditions for the site alternatives area (including potential air quality receptors) is included in Section 8.1.9. All four routing alternatives are surrounded by activities and infrastructure that contribute towards sources of emissions such as dust fallout and PM_{10}.

NOISE

A detailed description of the baseline noise environment for the site alternatives area (including potential noise receptors) is included in Section 8.1.10. All four routing alternatives are surrounded by activities and infrastructure that contribute towards sources of noise and baseline noise conditions between the alternatives are not expected to be materially different.

VISUAL

A detailed description of the baseline visual environment for the site alternatives area is included in Section 8.1.11. Visual baseline conditions are not expected to be materially different between the four alternatives.

TRAFFIC

A detailed description of the baseline traffic environment for the site alternatives area is included in Section 8.1.12. Traffic baseline conditions are the same regardless of which alternative is being considered for the routing of the powerline.

HERITAGE/PALAEONTOLOGICAL RESOURCES

A detailed description of the baseline heritage and palaeontological environment for the site alternatives area is included in Section 8.1.13. Baseline conditions are the same (i.e. no resources are expected to occur) within any of the alternatives identified for the routing of the powerline.

SOCIO-ECONOMIC

A detailed description of the socio-economic baseline environment for the site alternatives area is included in Section 8.1.14. Baseline socio-economic conditions are the same regardless of the alternative being considered for the routing of the powerline.

LAND USE

A detailed description of the baseline land use environment for the site alternatives area is included in Section 8.1.15. The 1st and 3rd routing alternatives for the powerline traverse existing Eskom servitudes as far as possible and then traverse the SCSC boundary fence. The 2nd and 4th routing alternatives traverse 3rd party land (that belonging to Anglo). The 2nd and 4th alternative follow no existing servitudes and therefore pass through Anglo's undisturbed game farming land.

10.3.2 SUMMARY OF ISSUES RAISED BY IAPS AND THE MANNER IN WHICH THEY INFLUENCED THE ALTERNATIVES

Anglo requested that portion 4 and 5 of Grootkuil (the Anglo game farm) be avoided as far as possible and that the proposed powerline routing follow existing servitudes/corridors of disturbance where possible. This therefore influenced the decision to route the powerline along an existing Eskom and thereafter through the SCSC property, and in so doing avoiding undisturbed land within the Anglo game farm area.

10.3.3 ASSESSMENT OF IMPACTS ASSOCIATED WITH ALTERNATIVES

The detailed impact assessment has been included in Section 9.1 and summarised (for each potential impact) below.

LOSS AND STERILISATION OF MINERAL RESOURCES

The potential impacts associated with the loss and sterilisation of minerals are not expected to be relevant for the powerline routing given that there are no known mineable resources located within the vicinity of the powerline routings. For further detail see Section 9.1.1.

HAZARDOUS EXCAVATIONS AND INFRASTRUCTURE

The potential impacts associated with hazardous excavations and infrastructure are expected to be the same for all four powerline routing alternatives. For further detail see Section 9.1.2.

LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH CONTAMINATION

The potential impacts associated with loss of soils and land capability through contamination are expected to be the same for all four powerline routing alternatives.For further detail see Section 9.1.3.

LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE

The potential impacts associated with loss of soils and land capability through physical disturbance are expected to be the same for all four powerline routing alternatives.For further detail see Section 9.1.4.

PHYSICAL DESTRUCTION OF BIODIVERSITY

All of the powerline routing alternatives will require stream crossings (sensitive areas), however powerline alternatives 1 and 3 traverse existing Eskom servitudes before running along the boundary fence of the SCSC property and it is expected that the impacts associated with these alternatives are less significant than those associated with alternatives 2 and 4 which may destroy currently undisturbed biodiversity. For further detail see Section 9.1.5.

GENERAL DISTURBANCE OF BIODIVERSITY

All of the powerline routing alternatives will require stream crossings (sensitive areas), however powerline alternatives 1 and 3 traverse existing Eskom servitudes before running along the boundary fence of the SCSC property and it is expected that the impacts associated with these alternatives are less significant than those associated with alternatives 2 and 4 which may disturb currently undisturbed areas. For further detail see Section 9.1.6.

ALTERATION OF NATURAL DRAINAGE PATTERNS

The potential impacts associated the alteration of natural drainage patterns are expected to be the same for all four powerline routing alternatives since all powerlines will require river crossings. For further detail see Section 9.1.7.

CONTAMINATION OF SURFACE WATER RESOURCES

The potential impacts associated contamination of surface water resources are expected to be the same for all four powerline routing alternatives given that all routes would require stream crossing. For further detail see Section 9.1.8.

REDUCTION IN GOUNDWATER LEVELS AND AVAILABILITY

Impacts associated with the reduction in groundwater levels and availability are not relevant for the powerline. For further detail see Section 9.1.9.

CONTAMINATION OF GOUNDWATER RESOURCES

Impacts associated with contamination of groundwater are not conisdered to be relevant for the powerline. For further detail see Section 9.1.10.

AIR POLLUTION

Air quality impacts associated with the powerline routing will be limited to the construction phase only and are expected to be equally significant regardless of which of the four routings are considered. For further detail see Section 9.1.11.

NOISE POLLUTION

Noise related impacts associated with the powerline are relevant only during the construction phase when the assessment remains the same regardless of the alternative being considered. For further detail see Section 9.1.12.

BLASTING IMPACTS

Blasting is not relevant to the powerline. For further detail see Section 9.1.13.

ROAD DISTURBANCE AND TRAFFIC SAFETY

Traffic related impacts are not relevant to the powerline routing. For further detail see Section 9.1.14.

NEGATIVE VISUAL IMPACTS

The potential visual impacts associated with alternatives 1 and 3 are expected to be less significant than those associated with 2 and 4 which traverse the Anglo game farm given that alternatives 1 and 3 run along existing Eskom servitudes as far as possible as thereafter along the SCSC boundary fence. For further detail see Section 9.1.15.

LOSS OF HERITAGE/CULTURAL AND PALAEONTOLOGICAL RESOURCES

The potential for loss of heritage/cultural and palaeontological resources is expected to be the same regardless of which powerline routing alternative is being considered. For further detail see Section 9.1.16.

INWARD MIGRATION IMPACT

The potential for inward migration and associated impacts is expected to be the same regardless of which powerline routing alternative is being considered. For further detail see Section 9.1.17.

ECONOMIC IMPACT

The potential for positive economic impacts to be realised is expected to be the same regardless of which powerline routing alternative is being considered For further detail see Section 9.1.18.

LAND USE IMPACT

The loss of current land uses as a result of the development of the powerline is more significant when considering alternatives 2 and 4 given that these routes run through the Anglo Game farm whereas alternatives 1 and 3 traverse existing Eskom servitudes as far as possible and thereafter run along the SCSC boundary fence line. For further detail see Section 9.1.19.

10.3.4 METHODOLOGY USED IN THE ASSESSMENT OF IMPACTS

The methodology used in the assessment of impacts is included in Section 9. The core impact assessment in Section 9 uses this methodology and includes a discussion on the severity/nature/degree to which impact may cause irreplaceable loss of resources, significance, consequence, spatial scale/extent, duration/reversibility, probability, whether or not there may be an irreplaceable loss of resources caused and whether the impact can be avoided, managed or mitigated. The consideration of the impacts of alternatives in Section 10 draws from the core assessment in Section 9 by focusing on impacts which differ when considering the four powerline routing alternatives against one another. Where there is no material difference in impacts this has been indicated.

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

A summary of the positive and negative impacts associated with all four powerline alternatives is presented in Table 60 and discussed above in Section 10. The detailed assessment is included in Section 9.

10.3.6 POSSIBLE MITIGATION MEASURES AND RESIDUAL LEVEL OF RISK/MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT WITHIN THE SITE

The residual level of risk including the corresponding mitigation measures are included in Section 9 and summarised in Table 64 to Table 82.

10.4 ACCESS ROAD ROUTING

10.4.1 ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE ALTERNATIVES (BASELINE CONSIDERATIONS)

GEOLOGY

A detailed description of the baseline geological environment for the entire site alternatives area is included in Section 8.1.1. Baseline conditions do not differ between the three alternatives for the routing of the access road however it should be noted that there is a known chrome ore body and associated mineral right located beneath a section of the 3rd access road alternative.

TOPOGRAPHY

A detailed description of the baseline topography for the entire site alternatives area is included in Section 8.1.2. Baseline conditions do not differ between the 2nd and 3rd alternatives for the routing of the access road. The 1st alternative is associated with the non-perennial Phufane and Brakspruit rivers, and tributaries thereof and would require crossings over these watercourses.

CLIMATE

A detailed description of the baseline climatic environment for the site alternatives area is included in Section 8.1.3. Baseline climatic conditions described are relevant for all three access road routing alternatives.

SOILS

A detailed description of the baseline soils environment for the site alternatives area is included in Section 8.1.4. Soil types Hutton and Bonheim are found to occur within the routing of the 1st access road alternative. Soil type Bonheim is found to occur within the routing of the 2nd access road alternative. Soil types Glenrosa, Bonheim, Arcadia and Witbank are found to occur within the routing of the 3rd access road alternative.

LAND CAPABILITY

A detailed description of the baseline land capability for the site alternatives area is included in Section 8.1.5. The soil types within the 1st and 2nd access road routing alternatives are associated with an "arable" land capability and the soil types within the 3rd access road routing alternative are associated with "arable" and "wilderness" land capabilities.

BIODIVERSITY

A detailed description of the baseline biodiversity for the site alternatives area is included in Section 8.1.6. The watercourses (over which the 1st routing alternative will be required to cross) are associated with higher biodiversity sensitivity. In addition, protected species *Vachellia erioloba* (Camel thorn) is expected to occur within the routing of this alternative considering that it would need to be widened for the purposes of the project. The 2nd and 3rd routing alternative have to an extent been disturbed by existing linear infrastructure (road and railway infrastructure).

SURFACE WATER

A detailed description of the baseline hydrology for the site alternatives area is included in Section 8.1.7. Baseline conditions are not expected to differ between the 2nd and 3rd alternatives for the routing of the access road. The 1st access road alternative is associated with the non-perennial Phufane and Brakspruit rivers, and tributaries thereof and would require crossings over these rivers.

GROUNDWATER

A detailed description of the baseline geohydrology for the site alternatives area is included in Section 8.1.8. Baseline conditions are not expected to differ between the alternatives for the routing of the access road.

AIR QUALITY

A detailed description of the baseline air quality conditions for the site alternatives area (including potential air quality receptors) is included in Section 8.1.9. All three routing alternatives are surrounded by activities and infrastructure that contribute towards sources of emissions such as dust fallout and PM_{10}. Alternatives 1 and 3 are located within closer proximity to potential air receptors than alternative 2.

NOISE

A detailed description of the baseline noise environment for the site alternatives area (including potential noise receptors) is included in Section 8.1.10. All three routing alternatives (particularly routing alternatives 2 and 3) are surrounded by activities and infrastructure that contribute towards sources of noise and baseline noise conditions between the alternatives are not expected to be materially different. Alternatives 1 and 3 are located within closer proximity to potential noise receptors than alternative 2.

VISUAL

A detailed description of the baseline visual environment for the site alternatives area is included in Section 8.1.11. Visual baseline conditions are not expected to be materially different between the three alternatives however alternatives 1 and 3 are located closer to potential visual receptors (Anglo's Tiramogo Lodge and the homestead and farm workers residences on portion 9 of Kameelhoek, respectively)

TRAFFIC

A detailed description of the baseline traffic environment for the site alternatives area is included in Section 8.1.12. Traffic baseline conditions are the same regardless of which alternative is being considered for the routing of the access road.

HERITAGE/PALAEONTOLOGICAL RESOURCES

A detailed description of the baseline heritage and palaeontological environment for the site alternatives area is included in Section 8.1.13. Baseline conditions are the same (i.e. no resources are expected to occur) within any of the alternatives identified for the routing of the access road.

SOCIO-ECONOMIC

A detailed description of the socio-economic baseline environment for the site alternatives area is included in Section 8.1.14. Baseline socio-economic conditions are the same regardless of the alternative being considered for the routing of the access road.

LAND USE

A detailed description of the baseline land use environment for the site alternatives area is included in Section 8.1.15**.** The 2nd and 3rd routing alternatives traverse 3rd party land which has already been disturbed to an extent by existing road and rail infrastructure. The 1st access road alternative follows an existing dirt road before travelling westwards through the SCSC project area. The 1st access road is approximately three times longer than the 2nd and 3rd alternatives. As per the geology baseline summary, a section of access road alternative 3 coincides with a potential future mining land use. Furthermore alternative 3 is located immediately adjacent to the farmstead and farm worker reseidences on portion 9 of Kameelhoek.

10.4.2 SUMMARY OF ISSUES RAISED BY IAPS AND THE MANNER IN WHICH THEY INFLUENCED THE ALTERNATIVES

The 2nd access road alternative (preferred alternative) was included in response to IAP concerns relating to the 1st alternative. Although not preferable from the perspective of IAPs, the 3rd access road alternative was included in the event that third-party land access and agreement from Transnet (both required for alternative 2) are not obtainable.

10.4.3 ASSESSMENT OF IMPACTS ASSOCIATED WITH ALTERNATIVES

The detailed impact assessment has been included in Section 9.1 and summarised (for each potential impact) below.

LOSS AND STERILISATION OF MINERAL RESOURCES

The potential impacts associated with the loss and sterilisation of mineral resources are not expected to be relevant for the access road routings 1 and 2. Access road alternative 3 passes over a known chrome ore body and is therefore associated with more significant impacts than 1 and 2. For further detail see Section 9.1.1.

HAZARDOUS EXCAVATIONS AND INFRASTRUCTURE

The potential impacts associated with hazardous excavations and infrastructure are expected to be the same for all three access road routing alternatives. For further detail see Section 9.1.2.

LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH CONTAMINATION

The potential impacts associated with loss of soils and land capability through contamination are expected to be the same for the 2nd and 3rd access road routing alternatives. The 1st alternative is approximately three times the length of the 2nd and 3rd alternative and it is therefore expected that soil contamination impacts associated therewith would be more significant. For further detail see Section 9.1.3.

LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE

The potential impacts associated with loss of soils and land capability through physical disturbance are expected to be the same for the 2nd and 3rd access road routing alternatives. The 1st alternative is approximately three times the length of the 2nd and 3rd alternative and it is therefore expected that soil disturbance impacts associated therewith would be more significant. For further detail see Section 9.1.4.

PHYSICAL DESTRUCTION OF BIODIVERSITY

The potential impacts associated with the physical destruction of biodiversity are expected to be the same for the 2nd and 3rd access road routing alternatives and both of these routings have to an extent already been disturbed by existing road and rail infrastructure. The 1st routing alternative would require stream crossings and it is expected that these stream crossings are all associated with areas of higher sensitivity. In addition, the 1st alternative is approximately three times the length of the 2nd and 3rd alternative and it is therefore expected that biodiversity related impacts associated therewith would be more significant. For further detail see Section 9.1.5.

GENERAL DISTURBANCE OF BIODIVERSITY

The potential impacts associated with the general disturbance of biodiversity are expected to be the same for the 2nd and 3rd access road routing alternatives and both of these routings have to an extent already been disturbed by existing road and rail infrastructure. The 1st routing alternative would require stream crossings and it is expected that these stream crossings are all associated with areas of higher sensitivity. In addition, the 1st alternative is approximately three times the length of the 2nd and 3rd alternative and it is therefore expected that biodiversity related impacts associated therewith would be more significant. For further detail see Section 9.1.6.

ALTERATION OF NATURAL DRAINAGE PATTERNS

The potential impacts associated the alteration of natural drainage patterns are expected to be more significant for alternative 1 since this would require several stream crossings whereas alternatives 2 and 3 would not require stream crossings. For further detail see Section 9.1.7.

CONTAMINATION OF SURFACE WATER RESOURCES

The potential impacts associated with contamination of surface water resources are expected to be the same for the 2nd and 3rd access road routing alternatives. The 1st access road alternative would require several stream crossings (over the Phufane, the Brakspruit and various tributaries thereof) and is therefore expected to be associated with more significant impacts. For further detail see Section 9.1.8.

REDUCTION IN GOUNDWATER LEVELS AND AVAILABILITY

Impacts associated with the reduction in groundwater levels and availability are not relevant for the access road. For further detail see Section 9.1.9.

CONTAMINATION OF GOUNDWATER RESOURCES

Impacts associated with the contamination of groundwater are not relevant for the access road. For further detail see Section 9.1.10.

AIR POLLUTION

The impacts associated with the 3rd access road alternative are expected to be more significant than those associated with alternatives 1 and 2 given that this alternative runs immediately adjacent to and within 150 m of a farmstead and farm worker residences located on portion 9 of the farm Kameelhoek. The 1st access road alternative is considered to be associated with more significant impacts than those associated with alternative 2 given the length of the road over which emissions from vehicles would take place (it is approximately three times the length of alternatives 2 and 3). In addition, alternative 1 is routed within close proximity to Anglo's Tiramogo Lodge. For further detail see Section 9.1.11.

NOISE POLLUTION

Noise related impacts associated with access road alternative 2 are expected to be less significant than those associated with alternative 1 and 3 given that the 1st alternative would bypass Anglo's Tiramogo Lodge and the 3rd alternative runs immediately adjacent to and within 150 m of a farmstead and farm worker residences located on portion 9 of the farm Kameelhoek. Moreover, the length of access road alternative 1 (over which noise from vehicles would be generated) is approximately three times the length of alternatives 2 and 3. For further detail see Section 9.1.12.

BLASTING IMPACTS

Blasting is not relevant to the access road. For further detail see Section 9.1.13.

ROAD DISTURBANCE AND TRAFFIC SAFETY

The fact that all alternatives intersect with the D869 is common to all roads, however each alternative has its own elements that present road disturbance and safety related issues. For alternative 1, concerns over common roads shared with farmers and associated problems have already been raised by IAPs. For alternative 2, the additional rail crossings which would need approval by Transnet/Union Section. For alternative 3, the proximity to the farmstead and farm workers residences on Portion 9 of Kameelhoek are problematic. It follows that the associated impact significance is expected to be similar for all alternatives. For further detail see Section 9.1.14.

NEGATIVE VISUAL IMPACTS

Access road alternative 1 and 3 are expected to be associated with more significant visual impacts due to the proximity of Anglo's Tiramogo Lodge and the homestead and farm worker's residences on portion 9 of Kameelhoek (immediately adjacent), respectively. It follows that access road alternative 2 is associated with the least significant visual impacts. For further detail see Section 9.1.15.

LOSS OF HERITAGE/CULTURAL AND PALAEONTOLOGICAL RESOURCES

The potential for loss of heritage/cultural and palaeontological resources is expected to be the same regardless of which access road routing alternative is being considered. For further detail see Section 9.1.16.

INWARD MIGRATION IMPACT

The potential for inward migration and associated impacts is expected to be the same regardless of which access road routing alternative is being considered. For further detail see Section 9.1.17.

ECONOMIC IMPACT

The potential for positive economic impacts to be realised is expected to be the same regardless of which access road routing alternative is being considered For further detail see Section 9.1.18.

LAND USE IMPACT

The significance of impacts associated with the loss of current land uses as a result of the development of the access road is more significant for alternative 3 given the location of the access road in relation to the homestead and farm worker residences on portion 9 of Kameelhoek. Moreover, access road alternative 3 is accociated with a potential future mining land use. For further detail see Section 9.1.19.

10.4.4 METHODOLOGY USED IN THE ASSESSMENT OF IMPACTS

The methodology used in the assessment of impacts is included in Section 9. The core impact assessment in Section 9 uses this methodology and includes a discussion on the severity/nature/degree to which impact may cause irreplaceable loss of resources, significance, consequence, spatial scale/extent, duration/reversibility, probability, whether or not there may be an irreplaceable loss of resources caused and whether the impact can be avoided, managed or mitigated. The consideration of the impacts of alternatives in Section 10 draws from the core assessment in Section 9 by focusing on impacts which differ when considering the three access road alternatives against one another. Where there is no material difference in impacts this has been indicated.

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

A summary of the positive and negative impacts associated with all three access road routing alternatives is presented in Table 60 and discussed above in Section 10. The detailed assessment is included in Section 9.

10.4.6 POSSIBLE MITIGATION MEASURES AND RESIDUAL LEVEL OF RISK/MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT WITHIN THE SITE

The residual level of risk including the corresponding mitigation measures are included in Section 9 and summarised in Table 64 to Table 82.

10.5 CONCLUDING STATEMENT ON PREFERRED ALTERNATIVES FOR SMELTER COMPLEX POWERLINE AND ACCESS ROAD ROUTING

With reference to Section 10, two smelter complex location alternatives, three access road alternatives and four powerline routing alternatives were considered as part of the proposed project (Figure 25). A basic alternative selection matrix was compiled in order to provide a summary in terms of the advantages and disadvantages of the site layout options. Table 60 presents the results of the related selection matrix process (including the positive and negative impacts associated with each alternative). The ranking system is a simple two score system for the smelter infrastructure and a three score system for the access road, where only two and three alternatives are provided for each respectively. A four score relative ranking system for the powerline routing has been used given that four powerline routing alternatives are provided. In the case of the smelter location and access road (where only two/three alternatives are presented) for each criterion, a score of one is allocated to the best option and a score of two/three to the worst. Similarly, for the powerline routing, a score of one is allocated to the best option and a score of four is allocated to the worst option. The option with the lowest total score is the preferred option.

It should be noted that the site selection matrix in Table 60 below has been compiled summarising information available to date. The more detailed discussion around the positive and negative impacts of the alternatives is included in Section 10 above and in the impact assessment in Section 9.1.

With reference to Figure 25, it follows that in totality, the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures (summarised in Table 64 to Table 82) identified through this assessment are as below:

- Alternative 1 is the preferred alternative for the location of the smelter complex. This takes into account the fact that land access is a definitive matter and access to portion 2 of Grootkuil (third party land) on which smelter alternative 2 is proposed is not possible.
- Alternative 1 is the preferred routing alternative for the powerline.
- Alternative 2 is the preferred routing alternative for the access road.

TABLE 60: SUMMARY AND RANKING OF POSITIVE AND NEGATIVE IMPACTS ASSOCIATED WITH ALTERNATIVES FOR THE LOCATION OF THE SMELTER COMPLEX, AND ROUTINGOF THE POWERLINE AND ACCESS ROAD

CRITERIA	RELATIVE RANKING									IMPACT SUMMARY
	SMELTER AREA 1	SMELTER AREA 2	POWER LINE 1	POWER LINE 2	POWER LINE 3	POWER LINE 4	ACCESS ROAD 1	ACCESS ROAD 2	ACCESS ROAD 3	
Sterilisation of mineral resources	1	1	N/A	N/A	N/A	N/A	1	1	3	**Smelter**: Alternative 1 and 2 are equally preferable. **Powerline:** Not relevant **Access Road**: Alternative 1 and 2 are preferred to alternative 3 since a section of alternative 3 is associated with a known chrome ore body
Hazardous excavations and infrastructure	1	1	1	1	1	1	1	1	1	**Smelter**: Alternative 1 and 2 are equally preferable. **Powerline:** All alternatives are equally preferable. **Access Road:** All alternatives are equally preferable.
Loss of soil resources and land capability through contamination	1	1	1	1	1	1	2	1	1	**Smelter:** Alternative 1 and 2 are equally preferable. **Powerline:** All alternatives are equally preferable. **Access Road:** Alternatives 2 and 3 are preferable to alternative 1 since alternative 1 would require stream crossings which are associated with more sensitive soil types. In addition, the 1st alternative is approximately three times the length of the 2nd and 3rd alternative.

CRITERIA	RELATIVE RANKING									IMPACT SUMMARY
	SMELTER AREA 1	SMELTER AREA 2	POWER LINE 1	POWER LINE 2	POWER LINE 3	POWER LINE 4	ACCESS ROAD 1	ACCESS ROAD 2	ACCESS ROAD 3	
Loss of soil resources and land capability through physical disturbance	1	1	1	1	1	1	2	1	1	**Smelter:** Alternative 1 and 2 are equally preferable. **Powerline:** All alternatives are equally preferable. **Access Road:** Alternatives 2 and 3 are preferable to alternative 1 since alternative 1 would require stream crossings which are associated with more sensitive soil types. In addition, the 1st alternative is approximately three times the length of the 2nd and 3rd alternative.
Physical destruction of biodiversity	1	1	1	4	2	3	2	1	1	**Smelter:** Alternative 1 and 2 are equally preferable. **Powerline:** Alternatives 1 and 3 are preferable to alternative 2 and 4 since they traverse existing Eskom servitudes and the SCSC boundary fence line as far as possible. **Access Road:** Alternatives 2 and 3 are preferable to alternative 1 since alternative 1 would require stream crossings which are associated with more sensitive biodiversity areas. In addition, the 1st alternative is approximately three times the length of the 2nd and 3rd alternative.
General disturbance of biodiversity	1	1	1	4	2	3	2	1	1	**Smelter**: Alternative 1 and 2 are equally preferable. **Powerline:** Alternatives 1 and 3 are preferable to alternative 2 and 4 since they traverse existing

CRITERIA	RELATIVE RANKING									IMPACT SUMMARY
	SMELTER AREA 1	SMELTER AREA 2	POWER LINE 1	POWER LINE 2	POWER LINE 3	POWER LINE 4	ACCESS ROAD 1	ACCESS ROAD 2	ACCESS ROAD 3	
										Eskom servitudes and the SCSC boundary fence line as far as possible. **Access Road:** Alternatives 2 and 3 are preferable to alternative 1 since alternative 1 would require stream crossings which are associated with disturbances of more sensitive biodiversity areas. In addition, the 1st alternative is approximately three times the length of the 2nd and 3rd alternative.
Alteration of natural drainage patterns	1	1	1	1	1	1	2	1	1	**Smelter**: Alternative 1 and 2 are equally preferable. **Powerline:** All alternatives are equally preferable. **Access Road:** Alternatives 2 and 3 are preferable to alternative 1 since alternative 1 would require stream crossings that may result in alteration of natural drainage patterns
Contamination of surface water resources	1	1	1	1	1	1	2	1	1	**Smelter**: Both alternatives are located outside of the floodlines of relevant watercourses, and are therefore equally preferable. **Powerline:** All alternatives are equally preferable. **Access Road:** Alternatives 2 and 3 are preferable to alternative 1 since alternative 1 would require stream crossings may result in surface water resources becoming contaminated.
Contamination	1	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**Smelter:** Both alternatives are equally

CRITERIA	RELATIVE RANKING									IMPACT SUMMARY
	SMELTER AREA 1	SMELTER AREA 2	POWER LINE 1	POWER LINE 2	POWER LINE 3	POWER LINE 4	ACCESS ROAD 1	ACCESS ROAD 2	ACCESS ROAD 3	
of groundwater resources										preferable. **Powerline:** Not relevant **Access Road:** Not relevant
Reduction of groundwater levels and availability	1	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**Smelter:** Both alternatives are equally preferable. **Powerline:** Not relevant **Access Road:** Not relevant
Air pollution	1	1	1	1	1	1	2	1	3	**Smelter**: Both alternatives are equally preferable. **Powerline:** All alternatives are equally preferable. **Access Road:** Alternatives 2 is preferred to both alternatives 1 and 3, and alternative 1 is preferred to alternative 3. This is due to the proximity of alternative 3 to the farmstead and farm worker residence on portion 9 of Kameelhoek, and the proximity of alternative 1 to Anglo's Tiramogo Lodge.
Noise pollution	1	1	1	1	1	1	2	1	3	**Smelter:** Both alternatives are equally preferable. **Powerline:** All alternatives are equally preferable. Noise related impacts associated with the powerline are relevant during the construction phase only.

CRITERIA	RELATIVE RANKING									IMPACT SUMMARY
	SMELTER AREA 1	SMELTER AREA 2	POWER LINE 1	POWER LINE 2	POWER LINE 3	POWER LINE 4	ACCESS ROAD 1	ACCESS ROAD 2	ACCESS ROAD 3	
										Access Road: Alternatives 1 and 2 are preferable to alternative 3 since alternative 3 is located immediately adjacent to the farmstead and farm worker residences on portion 9 of Kameelhoek. Alternative 2 is furthermore preferred to alternative 1 due to the proximity of alternative 1 to Anglo's Tiramogo Lodge.
Blasting impacts	1	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**Smelter:** Alternative 1 and 2 are equally preferable. **Powerline:** Not relevant **Access Road:** Not relevant
Road disturbance and traffic safety	1	1	N/A	N/A	N/A	N/A	3	3	3	**Smelter:** Alternative 1 and 2 are equally preferable. **Powerline:** Not relevant **Access Road:** Alternative 2 is preferable to alternatives 1 and 3. Alternative 1 would require a road almost three times as long as alternatives 2 and 3 (a greater distance over which traffic related impacts can result) and alternative 3 is located immediately adjacent to the farmstead (and farm workers) on portion 9 of Kameelhoek. Alternative 1 is located in close proximity to receptors at Anglo's Tiramogo Lodge.
Visual impacts	1	1	1	4	2	3	2	1	3	**Smelter:** Alternative 1 and 2 are equally preferable. **Powerline:** Alternatives 1 and 3 are preferable to alternative 2 and 4 since they traverse existing Eskom servitudes and the SCSC boundary fence

CRITERIA	RELATIVE RANKING									IMPACT SUMMARY
	SMELTER AREA 1	SMELTER AREA 2	POWER LINE 1	POWER LINE 2	POWER LINE 3	POWER LINE 4	ACCESS ROAD 1	ACCESS ROAD 2	ACCESS ROAD 3	
										line as far as possible whereas alternative 2 and 4 run directly through the Anglo game farm. **Access Road:** Alternative 1 and 2 are preferred to alternative 3 given that alternative 3 runs immediately adjacent to potential visual receptors associated with the farmstead and farm worker residences on portion 9 of Kameelhoek. Alternative 2 is preferred to alternative 1 since alternative 1 runs within proximity to Anglo's Tiramogo Lodge.
Loss of heritage, palaeontological and cultural resources	1	1	1	1	1	1	1	1	1	**Smelter:** Alternative 1 and 2 are equally preferable. **Powerline:** All alternatives are equally preferable **Access Road:** All alternatives are equally preferable
Inward migration	1	1	1	1	1	1	1	1	1	**Smelter:** Alternative 1 and 2 are equally preferable. **Powerline:** All alternatives are equally preferable **Access Road:** All alternatives are equally preferable
Economic impact	1	1	1	1	1	1	1	1	1	**Smelter:** Alternative 1 and 2 are equally preferable. **Powerline:** All alternatives are equally preferable

CRITERIA	RELATIVE RANKING									IMPACT SUMMARY
	SMELTER AREA 1	SMELTER AREA 2	POWER LINE 1	POWER LINE 2	POWER LINE 3	POWER LINE 4	ACCESS ROAD 1	ACCESS ROAD 2	ACCESS ROAD 3	
										Access Road: All alternatives are equally preferable
Land use impact	1	2	1	4	2	3	2	1	3	**Smelter:** Alternative 1 is preferable to alternative 2. Alternative 1 is located within SCSC owned property and would not require the displacement/disruption of existing land uses, whereas alternative 2 is located within third party land where cropping activities which currently take place would be displaced. **Powerline:** Alternatives 1 and 3 are preferable to alternative 2 and 4 since they traverse existing Eskom servitudes and the SCSC boundary fence line as far as possible (and would therefore not result in any loss in land use) whereas alternative 2 and 4 run directly through the Anglo game farm. **Access Road:** Alternative 1 and 2 are preferred to alternative 3 since alternative 3 passes immediately adjacent to existing land uses on portion 9 of Kameelhoek and a section of this road is also associated with a potential future mining land use.
TOTAL	**19**	20	**14**	26	18	22	28	**18**	28	**Smelter:** Alternative 1 is the overall preferred alternative. **Powerline:** Alternative 1 is the preferred overall alternative **Access Road:** Alternative 2 is the preferred overall alternative.

CRITERIA	RELATIVE RANKING									IMPACT SUMMARY
	SMELTER AREA 1	SMELTER AREA 2	POWER LINE 1	POWER LINE 2	POWER LINE 3	POWER LINE 4	ACCESS ROAD 1	ACCESS ROAD 2	ACCESS ROAD 3	

10.6 OTHER TECHNICAL ALTERNATIVES

WATER SUPPLY ALTERNATIVES

SCSC is currently planning to secure water (for process and potable water requirements) from the municipal supply scheme. It is anticipated that a combined total (potable and process water) of 219 m^3 will be required on a daily basis in the dry season in particular. As a preference, process water will be treated and re-used within the processing circuit so as to limit the total demand from the municipal supply scheme. This will be particularly relevant in the wet season when the project will have excess water (see Figure 8) for use within the process. In the event that the municipal sewage plant is not operational and SCSC treats sewage within its own on site sewage treatment plant, treated sewage effluent may also be used as process water, thereby further reducing the total demand from the municipal supply scheme.

In addition, SCSC is investigating the use of water from an on-site borehole in case of emergencies (i.e. when municipal supply is not available). The necessary application for abstraction of groundwater will be made as part of the WULA, as required.

SEWAGE TREATMENT/DISPOSAL ALTERNATIVES

It is expected that approximately 20 m^3 of sewage will be generated per day. Sewage will be temporarily stored on site prior to being removed by an accredited removal contractor and disposed of at the municipal sewage plant in Northam/Thabazimbi. If there is a time delay between the availability of the off-site solution (i.e. the Northam or Thabazimbi treatment plant) and the commencement of operations, then SCSC will implement its own on-site sewage treatment plant. In this regard, provision has been made to cater for the development and operation of an on-site sewage treatment facility with off-site disposal of the treated sewage sludge. Further technical information on the planned sewage treatment plant is provided in Section 4.2.2.

THE "NO-GO" ALTERNATIVE

The assessment of this option requires a comparison between the options of proceeding with the proposed project with that of not proceeding with the proposed project. Proceeding with the proposed project attracts potential economic benefits and potential negative environmental and social impacts in the unmitigated scenario in particular. With mitigation the positive benefits are maximised and the potential negative impacts are minimised (further detail on these issues is included in Section 9.Not proceeding with the proposed project leaves the status quo which means the lost opportunity for employment, taxes, foreign exchange etc. The potential for continued agriculture (albeit that the land is owned by SCSC and there is no intention to continue with agriculture) and the avoidance of the potential negative impacts in the scenario where mitigation is not successfully implemented.

FIGURE 25: SITE LAYOUT ALTERNATIVES

FIGURE 26: FINAL SITE MAP (INCLUDING ENVIRONMENTAL SENSITIVITIES AND ANY AREAS THAT SHOULD BE AVOIDED, INCLUDING BUFFERS)

11 SUMMARY OF SPECIALIST REPORT FINDINGS

The relevant specialist studies that were undertaken as part of the proposed project including the recommendations made by the specialist are as included in Section 9.1.19 and summarised in Table 64 to Table 82. The relevant specialist reports have been attached as appendices (Appendix E to Appendix T) to this EIA and EMP report.

12 ENVIRONMENTAL IMPACT STATEMENT

12.1.1 SUMMARY OF KEY FINDINGS OF THE EIA

This section provides a summary of the findings of identified and assessed potential impacts on the receiving environment in both the unmitigated and mitigated scenarios, including cumulative impacts. A summary of the potential impacts (as per Section 9.1), associated with the preferred alternatives (as per Section 10) in the unmitigated and mitigated scenarios for all project phases is included in Table 61 below.

TABLE 61: SUMMARY OF POTENTIAL IMPACTS

Section	Potential impact	Significance of the impact (the ratings are negative unless otherwise specified)	
		Unmitigated	Mitigated
Geology	Loss and sterilisation of mineral resources	H	L
Topography	Hazardous excavations and infrastructure	H	L
Soils and land capability	Loss of soil resources and land capability through contamination	H	L
	Loss of soil resources and land capability through physical disturbance	H	L
Biodiversity	Physical destruction of biodiversity	H	M
	General disturbance of biodiversity	H	L
Surface water	Contamination of surface water resources	H	L
	Alteration of natural drainage patterns	H	M (L at closure)
Groundwater	Contamination of groundwater resources	M	L
	Reduction of groundwater levels and availability	L	L
Air quality	Air pollution	H	M
Noise	Noise pollution	M	L
Blasting	Blasting impacts	M	L
Traffic	Road disturbance and traffic safety	H	M
Visual	Visual impacts	H	M (L at closure)
Heritage, palaeontological and cultural resources	Loss of heritage, palaeontological and cultural resources	M	L
Socio-economic	Economic impact	H+	H+
	Inward migration	H	M
Land use	Land use impact	H	M (L at closure)

The assessment of the proposed project presents the potential for significant negative impacts to occur (in the unmitigated scenario in particular) on the bio-physical, cultural and socio-economic environments both on the project sites and in the surrounding area. With mitigation these potential impacts can be prevented or reduced to acceptable levels.

It follows that provided the EMP is effectively implemented there is no environmental, social or economic reason why the project should not proceed.

12.1.2 FINAL SITE MAP (INCLUDING ENVIRONMENTAL SENSITIVITIES AND AREAS THAT SHOULD BE AVOIDED, INCLUDING BUFFERS)

The final preferred site layout plan (showing environmental sensitivities and areas that should be avoided, including buffers) is included in Figure 26.

12.1.3 SUMMARY OF THE POSITIVE AND NEGATIVE IMPACTS AND RISKS OF THE PROPOSED PROJECT AND IDENTIFIED ALTERNATIVES

The positive and negative impacts associated with the project and its alternatives are discussed in detail in Section 9 and Section 10 and summarised in Table 60.

13 IMPACT MANAGEMENT OBJECTIVES AND OUTCOMES FOR INCLUSION IN THE EMPR

Based on the outcome of the impact assessment and where applicable the recommendations from specialists the proposed management objectives and outcomes for inclusion into the environmental management programme are detailed in this section.

13.1 PROPOSED MANAGEMENT OBJECTIVES AND OUTCOMES FOR ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS

Specific environmental objectives to control, remedy or stop potential impacts emanating from the proposed project is provided in Table 62 below.

TABLE 62: ENVIRONMENTAL OBJECTIVES AND OUTCOMES

Aspect	Environmental objective	Outcome
Geology	To prevent unacceptable mineral sterilisation	Avoid mineral sterilisation.
Topography	To prevent physical harm to third parties and animals from potentially hazardous excavations and infrastructure	To ensure the safety of people and animals.
Soil and land capability	To prevent soil pollution and to minimise the loss of soil resources and related land capability through physical disturbance, erosion and compaction	To handle, manage and conserve soil resources to be used as part of rehabilitation and re-establishment of the pre-mining land capability.
Biodiversity	To prevent the unacceptable disturbance and loss of biodiversity and related ecosystem functionality through physical destruction and disturbance	To limit the area of disturbance as far as practically possible.
Surface water	To prevent pollution of surface water resources and related harm to surface water users (if any) and to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow	To ensure surface water quality remains within acceptable limits for both domestic and agricultural purposes. To ensure that the reduction of the volume of run-off into the downstream catchment is limited to what is necessary and that natural drainage patterns are re-established as part of rehabilitation.
Groundwater	To prevent pollution of groundwater resources and related harm to water users and to prevent losses to third party water users.	To ensure groundwater quality remains within acceptable limits for both domestic and agricultural purposes. To ensure that groundwater continues to be available to current users.
Air	To prevent air pollution health impacts	To ensure that any pollutants emitted as a result of the proposed project remains with acceptable limits.
Noise	To prevent unacceptable noise impacts	To ensure that any noise generated as a result of the proposed project remain within acceptable limits.
Visual	To limit negative visual impacts	To ensure visual views that complement

Aspect	Environmental objective	Outcome
		the surrounding environment.
Traffic	To reduce the potential for safety and vehicle related impacts on road users	To ensure that SCSC's use of public roads is done in a responsible manner.
Blasting	To minimise the potential for third party damage and/or loss	To protect third party property from proposed project-related activities, where possible. Where damage is unavoidable, to work together with the third parties to achieve a favourable outcome. To ensure public safety.
Heritage and cultural	To prevent unacceptable loss of heritage resources and related information	To protect heritage resources where possible. If disturbance is unavoidable, then mitigate impact in consultation with a specialist and the SAHRA and in line with regulatory requirements.
Socio-economic	To enhance the positive economic impacts and limit the negative economic impacts	To work together with existing structures and organisations.
Informal settlements	To limit the impacts associated with inward migration	To establish and maintain a good working relationship with surrounding communities, local authorities and land owners.
Land uses	To prevent unacceptable impacts on surrounding land uses and their economic activity	To co-exist with existing land uses To negatively impact existing land uses as little as possible.

13.1.1 IMPACTS THAT REQUIRE MONITORING PROGRAMMES

Outcomes of the environmental objectives are the implementation of monitoring programmes. Impacts that require monitoring include:

- Hazardous excavations and structures
- Physical destruction and general disturbance of biodiversity
- Pollution of surface water resources
- Contamination of groundwater
- Depletion of groundwater resources (only in the event that groundwater is abstracted for use on site)
- Increase in air pollution
- Increase in noise levels
- Blasting damage
- Traffic increase and road use

13.1.2 ACTIVITIES AND INFRASTRUCTURE

The source activities of potential impacts which require management are detailed in Section 4.1 and listed below.

- Site preparation
- Earthworks
- Civil works
- Smelter plant
- Transport systems
- Mineralised waste
- Non-mineralised waste
- Water supply, use and management
- Power supply and use
- Supporting services
- General site management
- Demolition
- Rehabilitation
- Maintenance and aftercare

13.1.3 MANAGEMENT ACTIONS

Management actions which will be conducted to control the project activities or processes which have the potential to pollute or result in environmental degradation are detailed in Section 26.

13.1.4 ROLES AND RESPONSIBILITIES

The key personnel to ensure compliance to this EMP report will be the engineering and operations manager, the environmental manager and the stakeholder engagement manager. As a minimum, these roles as they relate to the implementation of monitoring programmes and management activities will include:

- Senior Operational Manager and Environmental Department Manager:
  - Ensure that the monitoring programmes and audits are scoped and included in the annual operational budget.
  - Identify and appoint appropriately qualified specialists/engineers to undertake the programmes.
  - Appoint specialists in a timeously manner to ensure work can be carried out to acceptable standards.
- Stakeholder engagement department:
  - Liaise with the relevant structures in terms of the commitments in the EMP.
  - Ensure that commitments in the EMP are developed and implemented timeously.
  - Establish and maintain good working relations with surrounding communities and landowners.
  - Facilitate stakeholder communication, information sharing and grievance mechanism.

14 ASPECTS FOR INCLUSION AS CONDITIONS OF THE AUTHORISATION

Management measures including monitoring requirements as outlined in Sections 26 and 27 need to form part of the conditions of the environmental authorisation. With reference to Section 26 of GN.982 of NEMA, additional conditions that need to form part of the environmental authorisation that are not specifically included in the EIA and EMP report include the following:

- SCSC will comply with all applicable environmental legislation whether specifically mentioned in this document or not and which may be amended from time to time.

15 ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

Assumptions, uncertainties and limitations associated with the proposed project are included below.

15.1 ENVIRONMENTAL ASSESSMENT LIMIT

The EIA and EMP focused on third parties only and did not assess health and safety impacts on workers because the assumption was made that these aspects are separately regulated by health and safety legislation, policies and standards, and that SCSC will adhere to these.

15.2 PREDICTIVE MODELS IN GENERAL

All predictive models are only as accurate as the input data provided to the modellers. If any of the input data is found to be inaccurate or is not applicable because of project design changes that occur over time, then the model predictions will be less accurate.

15.3 TOPOGRAPHY

None.

15.4 CLIMATE

None.

15.5 SOILS AND LAND CAPABILITY

The assumptions and limitations were made as part of the soils and land capability study include the following (Terra Africa, March 2016):

The following assumptions were made during the assessment and reporting phases:

- Soil profiles were observed using a 1.5 m hand-held soil auger. A description of the soil characteristics deeper than 1.5 m cannot be given.

15.6 BIODIVERSITY

The assumptions and limitation that were made as part of the biodiversity impact assessment include the following (SAS, August 2015):

- The ecological assessment is confined to the site alternatives area and does not include the neighbouring and adjacent properties; these were however considered as part of the desktop assessment.

- Due to the nature and habits of most faunal taxa it is unlikely that all species would have been observed during a site assessment of limited duration. Therefore, site observations are compared with literature studies where necessary.
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most faunal and floral communities have been accurately assessed and considered.
- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa on the subject property may therefore been missed during the assessment.
- The riparian wetland delineation as presented in this report is regarded as a best estimate of the wetland/ riparian boundary based on the site condition present at the time of the assessment and limitations in the accuracy of the delineation due to anthropogenic disturbances are deemed possible.
- Wetland/ riparian and terrestrial areas form transitional areas where an ecotone is formed as vegetation species change from terrestrial species to facultative and obligate wetland species. Within the transition zone some variation of opinion on the wetland boundary may occur, however if the Department of Water Affairs2 (DWA, 2008) method is followed, all assessors should get largely similar results.
- Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required the subject property will need to be surveyed and pegged according to surveying principles.
- Field assessments were undertaken during April 2015 (rainy season) and August 2015 (dry season) to determine the ecological status of the subject property and the surrounding area. This is considered to be suitable times of year to conduct ecological assessment within this region due to favourable habitat conditions and this timeframe also still allowing the majority of floral species to be accurately identified. Although considered sufficient, a more accurate assessment would require that assessments take place in all seasons of the year.
- **Ecological conditions at the time of assessment:** At the time of assessment the several aquatic systems lacked flowing water and consisted of shallow still pools at the time of the assessment. This will greatly limit the aquatic macro-invertebrate community diversity and sensitivity expected at the sites;
- **Reference conditions are unknown:** The composition of aquatic biota in the Brakspruit area, prior to major disturbance, is unknown. For this reason, reference conditions are hypothetical, and are based on professional judgement and/or inferred from limited data available. It is however deemed essential that an aquatic biomonitoring program be implemented to define the seasonal community composition of the aquatic resources.

- Temporal variability: The data presented in this report are based on a single assessment performed in April 2015. No analyses of temporal trends are therefore currently possible; and
- **Ecological assessment timing:** Aquatic ecosystems are dynamic and complex. It is possible that aspectscould have been overlooked. A more reliable assessment of the biota would require routine seasonal sampling, with sampling being undertaken on a minimum of a six-monthly basis to cover seasonal variability.

15.7 SURFACE WATER

The flood modelling assumes the following (SLR, September 2016):

- That the topographic data provided was of a sufficient accuracy to enable hydraulic modelling at a suitable level of detail.
- There would be no significant attenuation or storage of floodwater within the farms dams in the vicinity of the project.
- The peak flow estimates adopted from Section 3 for the modelled events are realistic;
- The Manning's 'n' values used are considered suitable for both the 1:50 year and 1:100 events modelled.
- Steady state hydraulic modelling was undertaken, which assumes the flow is continuous at the peak rate.
- A mixed flow regime which is tailored to both subcritical and supercritical flows was selected for running of the steady state model.
- No flood protection infrastructure was modelled because this was not deemed necessary given that none of the smelter complex insfrastructure is located within the 1:100yr floodline and all powerline related road crossings will make use of existing gravel road crossings.
- The modelling of the adopted flow through the respective hydraulic structures was undertaken, whilst assuming no blockages were present.
- No abstractions from the river section or discharges into the river section were taken into account during the modelling.

Given that there are no flow gauging stations on the Brakspruit, the two nearest gauging stations are:

- A2H103: on the Bierspruit River at the outfall from Bierspruit Dam (4 km west of the project area). This gauging station was operational from 1961 - 1973.
- A2H108: on the Crocodile River (35 km north of the project area). This gauging station has been operational since 1965 and has a catchment area of approximately 2 500km^2 upstream of the gauging station.

Neither of the above gauging stations are considered useful for estimating peak flows for the Brakspruit tributary because Bierspruit Dam will significantly attenuate peak flows, and the catchment area of the Crocodile River is 125 times larger than the Brakspruit tributary. For further detail on the flow peak methods used, refer to the surface water study included in Appendix G.

In this regard, HEC-RAS 4.1 was used for the purposes of modelling the flooding resulting from a 1:50 year and 1:100 year flood event. HEC-RAS is a hydraulic programme used to perform one-dimensional hydraulic calculations for a range of applications, from a single watercourse to a full network of natural or constructed channels. The software is used worldwide and has consequently been thoroughly tested through numerous case studies. HEC-GeoRAS is an extension of HEC-RAS which utilises the ArcGIS environment. The HEC-GeoRAS extension is used to extract the cross-sections and river profiles from a Digital Elevation Model (DEM) for export into HEC-RAS for modelling and is used again to project the modelled flood levels back onto the DEM to generate flood-lines associated with the modelled events. For further details on the numerical hydraulic modelling programme and parameters used within the model, refer to the surface water study included in Appendix G.

The water balance assumes the following (SLR, September 2016):

- The water balance is steady state and no consideration is given to changes in flows associated with varying rainfall, production rates, or storage (e.g. start up water).
- Infrastructure is fully developed and operational, no consideration is given to changes in flows resulting from progressive development of infrastructure or changes in production rate.
- Rainfall related inflows and evaporation related losses for the wet and dry season scenarios were estimated based on: i) average values during the three driest months of the year; and ii) average values during the three wettest months of the year.
- Runoff and evaporation coefficients for each surface were fixed and not influenced by antecedent climatic conditions.
- All catchment areas are constant.
- Evaporation from the PWD and PCD would only occur if there was water in the dam.
- This water balance model is run for only steady state average wet season and average dry season conditions and no consideration is given to transient climate or storage of water between seasons i.e. flow in = flow out.

A critical component in sizing of PCDs in accordance with GN 704 is the rate at which water will be pumped from the dam for re-use within the plant (i.e. as process water). As part of the detailed design which will be undertaken in support of the WULA, the PCD volume and pump-out rate will be checked using a daily time step water balance model to ensure compliance with GN 704.

Discounting any storage in the Union Section Mine RWD below the spillway is considered to be a conservative approach but little can be done to improve upon this assumption without a more detailed water balance model being undertaken on the Union Section Mine itself and it is not considered necessary to undertake any further work to improve upon the peak flow estimates presented above.

15.8 GROUNDWATER

The assumptions and limitations that were made as part of the groundwater assessment (SLR, September 2016) are listed below.

- The groundwater model suggested that water abstraction from borehole SIY-BH02S will not have impact on the groundwater regime, however If additional boreholes are to be drilled and used for groundwater abstraction, then an update of the groundwater model will be run to include the new boreholes.
- All facilities were considered as being lined with a Class C liner; this presents a worst case scenario
- and the actual impacts are associated to be even less significant than what has been assessed given
- that the liner will be designed according to a higher/more stringent design specifications.
- The life of facilities is assumed to be 20 years. If through waste minimisation efforts the life of the facilities are extended the groundwater model should be updated at that point.
- The source concentration estimation for the PCD facility is an overestimation. The scenario simulated therefore represents a worst case scenario.

15.9 GEOCHEMISTRY

The following assumptions were made as part of the geochemistry assessment (SLR, August 2016) undertaken for the proposed project:

- Slag samples from the project specific pilot plant are assumed to represent the actual slag.
- Baghouse dust sample (from a similar smelter operation) tested as part of this assessment is considered to be a proxy sample which gives a good indication of the expected waste characteristics.

15.10 AIR QUALITY

The assumptions and limitations that were made as part of the air quality impact assessment include the following (Airshed, September 2016):

- All project information required to calculate emissions for proposed operations was provided by the technical project team.

- The impact of the construction and operational phases were determined quantitatively through emissions calculation and simulation. Decommissioning phase impacts are expected to be similar or somewhat less significant that construction phase impacts. Mitigation and management measures recommended for the construction and operational phases are however also applicable to the decommissioning phase. No impacts are expected post-closure provided the rehabilitation of final land forms is successful.
- Meteorology:
  - In the absence of on-site or nearby South African Weather Service (SAWS) meteorological data, use was made of data simulated data (MM5). The MM5 (short for Fifth-Generation Penn State/NCAR Mesoscale Model) is a regional mesoscale model used for creating weather forecasts and climate projections. It is a community model maintained by Penn State University and the National Centre for Atmospheric Research (NCAR).
  - The National Code of Practice for Air Dispersion Modelling prescribes the use of a minimum of 1-year on-site data or at least three years of appropriate off-site data for use in Level 2 assessments. It also states that the meteorological data must be for a period no older than five years to the year of assessment. The MM5 data set applied in this study complies with the requirements of the code of practice.
- The estimation of greenhouse gas (GHG) emissions was not included in the scope of work but reference made to draft GHG emission reporting regulations for reference purposes.
- Dust fallout, $PM_{2.5}$, PM_{10}, NO_x, SO_2 and VOCs are presently sampled in the project area.
- Emissions:
  - The impact assessment was limited to airborne particulates (including TSP, $PM_{10,}$ $PM_{2.5}$, Cr^{6+} and DPM) and gaseous pollutants from vehicle exhausts, including CO, NO_x, VOCs and SO_2. These pollutants are either regulated under MES, NAAQS or considered a key pollutant released by FeCr industries.
  - The quantification of sources of emission was restricted to the proposed Project. Although other existing sources of emission within the area were identified, such sources were not quantified as part of the emissions inventory and simulations. Their impact is however considered by ambient air quality monitoring currently under way.
  - In the absence of a detailed construction plan, construction phase fugitive dust emission had to be estimated over an area wide basis and several assumptions had to be made. The confidence rating of these emissions are therefore low in comparison with operational phase emissions. Assumptions included a) 25% of the project footprint area would be under construction at any given time; and b) 35% of PM released would be in the 10 µm size fraction and 18% in the 2.5 µm fraction

- Where site/project specific particle size, moisture and silt content data were not available, use was made of default values published as part of the US EPA or ADE emission estimation manuals.
- In the estimation of windblown dust emissions use was made of the ADE NPI emission factor, conservatively assuming emissions would occur continuously instead of only during high wind speed incidences.
- Vehicle exhaust emissions were conservatively estimated using emission factors published by the ADE. These have been found to be comparable to pre-Euro vehicle emission standards.
- Although not specifically modelled, the option of pre-heating is not likely to alter the conclusions of this study. As indicated, CO rich cleaned furnace off-gas may be used as the energy source for the GSPH installation. Cleaned CO gas is ducted to a combustion chamber, where it is burned, together with atmospheric air, and fed into the GSPH. It is expected that combustion off-gas will be emitted through a separate, dedicated stack. The same pollutants are likely to be released irrespective of whether the cleaned off-gas is combusted in the clean gas flare or the combustion chamber of the pre-heater. PM and SO_2 emission rates are expected to remain similar. Whereas NO_x and Cr^{6+} emissions may differ due to different combustion temperatures, CO and VOC emissions may differ due to different combustion efficiencies.
- It was conservatively assumed that all NO_x emitted from stacks were assumed to be emitted as NO_2.

- NO2 emissions and impacts:
  - Nitrogen monoxide (NO) emissions are rapidly converted in the atmosphere into NO_2. NO_2 impacts where calculated by AERMOD using the ozone limiting method assuming constant monthly average background ozone concentrations of 30 ppb (Zunckel, et al., 2004) and a NO_2/NO_x emission ratio of 0.2 (Howard, 1988).
- Cr6+ emissions and impacts:
  - Closed DC furnaces operate under reducing conditions and chromium contained in furnace off-gas would primarily be in the trivalent state (Cr3+). However, the combustion or reaction of CO rich furnace off-gas may result in the formation $Cr^{6+.}$
  - Data on the formation of Cr^{6+} throughout the entire FeCr production process is limited, but emissions from the flare and tapping could be estimated based on research conducted by du Preez et al (2015) and Ma (2005).
  - The calculation of Cr6+ emissions from the flare was based on the assumption that (a) the chrome content in the particles in the off-gas is the same as the chrome content in the ore (~30%); (b) all the chrome in contained in the off-gas before flaring is in the trivalent form i.e. Cr3+; and (c) the amount of Cr^{3+} converted to Cr^{6+} is between 0.027% and 0.35% (du Preez, Beukes, & van Zyl, 2015).

- The calculation of Cr6+ emissions from tapping was based on the assumption that (a) the chrome content in the particles in the off-gas is the same as the chrome content in the ore (~30%); and (b) the amount of Cr^{6+} as PM_{10} is similar to what is found in open furnace baghouse dust i.e. between 0.035% and 0.122% (Ma, 2005).
- It was conservatively assumed that all Cr^{6+} emitted would be in the PM_{10} (thoracic) size fraction.
- It was conservatively assumed that all forms of Cr^{6+} were carcinogenic. Known carcinogenic Cr^{6+} compounds include chromium trioxide, lead chromate, strontium chromate and zinc chromate.
- In estimating increased health risk, use was made of simulated annual average Cr^{6+} concentrations. This approach is conservative since it assumes an individual will be exposed to this concentration constantly over a period of 70 years.
- The range in health unit risk factors (URF) for exposure to Cr^{6+} is evidence of uncertainty related to increased lifetime health risk associated with this pollutant. In this regard, use was made of both the US EPA Integrated Risk Information System URF of 0.012 (µg/m3)-1 (the lower limit) and the World Health Organisation (WHO) URF of 0.04 (µg/m3)-1 (the geometric mean).

15.11 NOISE

The assumptions and limitations that were made as part of the noise impact assessment include the following (Airshed, August 2016):

- Screening effects of buildings such as offices/warehouses/stores etc. was not accounted for in simulations.
- The quantification of sources of noise was restricted to activities associated with the Siyanda FeCr Project.
- All project information required to calculate noise impacts were provided by the technical project team.
- Routine noise impacts from smelter operations were estimated and modelled.
- In the absence of on-site meteorological data, use was made of simulated data for Northam.
- Construction and decommissioning phase impacts were assumed to be similar/slightly less significant than operational phase impacts.
- There will be no noise impacts during the closure phase.

15.12 VISUAL ASPECTS

The assumptions and limitations that were made as part of the visual impact assessment include the following (NLA, August 2016):

- The study uses the worst case scenario in predicting impacts (day time and night time);

- The viewshed analyses considered only the topography of the area and did not factor in any features such as existing trees and other obstacles. This means that the spatial patterns generated in the analyses are inclined towards the worst case-scenario rather than the actual situation;
- The extent of the study area is determined by the zone of potential influence, which in this study relates to a radius about the project site of 12 km. At 12 km and beyond the Project would recede into background views.
- The computer model for the 3D depiction of the project components is based on CAD information provided to NLA by the project engineers.
- Only the alternatives provided to the specialist by the project team were considered for the plant and associated infrastructure, access road and the 275 kV powerline.

15.13 BLASTING

The assumptions that were made as part of the blasting assessment include the following:

- Should blasting be required it will be undertaken to a limited extent during site preparation (construction phase only).

15.14 HERITAGE/ CULTURAL AND PALAEONTOLOGICAL RESOURCES

The assumptions and limitations that were made as part of the heritage impact assessment and paleontological impact assessment include the following (Julius Pistorius cc, August 2016) (Bruce Rubidge, December 2015):

- Although due consideration was given to the observing and documenting of all heritage resources in the project area, some resources may not have been detected due to various reasons (occurring beneath the surface, unmarked, inconspicuous or eroded nature, covered by vegetation, human failure to recognise, etc.).
- This palaeontological assessment report is based on a desktop study combining the use of geological maps and background knowledge of the stratigraphic occurrence of fossils.

15.15 SOCIAL IMPACT ASSESSMENT (SIA)

The assumptions and limitations that were made as part of the social impact assessment and include the following (Synergistics, August 2016):

- It is anticipated that social impacts will be incurred during the construction, operational anddecommissioning/ closure phases of the project.
- The SIA assumes that all mitigation measures defined in the economic, noise, air quality, visual andtraffic impact assessments will be implemented by SCSC.

It was assumed that information provided by SCSC and SLR EIA team was accurate and that thetechnical specifications of the Project and site selection are in accordance with the relevant requirements.

- This SIA and assessment is dependent on the accuracy of the publicly available secondary information; such as Statistics South Africa (StatsSA, 2011). Where possible, the information was verified during a site visit. The data was considered sufficient for the purpose of this study.
- The opinions expressed during the public participation process were sourced from the members of the public who attended the meetings or through written comment. These opinions can therefore not be taken to represent the views of all the community members who are based around the project area.
- The local context assessment is limited to communities within 10km from the proposed project location, which includes wards 5, 7 and 8 of TLM in the LP and wards 5 and 7 of the MKLM in the North West Province (NWP).
- The social environment constantly changes and adapts to change. It is therefore difficult to predict impacts to a high level of accuracy.

15.16 ECONOMIC LAND USE

The following assumptions and limitations apply to the economic impact assessment (Mercury Financial Consultants, August 2016):

- Land value figures were based on valuators from Standard Bank and estate agents. These figures are estimated guidelines only.
- No environmental buffer zone was applied in any of the calculations as it is recommended that a professional property evaluation exercise be undertaken before construction activities commences.
- The entire portion 3 of the farm Grootkuil, which constitutes an area of 626 ha was assumed to be impacted upon, even though the total footprint of disturbance on portion 3 of the farm Grootkuil for the surface infrastructure is estimated at approximately 140 ha. For this purposes, an area of 626 ha was used to calculate the agricultural yield arising from cattle and sunflower farming practices to determine the respective economic contributions. This makes for a conservative worst case outcome.
- As mentioned the entire farm area was used in the calculations, it is highly unlikely that the entire 626 ha will be planted with sunflower. This however represents the best-case scenario from an alternative land use perspective.
- For the purposes of determining the agricultural yield from cattle farming ,a calf ratio of 80% and a cattle price of R5000 per calf were assumed. These figures were obtained from commercial farmers in the region.
- Due to the complexity of stud breeding, only commercial cattle prices were used. Stud cattle could easily fetch in excess of the R5000 per calf used in the calculations used in this report.

- Labour calculations was based on two furnaces and excluded spend on contracted labour
- Project life equates to 32 years, which includes 2 years of construction and an operational life of 30 years. This assumes that additional waste disposal capacity of at least 10 years will be secured either by limiting the requirement to dispose waste to land (re-use, sale) or by developing additional capacity.
- A discount factor of 6% as advised by the client was used to calculate the net present value calculations.
- The information supplied in relation to employment opportunities, income generation, life of operation, etc. by the client is an accurate reflection of the activities during construction, operational and closure phases of the proposed project.
- Information which was used in some of the agricultural calculations were sourced from third parties.
- This economic evaluation was predominantly based on revenue generated and employment contributions. The assessment did not take profitablility into account.
- This assessment did not provide for a geographical allocation of the capital expenditure and operational expenditure. At this stage is it almost impossible to determine what proportions of money will be spent locally, regionally and nationally. Mitigation measures were included to optimise local procurement spend.

15.17 TRAFFIC IMPACT ASSESSMENT

Assumptions relevant to the traffic impact assessment include (Siyazi, February 2016):

- The anticipated average rate of growth will be included as background traffic for the respective road sections at 3% per annum;
- The relevant manual traffic counts were conducted August 2014 and it was anticipated that vehicle traffic volumes grew at the last mentioned rate up to the timeframes for which the Traffic Impact Assessment was prepared; and
- That the absorption rate by all other types of completed developments will maintain the same status for the next ten years.

15.18 ENGINEERING DESIGN OF MINERALISED WASTE FACILITIES

Assumptions relevant to the engineering design include (SLR, September 2016)

- It will be possible to practically insulate the slag dump lining system to protect it from the molten slag. Thermal modelling has confirmed the exact requirements.
- The assumed permeability of the molten slag has conservatively been based on the expectation that the slag will crack significantly and result in a “waste rock-type” surface.

- The current conservative approach has assumed that all slurry will be placed in bags. SLR is optimistic that it will be able to reduce the number of bags by “constructing” embankments using the slurry filled bags and then depositing into the middle of the facility like a traditional tailings storage facility. This will be investigated further in future design phases.
- The exact geosynthetic grading of the bags has been assumed and will need to be confirmed.
- No flocculent is required, although that may change with further test work.
- No geo-grids for stabilising layers within the baghouse slurry facility are required.

15.19 CLOSURE PLAN

The closure plan for the proposed project was based on the following assumptions (SLR, September 2016):

- The smelter will follow and adhere to the commitments made in the EIA/EMP report.
- The smelter will follow the operational plan by designing and structuring the layout to minimise the potential for disturbance of previously undisturbed areas.
- The volume of stockpiled topsoil that has been stripped from infrastructure areas will be sufficient for closure activities.
- Runoff water quality from rehabilitated areas will be acceptable and will not require any further treatment.
- Inert building and demolition rubble can be safely disposed and buried on site.
- Hazardous material can be safely disposed of off-site at an appropriately licensed facility.
- Details and recommendations regarding a social closure plan have not been considered.
- No extra mineralised waste facilities other than those discussed in this report will be needed during the operational life of the smelter.
- Final metals analyses of the soils on site should indicate similar metals content to that existing before construction.

Assumptions will be reviewed during the ongoing operations of the proposed smelter and any required technical work conducted in order to reduce information gaps and uncertainty prior to final closure.

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

16.1.1 REASONS WHY THE ACTIVITY SHOULD BE AUTHORISED OR NOT

The assessment of the proposed project presents the potential for significant negative impacts to occur (in the unmitigated scenario in particular) on the bio-physical, cultural and socio-economic environments both in the site alternatives area and in the surrounding area. With mitigation these potential impacts can be prevented or reduced to acceptable levels. It follows that provided the EMP is effectively implemented there is no environmental, social or economic reason why the project should not proceed.

16.1.2 CONDITIONS THAT MUST BE INCLUDED IN THE AUTHORISATION

16.1.2.1 Specific conditions for inclusion in the EMPR

Refer to Section 14.

17 PERIOD FOR WHICH AUTHORISATION IS REQUIRED

The life of the project is expected to be approximately 30 years.

18 UNDERTAKING

I, Caitlin Hird, 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 has been included;
- Inputs and recommendations from the specialist reports have been included where relevant.
- 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.

Signature of EAP	Date
Signature of commissioner of oath	Date

19 PROVISION FOR REHABILITATION AND CLOSURE

19.1 PLANNING FOR THE REHABILITATION, CLOSURE, AND ON-GOING POST DECOMMISSIONING MANAGEMENT OF NEGATIVE ENVIRONMENTAL IMPACTS

The project believes in proactive and progressive rehabilitation throughout the life of the project where possible and in this regard a preliminary closure plan has been included in Appendix T. This closure plan which provides the objectives for closure, the plan for rehabilitation and key performance indicators thereof will need to be reviewed and updated and re-submitted prior to the decommissioning phase.

The closure objectives for the proposed project including how the objective will align with the current baseline environment and includes the following:

- To maintain a relatively flat topography or a topography that emulates the existing ground lines.
- To maintain a functioning ecosystem.
- Moderate groundwater quality.
- Stable water table providing groundwater as a water supply source for domestic and livestock watering.
- Environmental damage is minimised to the extent that it is acceptable to all parties involved.
- The land is rehabilitated to achieve a condition approximating its natural state, or so that the envisaged end use of arable land and wilderness is achieved.
- All surface infrastructure will be removed from site after rehabilitation (with the exception of the slag dump and baghouse slurry facility which will be rehabilitated and will remain in perpetuity if no third party market for mineralised waste can be secured). This rehabilitation will include appropriate covering of the waste facilities according to best practice.
- Contamination beyond the smelter site by surface water run-off, groundwater movement and wind will be prevented. This will be achieved through post-closure monitoring as outlined in Section 27.
- Project closure is achieved efficiently, cost effectively and in compliance with the law.
- The social impacts resulting from closure are managed in such a way that negative socio-economic impacts are minimised.

Additional and more specific closure objectives may be tied to the final land use for the proposed project area, and these will be determined in collaboration with local communities and other stakeholders during the on-going operations of the proposed smelter. The closure plan will be refined and updated and submitted to the DEA prior to decommissioning.

20 DEVIATIONS FROM SCOPING REPORT AND APPROVED PLAN OF STUDY

20.1.1 DEVIATION FROM THE METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS

No deviations in terms of the methodology used to determine the significance of potential environmental impacts and risks were made as per the approved plan of study in the scoping report, and the EIA/EMP report has addressed the terms of reference as set out in the final scoping report.

It should however be noted that subsequent to the submission of the scoping report it was determined that 24P of NEMA does not apply and the associated financial provision commitments are therefore not relevant. Notwithstanding this, a closure plan has been compiled in accordance with the requirements of Appendix 5 of NEMA and the requirements of Equator Principles and has been included as Appendix T.

20.1.2 MOTIVATIONS FOR DEVIATION

Not applicable.

21 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

Specific information as requested by the DEA in the Scoping Acceptance letter dated 14 Septemeber is summarised in Table 63 below. Where relevant the reader is referred to the section of the report where this information can be found.

TABLE 63: ADDITIONAL INFORMATION AS REQUESTED BY THE DEA IN CORRESPONDENCE DATED 14 SEPTEMBER 2016

Information required	Reference in the EIA/EMP report
a) The geology of the area.	Section 8.1.1
b) Hydrogeology on site, structural features such as lakes, etc	Section 8.1.7, 8.1.8 and Appendix H
c) Historical groundwater monitoring data if available	Historical monitoring data not available. Baseline monitoring data included in Section 8.1.8 and Appendix H
d) Current groundwater quality on site	Section 8.1.8 and Appendix H
e) A groundwater monitoring plan in terms of quality and quantity	Section 27 and Appendix H
f) A stormwater management plan	Section 4.2.2 and Appendix G
g) Specialist studies as outlined in the final scoping report, dated July 2016, including Visual Impact Assessment study and Surface water risk assessment study	Appendix E to Appendix T
h) Groundwater risk assessment should include impact assessment/statement of impacts	Section 8.1.8 and Appendix H
i) Details of the contracted third party buyer of disposed mineral waste is required	The EIA and and associated specialist studies have provided for the scenario where there is no buyer (i.e. where waste has to be disposed of permanently in the provided waste facilities). SCSC is however investigating third party markets for resale/re-use of waste. If a market can be secured, the mineralised waste facilities (or part thereof) may not be fully utilised.
j) Attachment of tangible evidence for confirmation of land use application from Thabazimbi Local Municipality is required if available	Initial correspondence with the municipality regarding land use re-zoning has been included in Appendix D. The formal land use re-zoning process will be undertaken at a later stage in the environmental permitting process.
k) Details of the hazardous waste contractors to handle and transport waste generated in the facility are required	Initial correspondence with the hazardous waste contractor regarding the removal of hazardous waste is included in Appendix D. A formal waste contract agreement will be concluded prior to construction.
l) A construction and operational phase EMPr to include mitigation and monitoring measures	The EMP includes mitigation and monitoring measures for both the construction and operational phases. See specifically Table 64 to Table 82 and Section 27.
m) A description of all site alternatives, including the size/area of each site, and GPS coordinates	Section 10, Figure 2 and Figure 25
n) A description of all road route alternatives, including the length and GPS coordinates for the start, middle and end points	Section 10, Figure 2 and Figure 25

Information required	Reference in the EIA/EMP report
o) A description of all power line route alternatives, including the length of each route, and GPS coordinates for the start, middle and end points	Section 10, Figure 2 and Figure 25
p) A description of the railway siding which will join onto the main Union Section railway line, including its length, and GPS coordinates for the start, middle and end points.	Section 4.2.2 and Figure 25
q) Information on services required on the site, e.g. sewage, refuse removal and water supply. Who will supply these services and has as agreement and confirmation of capacity been obtained	Information on services to be supplied is included in Section 4.2. Initial correspondence with service providers is included in Appendix D and formal contracts agreement will be concluded prior to construction.
r) Should a water use license be required, proof of application for a license needs to be submitted	The WULA will be submitted when further technical and detailed design information is available. SLR (on behalf of SCSC) has submitted a letter of intent to DWS outlining SCSC's intention to lodge a WULA. This letter of intent has been included in Appendix D.
s) Activity 15 of GN R. 984: Please remove this activity as clearance of indigenous vegetation for linear activities is excluded, and only 7ha of indigenous vegetation will need to be cleared for the proposed smelter complex development infrastructure. The correct activity for the actitivity description is Activity 27 of GN R. 983, which has already been applied for	This activity has been removed from Table 3 and the NEMA NEM:WA application has been updated accordingly. It is noted that the relevant activity (as already included in the application is Activity 27 of GN R. 983)
t) Please ensure that thresholds for all activities applied are determined in the EIAr, that only the applicable activities are applied for, and the activity descriptions amended accordingly, as Appendix 3 (1) (2) of the 2014 EIA Regulations cannot be determined if the thresholds are indefinite (by how much do the thresholds of the proposed development exceed those of each listed activity?)	This list of activities being applied for has been refined (both in Table 3 as well as in the NEMA NEM:WA application included in Appendix D).
Air Quality Management	
u) The following Section 21 listed activities are triggered by the proposed development and mitigation measures must be addressed: • Subcategory 4.20: Slag processing • Subcategory 8.1: Thermal treatment of hazardous and general waste • Any additional listed activity which may arise in the near future	It is understood (and agreed in correspondence between SLR and DEA) that subcategory 4.20 and 8.1 are not relevant for the proposed project however subcategory 4.9 is relevant and should be included.
v) Reference must be made to emission concentrations as stipulated in the minimum emission standard.	The air quality specialist study has been compiled in accordance with the relevant legislation as stipulated by the DEA. See Appendix I for the air quality specialist report.
w) Suitable abatement technology to be used for point source emissions must be considered and detailed in terms of availability and control efficient. The Department also encourages cleaner technology where necessary. Dispersion modelling to be used must be in terms of section 53(f) of the National Environmental Management: Air Quality Act, (Act No. 39 of 2004), Regulations Regarding Air Dispersion Modelling, 11 July 2014, 2014 GN No R.533	
x) Air quality specialist studies as indicated in the FSR dated July 2016, must take into account all relevant specialist arrangements with regards to each Section 21 triggered activity	
y) Compliance road map with provincial and national regulation on the following:	

Information required	Reference in the EIA/EMP report
• Control of dust in terms of section 32(a), (b) and (c) of the National Environmental Management: Air Quality Act, (Act No 39 of 2004).	
z) Compliance road map on the design and operation of the waste recovery, benefication and energy project with the minimum emission standard as listed under the above-mentioned subcategories	It is understood (and agreed in correspondence between SLR and DEA) that subcategory 4.20 and 8.1 are not relevant for the proposed project however subcategory 4.9 is relevant and should be included. .
aa) Emission inventory study: the facility must provide the methodology and how the inventory was calculated. All the assumption and basis for the calculations must be clearly stated;	See Appendix I
bb) Emission control Technology: The facility must detail and commit the expected abatement equipment performance and this must include the equipment efficiency, equipment availability and the expected emission concentration in mg/Nm^3 (under normal conditions of 273K, 101.3kPa, dry gas, 10% oxygen) for all pollutants listed in terms of Section 21 of NEM: AQA (Act 39 of 2004) listed activities. Furthermore, the facility must elaborate how they will achieve the exit of 200°C, given the high incinerator operating temperature	It is understood (and agreed in correspondence between SLR and DEA) that subcategory 4.20 and 8.1 are not relevant for the proposed project however subcategory 4.9 is relevant and should be included.
cc) Fugitive emission management plan: subcategory 4.20 of section 21 of NEM:AQA (Act 39 of 2004) states that best practise measures intended to minimise or avoid offensive odours must be implemented by all installations. The proposed facility must provide the authority with odour management plan, measures and technology to be installed to control offensive odour	
dd) Emissions Monitoring Plan: Subcategory 8.1 of the listed activity from section 21 of NEM: AQA (39 of 2004) requires continuous, on-line measurement of the following emissions and operating parameters: • Particulate matter (total particulate), O_2, CO, NO_x, SO_2, HCl, HF, VOC/TOC, emission exhaust volume (e,g, Nm^3/hr) and flow rate (e.g. m/s), water vapour content of exhaust gas (humidity), exhaust gas temperature, internal process temperature/s and pressure. The facility must commit and detail their monitoring plan	It is understood (and agreed in correspondence between SLR and DEA) that subcategory 4.20 and 8.1 are not relevant for the proposed project however subcategory 4.9 is relevant and should be included.
ee) In terms of the National Environmental Management: Air Quality Act (NEM:AQA), Section 36(5)(d), the National Department of Environmental Affairs would fulfil the role of the licensing authority for the Atmospheric Emissions License application. The relevant section of NEM:AQA reads as follows, S36(5)(d): Notwithstanding subsections (1) to (4), the Minister is the licensing authority and must perform the functions of the licensing authority if: (d) the listed activity relates to the activities listed in terms of section 24(2) of the National Environmental Management Act, 1998, or in terms of section 19(1) of the National Environmental Management Act, 1998, or in terms of section 19(1) of the National Environmental Management: Waste Act, 2008, or the Minister has been identified as the competent authority	The AEL will be submitted to DEA for authorisation
Should an application for Environmental Authorisation be subject to the provisions of Chapter II, Section 38 of the National Heritage Resources Act, Act 25 of 1999, then this Department will not be able to make nor issue a decision in terms of your application for Environmental Authorisation pending a letter from the pertinent heritage authority categorically stating that the application fulfils the requirements of the relevant heritage resources authority as	SAHRA has been engaged as a commenting authority.

Information required	Reference in the EIA/EMP report
described in Chapter II, Section 38(8) of the National Heritage Resources Act, Act 25 of 1999.	

22 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.

PART B – ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

23 DETAILS OF THE EAP

The details of the EAP who undertook the EIA and prepared this EMP are provided in Part A, Section 2 of the EIA report.

24 DESCRIPTION OF THE ASPECTS OF THE ACTIVITY

The activities covered by this EMP (and as described by the project description) are fully described in Part A, Section 4 of the EIA report.

25 COMPOSITE MAP

A map indicating all surface infrastructure superimposed on the environmentally sensitive areas indicating any areas that should be avoided (including buffers) is included in Figure 26.

26 ACTION PLANS TO ACHIEVE OBJECTIVES AND GOALS

A description of the impact management objectives, including management statements and outcomes, identifying the impacts and risks that need to be avoided, managed and mitigated for all phases of the project has been included in detail in Section 9.

Action plans to achieve the objectives and goals set out in Section 9, are summarised in tabular format (Table 64 to Table 82). In addition, the monitoring requirements as presented out in Section 27 are relevant.

In accordance with the requirements of Appendix 4 (Content of an EMP) of the 2014 EIA Regulations, the action plans include the following:

- Impact management actions to:
  - Avoid, modify, remedy, control or stop any action, activity or process which cases pollution or environmental degradation.
  - Comply with prescribed environmental management standards or practices.
  - Comply with impact management outcomes.
- Relevant phase (i.e. planning and design/pre-construction, construction, operation, decomissioning/rehabilitation, closure). It should be noted that the action plans required for the planning and design phases and pre-construction phases are included in the above.
- Indication of the persons who will be responsible for the implementation of impact management actions.
- Timeframes and frequency within which the impact management actions will be implemented.

Technical and management options have been identified for the following impacts presented in the action plans:

- Loss and sterilisation of mineral resources (Table 64)
- Hazardous excavations and infrastructure (Table 65)
- Loss of soil resources and land capability through pollution (Table 66)
- Loss of soil resources and land capability through physical disturbance (Table 67)
- Physical destruction of biodiversity (Table 68)
- General disturbance of biodiversity (Table 69)
- Alteration of natural drainage patters (Table 70)
- Pollution of surface water resources (Table 71)
- Reduction in groundwater levels and availability (Table 72)
- Contamination of groundwater (Table 73)
- Air pollution (Table 74)

- Noise pollution (Table 75)
- Blasting (Table 76)
- Traffic impacts (Table 77)
- Visual impacts (Table 78)
- Destruction of heritage, paleontological and cultural resources (Table 79)
- Inward migration (Table 80)
- Economic impact (Table 81)
- Land use (Table 82)

TABLE 64: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO THE LOSS AND STERILISATION OF MINERAL RESOURCES
(as summarised from Section 9.1.1)

Phase of operation	**Activities (see** Table 50)	**Impact Significance**		**Standard to be achieved (Impact management statement/outcome/objectives)**	**Technical and management actions and compliance with standards**	**Action plan**		
		UM	**M**			**Timeframe**	**Frequency**	**Responsible parties**
Planning and design/pre-construction	All activities	**H**	**L**	To avoid sterilisation of mineral resources to prevent unacceptable mineral sterilisation.	SCSC will incorporate cross discipline planning structures for infrastructure developments to avoid mineral sterilisation.	On-going	On-going	Engineering and operations manager, and environmental manager
Construction	Transport systems Mineralised waste Placement of infrastructure				Where feasible, SCSC will make provision for the re-processing of mineralised waste. The mineralised waste facilities will be designed in such a way that re-processing is possible.	On-going As required	On-going As required	Engineering and operations manager and environmental manager
Operation	Transport systems Mineralised waste Placement of infrastructure							
Decommissioning	Mineralised waste							
Rehabilitation/closure	Maintenance and aftercare of rehabilitated areas							

TABLE 65: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO HAZARDOUS EXCAVATIONS AND INFRASTRUCTURE

(as summarised from Section 9.1.2)

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Planning and design/pre-construction	All activities	H	L	To prevent physical harm to third parties and animals from potentially hazardous excavations and infrastructure.	Mineralised waste facilities will be planned/designed, constructed, operated and closed in a manner to ensure that stability and related safety risks to third parties and animals are addressed. These issues will be monitored according to a schedule that is deemed relevant to the type of facility by a professional engineer.	As required	As required	Engineering and operations manager and environmental manager
Construction	Site preparation Earthworks Civil works				During construction and operation the safety risks associated with identified hazardous excavations and infrastructure will be addressed through one or more of the following: • Fencing, berms, barriers and/or security personnel to prevent unauthorised	On-going	On-going	Engineering and operations manager and environmental manager
Operation	Smelter plant Transport systems Power supply							

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
	and use Water supply and use Mineralised waste Support services Rehabilitation				access. Warning signs in the appropriate language(s). Warning pictures are an alternative. SCSC will survey the entire project area and update its surface infrastructure map on a routine basis (as a minimum annually) to ensure that the position and extent of all potential hazardous excavations and infrastructure is known. It will furthermore ensure that appropriate management measures are taken to address the related safety risks to third parties and animals. Where SCSC has caused injury or death to third parties and/or animals, as a result of its operations, appropriate compensation will be provided.			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Support services Demolition Rehabilitation				During the decommissioning planning, provision will be made to address long term safety risks in the decommissioning and rehabilitation phases.	As required	As required	Engineering and operations manager and environmental manager
Rehabilitation/closure	Maintenance and aftercare of rehabilitated areas				At closure, the hazardous infrastructure will either have been removed or decommissioned and rehabilitated in a manner that it does not present a long term safety and/or stability risk. If no third party market can be secured for the resale of slag and baghouse dust material these facilities will remain in perpetuity and in this regard will be made safe and rehabilitated. At closure the hazardous excavations and infrastructure will be dealt with as follows: monitoring and maintenance will take place to	As required	As required	Engineering and operations manager and environmental manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					observe whether the relevant long term safety objectives have been achieved and to identify the need for additional intervention where the objectives have not been met.			

TABLE 66: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH CONTAMINATION

(as summarised from Section 9.1.3)

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Planning and design/pre-construction	All activities	H	L	To prevent soil pollution as a first priority and to remedy any pollution should it occur.	The designs of any permanent and potentially polluting structures (mineralised waste facilities) will take account of the requirements for long term soil pollution prevention, land function and confirmatory monitoring.	As required	As required	Engineering and operations manager and environmental manager
Construction	Site preparation Earthworks Civil works				In the construction, operation and decommissioning phases SCSC will ensure that all hazardous chemicals (new and used), dirty water, mineralised wastes and non-	On-going	On-going	Engineering and operations manager and environmental manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Operation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Rehabilitation				mineralised wastes are transported, handled and stored in a manner that they do not pollute soils. This will be implemented through procedure(s) covering the following: • Pollution prevention through basic infrastructure design pollution prevention through maintenance of equipment. • Pollution prevention through education and training of workers (permanent and temporary). • Pollution prevention through appropriate management of hazardous materials and wastes. • The required steps to enable fast reaction to contain and remediate pollution incidents. In this regard the remediation options include containment and in-situ treatment or disposal of contaminated soils as hazardous waste. In-situ treatment is generally considered to be the preferred option because with successful in situ remediation the soil resource will be retained in the correct place. The in-situ options include			
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Support services General site management Demolition Rehabilitation					As required	As required	Engineering and operations manager and environmental manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					bioremediation at the point of pollution, or removal of soils for washing and/or bio remediation at a designated area after which the soils are returned. During the decomissioning phase a land contamination assessment must be conducted. The data presented in Table 52 can be used as a baseline to measure any variances that may occur as a result of project related activities. SCSC will ensure that the handling and disposal of general and hazardous waste is undertaken in accordance with the waste management procedures as outlined in Table 53.			
Rehabilitation/closure	Maintenance and aftercare of rehabilitated areas				Specifications for post rehabilitation audit criteria to ascertain whether the remediation of any polluted soils and re-establishment of soil functionality has been successful and if not, to recommend and implement further measures.	As required	As required	Environmental manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					During the rehabilitation/closure phase, inspections will be undertaken to ensure that the management/mitigation actions as described above have satisfied the objectives of the closure plan as summarised in Section 19 and detailed in Appendix T.			

TABLE 67: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE

(as summarised from Section 9.1.4)

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Planning and design/pre-construction	All activities	**H**	**L**	To minimise the loss of soil resources and related land capability through physical disturbance, erosion and compaction.	In the planning, construction, operation and decommissioning phases a soil management plan, with the following key components, will be compiled and implemented: • Limit the disturbance of soils to what is	On-going	On-going	Environmental manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks				absolutely necessary for earthworks, on-going activities, infrastructure footprints and use of vehicles. • Where soils have to be disturbed the soil will be stripped, stored, maintained and replaced in accordance with the specifications of the soil management principles in Table 54 and the detailed SCSC soils management procedure. To prevent the erosion of topsoils, management measures may include berms, soil traps, hessians and stormwater diversions away from areas susceptible to erosion. It will be ensured that topsoil stockpiles are located outside of any drainage lines and areas susceptible to erosion.	As required	As required	Environmental manager
Operation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services General site management Rehabilitation							
Decommissioning	Power supply and use Water supply and use Mineralised waste Support services General site management Demolition				All areas affected by construction should be rehabilitated upon completion of the construction phase of the development. Permanent infrastructure should be suitably re-vegetated, if possible.			Environmental manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
	Rehabilitation							
Rehabilitation/closure	Maintenance and aftercare of rehabilitated areas				During the rehabilitation/closure phase, inspections will be undertaken to ensure that the management/mitigation actions as described above have satisfied the objectives of the closure plan as summarised in Section 19 and detailed in Appendix T.	As required	As required	Environmental manager

TABLE 68: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO PHYSICAL DESTRUCTION OF BIODIVERSITY
(as summarised from Section 9.1.5)

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Planning and design/pre-construction	All activities	H	M	To prevent the unacceptable loss of biodiversity and related ecosystem functionality through physical destruction.	Where protected plant and/or tree species are going to be removed/destroyed the relevant permits must be obtained. An ecology expert should be engaged prior to the vegetation clearing phase to make the necessary applications for the outstanding permissions.	As required	As required	Environmental manager (with assistance of ecology expert)

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works				Activities and infrastructure will be confined to the infrastructure layout as described and assessed in this EIA and EMP report. This requires that no land disturbance is allowed outside of the infrastructure footprint. Furthermore, the following actions apply: *Development Footprint* A sensitivity map has been developed for the project area, indicating wetland and riparian features, as well as moderately high terrestrial bushveld habitat considered to be of increased ecological importance. This sensitivity map with the associated buffer zone will be considered during the planning/ pre-construction and construction phases of the project activities to aid in the conservation of ecology within the project area. Placement of infrastructure will be as far as possible from the areas of increased ecological sensitivity including buffer zones associated with wetland and riparian areas.	On-going	On-going	Environmental manager (with assistance of ecology expert where required)
Operation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services General site management Rehabilitation							
Decommissioning	Smelter plant Transport systems				During the construction phase, access to the construction areas will be limited to existing			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
	Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services Demolition Rehabilitation				access roads in order to minimise stream and wetland crossings. No new crossings for access roads be constructed. Access to wetland and riparian areas within the remainder of the SCSC property by site personnel will be prohibited to prevent compaction of soils, loss of vegetation and increased erosion. Smelter infrastructure, including contractor laydown areas and areas designated for washing, cutting, mixing, etc. will be placed, as planned, within designated low sensitivity areas as far as possible and well outside of the wetland buffer zones. Operational related activities will be kept within the development footprint and designated operational areas. The project, particularly road upgrades and stream crossings, will be implemented in a manner that they will not lead to a reduction of stream flow and connectivity of the wetland and riparian features will be maintained.			

Phase of operation	**Activities (see** Table 50)	**Impact significance**		**Standard to be achieved (Impact management statement/outcome/objectives)**	**Technical and management actions and compliance with standards**	**Action plan**		
		UM	**M**			**Timeframe**	**Frequency**	**Responsible parties**
					No incision and canalisation of the riparian resource takes place as a result of the construction of the powerline. Disturbances within the active riparian channels and riverbeds will be minimised as far as possible. In this regard the following key points are highlighted: • The powerline will span the entire delineated riparian zone, with no infrastructure apart form the service roads being placed within the active river channels. Placement of the powerline and its support structures will ensure that no upstream ponding and no downstream erosion and scouring occur. • The narrowest points in the watercourses will be identified and used as the crossing point and the powerline will not cross the rivers longitudinally, i.e. run within or adjacent to the river for extended lengths, with particular reference to the Phufane River where it exists within the SCSC property.			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					• The powerline will cross the rivers at a 90 degree angle to minimise the damage to riparian areas. • The powerline will not cross the rivers in any area where the river or active channel makes sharp bends. The duration of impacts on the rivers will be minimised as far as possible by ensuring that the duration of time in which flow alteration and sedimentation will take place is minimised. Construction will be restricted to the low flow season, during the drier winter months if possible, to avoid further sedimentation of wetland and riparian features in the vicinity of access road or powerline stream crossings and to decrease the potential for erosion and sedimentation within disturbed areas due to rainfall. *Vehicles:* Vehicles willt be limited to travelling only on designated roadways to limit the ecological			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					footprint of the proposed project activities. Culverts associated with stream crossings will be de-silted and regularly cleared of any debris. *Soils* Soils will be managed in accordance with the mitigation measures/actions outlined in Table 66 and Table 67 of the EMP. *Alien Vegetation* Proliferation of alien and invasive species is expected within any disturbed areas and common agricultural weeds are already present within the smelter footprint area. These species, as well as emerging species will be eradicated and controlled to prevent their spread beyond the project footprint. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, will also be controlled. Removal of the alien and weed species will			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					take place in order to comply with existing legislation (NEMBA Alien and Invasive Species Regulations, 2014). Focus will be on the removal of Category 1 alien species and will take place throughout the construction, operational and decommissioning and closure phases. *On-going rehabilitation* After construction has been completed suitable reprofiling, reseeding with indigenous grasses and revegetation of any bare or disturbed areas will take place to minimise the potential of sedimentation and erosion of wetland features. *Waste* Waste will be managed in accordance with the measures outlined in Table 66 and Table 67 *Fire* Informal fires in the vicinity of development construction areas will be prohibited. *Floral SCC*			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					Permits will be obtained for the removal/destruction of V. erioloba under the National Forests Act (Act 84 of 1998) within the powerline footprint, prior to the construction phase. The number of V. erioloba removed for construction of the powerline will be kept to a minimum and no trees will be needlessly destroyed. Should any other floral SCC, including SANBI RDL species, such as Crinum macowanii or Boophane disticha be encountered within the project footprint, these species will be relocated and monitoring of relocation success, if undertaken, will take place during the operational phase and during and beyond the decommissioning and closure phases. Should any floral species protected under LEMA (Act 7 of 2003), such as Scadoxus puniceus or NEMBA (Act 10 of 2004) be encountered within the powerline footprint, authorisation to relocate such species will be			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					obtained from LEDET or DEA respectively. Floral SCC are to be handled with care and the relocation of these plant species to nearby suitable similar habitat is to be overseen by a suitably qualified botanist. However should any species protected under LEMA or NEM:BA have been overlooked during the field assessment and be encountered within the proposed powerline alignment, authorisation to relocate such species will be obtained from theLEDET or the DEA respectively. *Fauna* Should any Pyxicephalus adspersus (Giant Bullfrog) be encountered within the project area, special care will be taken to catch and relocate such species to similar habitat within or in the vicinity of the SCSC property. Relocation will be done by a suitably qualified person. In order to conserve foraging habitat for			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					avifaunal SCC, the cultivated land closest to the Wetland/ Riparian Habitat Unit adjacent to the smelter complex area should ideally remain under cultivation as this will ensure sustained habitat for the avifaunal SCC Polemaetus bellicosus (Martial Eagle) and Pteocles gutturalis (Yellow-throated Sandgrouse) within the SCSC property. It is however noted that SCSC has no control over the activities on the adjacent cultivated lands and the decision of the adjacent landowners cannot be controlled by this EMP. *Aquatic monitoring* Since the aquatic systems within the SCSC property lacked flowing water at the time of the aquatic assessment, a high flow aquatic ecological assessment will be undertaken in the future to provide improved insight on the local aquatic ecological conditions. On-going aquatic ecological monitoring will take place on an annual basis in the high flow season by a suitably qualified assessor focusing on aquatic macro-invertebrates,			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					habitat integrity and biota specific water quality. Future development planning will ensure that activities do not lead to a reduction of stream flow or dewatering of any aquatic / wetland / riparian areas and connectivity of the aquatic features in the vicinity of the project area should be maintained. As much vegetation growth as possible will be promoted within the project area in order to protect soils. In this regard special mention is made of the need to use indigenous vegetation species where hydroseeding, landscaping and rehabilitation are to be implemented. Prior to closure, suitable reprofiling, reseeding with indigenous grasses and revegetation of any bare or disturbed areas will take place to minimise the potential of sedimentation and erosion of wetland features. Any disturbed wetland and riparian areas will be rehabilitated upon decommissioning to			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					ensure that wetland and riparian functions are re-instated to at least pre-development conditions.			
Rehabilitation/closure	Maintenance and aftercare of rehabilitated areas				For a period of at least five years after the re-establishment of vegetation, a programme of monitoring and "after care" will be implemented to ensure that vegetation is recovering and that pioneer and alien/invasive species are not becoming an ecological problem (see Section 27). This issue will be revisited as part of the detailed closure planning for the project. During the rehabilitation/closure phase, inspections will be undertaken to ensure that the management/mitigation actions as described in the phases above have satisfied the objectives of the closure plan as summarised in Section 19 and detailed in Appendix T.	As required	As required	Environmental manager

TABLE 69: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO GENERAL DISTURBANCE OF BIODIVERSITY
(as summarised from Section 9.1.6)

Phase of operation	Activities (see Table 50)	IImpact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Planning and design/pre-construction	All activities	H	L	To prevent the unacceptable loss of biodiversity and related ecosystem functionality through general disturbance.	Activities and infrastructure will be confined to the infrastructure layout as described and assessed in this EIA and EMP report. This requires that no land disturbance is allowed outside of the infrastructure footprint. The same actions as presented in Table 68 above apply equally to mitigation associated with the general disturbance of biodiversity. In addition: • Light pollution will be seriously and carefully considered and kept to a minimum wherever possible. Measures to be considered in the lighting design of the SCSC project are are as described in Table 78. • No trapping or hunting of fauna is to take place and all staff will be briefed and educated in this regard. • The collection of plant material for medicinal purposes or collection of firewood will be prohibited. • Should avifaunal SCC be encountered within the project area during the	On-going	On-going	Environmental manager
Construction	Site preparation Earthworks Civil works							
Operation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste							

Phase of operation	Activities (see Table 50)	IImpact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
	Non-mineralised waste Support services General site management Rehabilitation				construction or operational phases of the project, care will be taken not to disturb these species, particularly when foraging. • Bird flappers will be placed along the powerline, also in areas in close vicinity to remaining cultivated fields in order to minimise collisions of avifaunal species with powerlines. • Excessive dust fallout will be managed in accordance with mitigation measures/actions decribed in Table 74. • Noise related impacts will be managed in accordance with mitigation measures/actions decribed in • Table 75. • Traffic safety related impacts will be managed in accordance with mitigation measures/actions decribed in Table 77. • Impacts relating to littering will be managed in accordance with mitigation measures/actions described in Table 80.			
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services Demolition Rehabilitation							
Rehabilitation/closure	Maintenance and aftercare of				During the rehabilitation/closure phase, inspections will be undertaken to ensure that	As required	As required	Environmental manager

Phase of operation	Activities (see Table 50)	IImpact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
	rehabilitated areas				the management/mitigation actions as described in the phases above have satisfied the objectives of the closure plan as summarised in Section 19 and detailed in Appendix T. In addition, post closure monitoring will be undertaken in accordance with the monitoring requirements outlined in Section 27.			

TABLE 70: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO ALTERATION OF NATURAL DRAINAGE PATTERNS
(as summarised from Section 9.1.7)

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/ objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Planning and design/pre-construction	All activities	**H**	**M (L at closure)**	To prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow.	All water uses triggered in terms of the NWA wil be applied for as part of the WULA process.	As required	As required	Engineering and operations manager and environmental manager (with assistance from external consultant)

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/ objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Construction	Earthworks Civil works				In all phases project phases, in order to limit the alteration of natural drainage patterns, infrastructure will be constructed, operated and maintained so as to comply with the provisions of the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) or any future amendments thereto. The soil resource will be conserved and managed as detailed in Table 66 and Table 67 above. Prevention of contamination and containment of potential pollution sources will be achieved as described in in Table 66 and Table 67 and Section 4.2.2 of the EIA. Water management facilities for the control of stormwater and for pollution prevention will be designed to meet the requirements of Regulation 704 (4 June 1999) for water management on mines. Even though the SCSC project is not a mine, these design principles are considered to be good industry	On-going	On-going	Engineering and operations manager and environmental manager
Operation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services General site management Rehabilitation							
Decommissioning	Smelter plant Transport							

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/ objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
	systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services Demolition Rehabilitation				practice and are therefore being applied. The five main principles of Regulation 704 that are applicable to the stormwater management of the proposed project include: • Condition 4 which defines the area in which, mine workings or associated structures may be located, with reference to a watercourse and associated flooding. Any residue deposit, dam, reservoir together with any associated structure or any other facility should be situated outside the 1:100 year flood-line. Any underground or opencast mining, prospecting or any other operation or activity should be situated or undertaken outside of the 1:50 year flood-line. Where the flood-line is less than 100 m away from the watercourse, then a minimum watercourse buffer distance of 100 m is required for infrastructure and activities. • Condition 5 which indicates that no residue or substance which causes or is likely to cause pollution of a water			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/ objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					resource may be used in the construction of any dams, impoundments or embankments or any other infrastructure which may cause pollution of a water resource. • Condition 6 which describes the capacity requirements of clean and dirty water systems. Clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated to ensure conveyance of flows of a 1:50 year recurrence event. Clean and dirty water systems should not spill into each other more frequently than once in 50 years. Any dirty water dams should have a minimum freeboard of 0.8m above full supply level. • Condition 7 which describes the measures which must be taken to protect water resources. All dirty water or substances which may cause pollution should be prevented from entering a water resource (by spillage, seepage, erosion etc.) and ensure that water used			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/ objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					in any process is recycled as far as practicable. • Condition 10 which describes the requirements for operations involving extraction of material from the channel of a watercourse. Measures should be taken to prevent impacts on the stability of the watercourse, prevent scour and erosion resulting from operations, prevent damage to in-stream habitat through erosion, sedimentation, alteration of vegetation and flow characteristics, construct treatment facilities to treat water before returning it to the watercourse, and implement control measures to prevent pollution by oil, grease, fuel and chemicals. As part of closure planning, the slag dump and baghouse slurry facility will be designed and stabilised so as to prevent erosion and associated suspended solids. Monitoring of potential seepage from these facilities will be conducted.			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/ objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					The water balance for the project will be refined on an on-going basis during the life of the project. Flow meters will be installed in the water circuit to provide actual data on water flows to confirm or amend predictions made in the water balance model. The water balance will be used to check on an on-going basis that the capacity of the dirty water holding facilities is adequate, taking the operational distribution and use of water into account. An annual water balance report will be submitted to DWS, providing information on the status of the water balance in the wet and dry season and under conditions of extreme rainfall. Water quality monitoring will take place as detailed in Section 27 of the EMP. If an incident occurs where water has been contaminated to levels exceeding the maximum acceptable limits agreed to by DWS, SCSC will immediately notify DWS and			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/ objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					then identify the source of the contamination and implement measures to prevent further contamination in consultation with DWS.			
Rehabilitation/closure	Maintenance and aftercare of rehabilitated areas				During the rehabilitation/closure phase, inspections will be undertaken to ensure that the management/mitigation actions as described in the phases above have satisfied the objectives of the closure plan as summarised in Section 19 and detailed in Appendix T.	As required	As required	Engineering and operations manager and environmental manager

TABLE 71: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO POLLUTION OF SURFACE WATER RESOURCES

(as summarised from Section 9.1.8)

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties

Phase of operation	**Activities (see** Table 50)	**Impact significance**		**Standard to be achieved (Impact management statement/outcome/objectives)**	**Technical and management actions and compliance with standards**	**Action plan**		
		UM	**M**			**Timeframe**	**Frequency**	**Responsible parties**
Planning and design/pre-construction	All activities	**H**	**L**	To prevent pollution of surface water resources and related harm to surface water users.	Waste facilties (such as the slag dump, baghouse slurry dam, PCD and associated silt trap) will be licensed as part of the WULA process.	As required	As required	Engineering and operations manager and environmental manager (with assistance from external consultant)
Construction	Earthworks Civil works				Management measures will focus on the prevention of pollution, the containment of pollution sources, and the remediation of contamination incidents should they occur. The soil resource will be conserved and managed as detailed in Section 9.1.3. Prevention of contamination and containment of potential pollution sources will be achieved as described in Section 4.2.2. The clean and dirty water systems (as described in Section 4.2.2.) will be designed, implemented and managed in accordance with the provisions of Regulation 704. In this regard:	As required	As required	Engineering and operations manager and environmental manager
Operation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised					On-going	On-going	Engineering and operations manager and environmental manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
	waste management Support services General site management Rehabilitation				• Clean water will be diverted around operational areas. • Dirty water will be contained in the dirty water run-off and/or process water system that comprises channels and dams, and from which dirty water will be reused as a priority and/or treated prior to being discharged to the environment. • These systems will be routinely inspected to detect possible breaches and implement preventative or corrective action. As part of closure planning, mineralised waste facilities will be designed and stabilised so as to prevent erosion and associated suspended solids. Monitoring of potential seepage from these facilities will be conducted. The water balance for the project will be refined on an on-going basis during the life of the project. The water balance will be used to check on an on-going basis that the capacity of the dirty water holding facilities is adequate,			
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services Demolition Rehabilitation					As required	As required	Engineering and operations manager and environmental manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					taking the operational distribution and use of water into account. An annual water balance report will be submitted to DWS, providing information on the status of the water balance in the wet and dry season and under conditions of extreme rainfall. Surface water quality monitoring will take place as detailed in Section 27 of the EMP. If an incident occurs where water has been contaminated to levels exceeding the maximum acceptable limits agreed to by DWS, SCSC will immediately notify DWS and then identify the source of the contamination and implement measures to prevent further contamination in consultation with DWS.			
Rehabilitation/closure	Maintenance and aftercare				During the rehabilitation/closure phase,	As required	As required	Engineering and

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
	of rehabilitated areas				inspections will be undertaken to ensure that the management/mitigation actions as described in the phases above have satisfied the objectives of the closure plan as summarised in Section 19 and detailed in Appendix T. In addition, post closure monitoring will be undertaken in accordance with the monitoring requirements outlined in Section 27.			operations manager and environmental manager

TABLE 72: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO REDUCTION OF GROUNDWATER LEVELS AND AVAILABILITY
(as summarised from Section 9.1.9)

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Planning and design/pre-construction	Water supply and use	L	L	To prevent water losses to third party water users.	Abstraction of groundwater from an on-site borehole (for use in emergency cases where municipal supply is not available) will be applied for as part of the WULA process.	As required	As required	Environmental manager (witih assistance from external consultant)
Construction	Water supply and use				If an emergency situation arises which requires borehole abstraction, the recommended abstraction plan will be followed. This is limited to pumping at a rate of 3 L/s for a period of 12 hrs/day. In the unlikely event that any project related loss of water supply is experienced by the surrounding borehole users, SCSC will provide compensation that could include an alternative water supply of equivalent quantity and water quality.	As required	As required	Environmental manager
Operation	Water supply and use					As required	As required	Environmental manager
Decommissioning	Water supply and use					As required	As required	Environmental manager
Rehabilitation/closure	N/A				During the rehabilitation/closure phase, inspections will be undertaken to ensure that the management/mitigation actions as described in the phases above have satisfied the objectives of the closure plan as	As required	As required	Environmental manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					summarised in Section 19 and detailed in Appendix T. In addition, post closure monitoring will be undertaken in accordance with the monitoring requirements outlined in Section 27.			

TABLE 73: ACTION PLAN – CONTAMINATION OF GROUNDWATER

(as summarised from Section 9.1.10)

Phase of operation	Activities (see Table 50)	Impact Significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Planning and design/pre-construction	All activities	**M**	**L**	To prevent pollution of groundwater resources and related harm to water users (people, animals and biodiversity).	All potentially polluting waste facilities (i.e. slag dump, baghouse slurry facility and PCD) will be licensed as part of the WULA process.	As required	As required	Environmental manager (with assistance of external consultant)

Phase of operation	Activities (see Table 50)	Impact Significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Construction	Earthworks Civil works				SCSC will comply with both the National Water Act (36 of 1998) and Regulation 704 (4 June 1999) or any future amendments thereto, and the terms and conditions of water authorisations/licenses. In the planning, construction, operation and decommissioning phases SCSC will ensure that all hazardous chemicals (new and used), incoming raw materials, product, dirty water, mineralised wastes and non-mineralised wastes are handled in a manner that they do not pollute groundwater. This will be implemented through a procedure(s) covering the following: • Pollution prevention through basic infrastructure design. • Pollution prevention through maintenance of equipment. • Pollution prevention through education and training of workers (permanent and temporary). • Pollution prevention through appropriate management of hazardous chemicals,	On-going	On-going	Environmental manager
Operation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services General site management Rehabilitation					On-going	On-going	Environmental manager
Decommissioning	Smelter plant Transport					On-going	On-going	Environmental manager

Phase of operation	Activities (see Table 50)	Impact Significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
	systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services Demolition Rehabilitation				materials and non-mineralised waste. • The required steps to enable containment and remediation of pollution incidents. • Specifications for post rehabilitation audit criteria to ascertain whether the remediation has been successful and if not, to recommend and implement further measures. Infrastructure that has the potential to cause groundwater contamination will be identified and included in a groundwater pollution management plan which will be implemented as part of the operational phase. This plan has the following principles: • Map potential pollution sources. • Track (through groundwater modelling updates every 3 years) the extent of the existing or potential contamination plume. • Design and implement intervention measures to prevent, eliminate and/or control the pollution plume.			

Phase of operation	**Activities (see** Table 50)	**Impact Significance**		**Standard to be achieved (Impact management statement/outcome/objectives)**	**Technical and management actions and compliance with standards**	**Action plan**		
		UM	**M**			**Timeframe**	**Frequency**	**Responsible parties**
					• Monitor (according to Section 27) all existing and potential impact zones to track pollution and mitigation impacts. • Where monitoring results indicates that third party water supply has been polluted by SCSC, SCSC will ensure that an alternative equivalent water supply will be provided.			
Rehabilitation/closure	Maintenance and aftercare of rehabilitated aras				During the rehabilitation/closure phase, inspections will be undertaken to ensure that the management/mitigation actions as described in the phases above have satisfied the objectives of the closure plan as summarised in Section 19 and detailed in Appendix T. In addition, post closure monitoring will be undertaken in accordance with the monitoring requirements outlined in Section 27.	As required	As required	Environmental manager

TABLE 74: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO AIR POLLUTION
(as summarised from Section 9.1.11)

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Planning and design/pre-construction	All activities	H	M	To manage the generation of air quality impacts such that third party receptors do not experience air pollution exceedances.	AEL to be compiled and submitted to DEA. Mitigation measures which will be inherently included as part of the project planning/design includes: • Water sprays at the crushing and screening plant. • Dust extraction systems (with an estimated 83 % efficiency) fitted to materials handling areas (rail and road boxes and conveyor transfer points). • Paved roads (internal haul roads and access road). • Baghouses fitted to drying stacks and fume extraction stacks (dry scrubber for clean gas stack). Other mitigation measures specifically required include: *Emissions Control for Vehicle Exhaust* To meet internationally acceptable vehicle emission standards vehicle exhaust emissions will be reduced through the following methods:	As required	As required	Engineering and operations manager and environmental manager (with assistance from external consultant)
Construction	Site preparation Earthworks Civil works					As required	As required	Engineering and operations manager and environmental manager
Operation	Smelter plant Transport systems Power supply and use Mineralised waste Non-mineralised waste management					On-going	On-going	Engineering and operations manager and environmental manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
	Support services General site management Rehabilitation				• Diesel particulate filters (DPF) and selective catalytic reduction (SCR) or other similar tailpipe technologies. • Use of better quality diesel. • Inspection and maintenance programs. • Effective inspection and maintenance programs will ensure new vehicles remain in good condition and reduce emissions from old vehicles. Vehicles will be fitted with DPFs and SCR technologies. Regular maintenance and emission testing will be done on all mobile diesel combustion sources. Use will also be made of low sulphur fuel (50 ppm better). _Dust Control Options for Paved Roads_ In selecting a suitable sweeper, close attention will be paid to the PM_{10} collection efficiency of the machine. Factors in addition to PM_{10} control efficiency to will be taken into account in selecting an appropriate sweeper include: the extent of the sweeping path, hopper capacity, water capacity, travel speed, drive-			
Decommissioning	Smelter plant Transport systems Power supply and use Mineralised waste Non-mineralised waste management Support services Demolition Rehabilitation					As required	As required	Engineering and operations manager and environmental manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					by noise levels and maneuverability. Large hopper, water and sweep path capacities allow for extended sweeping time and maximum productivity. *Source Monitoring* Under Section 21 of the NEM: AQA it is compulsory to measure and report annually, Cr^{6+} emissions from the primary fume capture systems of ferrochrome furnaces. It further requires the holder of an AEL to submit an emission report in the format specified by the National Air Quality Officer or Licensing Authority on an annual basis. Annual emission testing for PM, SO_2 and NO_x will be conducted on an annual basis. Stack emissions testing will be undertaken in accordance with Table 58 Should the source monitoring be implemented the suggested IFC General EHS guidelines (IFC, 2007) for source monitoring will also be satisfied. Exhaust emissions testing must be done on all mobile and stationary diesel combustion			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					sources as part of equipment maintenance schedules. *Ambient Air Quality Monitoring* As a minimum continuous dust fallout, PM_{10}, $PM_{2.5}$ sampling will be conducted as part of the project's air quality management plan. A short sampling campaign after commencement of operations for NO_2, SO_2 and VOCs will be conducted to determine if the operations are compliant with the NAAQSs. Recommended monitoring locations are shown in Figure 27 and monitoring requirements are described in Section 27. The same methods employed for baseline/pre-development sampling are recommended. These include: • For dust fallout, the NDCR specifies that the method to be used for measuring dust fallout and the guideline for locating sampling points shall be ASTM D1739 (1970), or equivalent method approved by any internationally recognized body.			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					• For PM10 and PM2.5 the method as set out by British Standards (BS EN 12341). • Radiello® passive/diffusive samplers for NO2, SO2 and VOC sampling. Should the discussed ambient monitoring be implemented the suggested IFC General EHS guidelines (IFC, 2007) for ambient monitoring will mostly be satisfied. Based on the IFC General EHS guidelines for ambient monitoring, the installation of a weather station is also recommended.			
Rehabilitation/closure	Maintenance and aftercare of rehabilitated areas				During the rehabilitation/closure phase, inspections will be undertaken to ensure that the management/mitigation actions as described in the phases above have satisfied the objectives of the closure plan as summarised in Section 19 and detailed in Appendix T.	As required	As required	Engineering and operations manager and environmental manager

TABLE 75: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO NOISE POLLUTION

(as summarised from Section 9.1.12)

Phase of operation	**Activities (see** Table 50)	**Impact significance**		**Standard to be achieved (Impact management statement/outcome/objectives)**	**Technical and management actions and compliance with standards**	**Action plan**		
		UM	**M**			**Timeframe**	**Frequency**	**Responsible parties**
Planning and design/pre-construction		**M**	**L**	To prevent public exposure to disturbing noise. In general, this limit is considered an increase of 5dB, but this may be as low as 3dB depending on the nature of the receptor.	*Engineering and operational practices* • All diesel powered equipment and plant vehicles will be kept at a high level of maintenance. This will particularly include the regular inspection and, if necessary, replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment will serve as trigger for withdrawing it for maintenance. • To minimise noise generation, vendors will be required to guarantee optimised equipment design noise levels. • Vibration isolators will be installed to reduce noise and vibration from crushers and screens. • A mechanism to monitor noise levels, record and respond to complaints and mitigate impacts will be developed.	As required	As required	Environmental manager
Construction	Site preparation Earthworks Civil works							
Operation	Smelter plant Transport systems Power supply and use Water supply and use					On-going	On-going	Environmental manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
	Mineralised waste Non-mineralised waste management Support services General site management Rehabilitation				*Traffic* The following general factors are considered the most significant with respect to road traffic noise generation. In managing transport noise specifically related to trucks, efforts will be directed at: • Minimizing individual vehicle engine, transmission and body noise/vibration. This is achieved through the implementation of an equipment maintenance program. • Minimise slopes by managing and planning road gradients to avoid the need for excessive acceleration/deceleration. • Maintain road surface regularly to avoid corrugations, potholes etc. • Avoid unnecessary idling times. • Minimising the need for trucks/equipment to reverse. This will reduce the frequency at which disturbing but necessary reverse warnings will occur. Alternatives to the traditional reverse 'beeper' alarm such as a 'self-adjusting' or 'smart' alarm will be considered. These alarms include a			
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services Demolition Rehabilitation					As required	As required	Environmental manager
Rehabilitation/closure	Maintenance and aftercare of rehabilitated areas					N/A	N/A	N/A

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					mechanism to detect the local noise level and automatically adjust the output of the alarm is so that it is 5 to 10 dB above the noise level in the vicinity of the moving equipment. The promotional material for some smart alarms does state that the ability to adjust the level of the alarm is of advantage to those sites 'with low ambient noise level' (Burgess & McCarty, 2009). *Operational hours* As per the project description, crushing and screening activities will be limited to day-time hours. Where possible, the more noisy activities as associated with construction and decommissioning will also be limited to day-time hours. *Monitoring* In the event that noise related complaints are received short term (24-hour) ambient noise measurements are a possible tool that could be conducted as part of investigating the			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					complaints. The results of the measurements can be used to inform any follow up interventions. Complaints can however be addressed without the need for monitoring			

TABLE 76: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO BLASTING IMPACT

(as summarised from Section 9.1.13)

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Planning and design/pre-construction	Site preparation Earthworks Civil works	M	L	To prevent harm to people, animals and structures.	The following specific actions are required in addition to compliance with the relevant blasting and explosives legislation including the Explosives Act: The blast design will, as a minimum standard, ensure that the peak particle velocity from all blasts is less than 12mm/s at all vulnerable third party structures, that flyrock is contained within 500 m of each blast and that the airblast is less than 130 dB at third party structures for	As required	As required	Engineering and operations manager and environmental manager
Construction	N/A			N/A		N/A	N/A	N/A

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					all blasts. Monitoring of these three aspects (fly rock, airblast and ground vibration) will be undertaken to determine whether the blasts are within compliance. All potentially vulnerable structures that are within 1000 m of the blast will be marked on a site plan and surveyed photographically in the presence of the owner before blasting takes place. If surrounding property owners have vulnerable structures outside of this zone, they can request SCSC to have them included in the pre blast survey. All parties that exist and/or that have property and/or that provide services within 3000 m of the blast sites will be informed, prior to blasting, about the blast programme and associated safety precautions. For each blast, SCSC will observe the following procedural safety steps: • The fly rock danger zone associated with each blast is delineated and people and animals are cleared from this zone before			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					every blast. • An audible warning is given at least three minutes before the blast is fired. SCSC will respond immediately to any blast related complaints. These complaints and the follow up actions will be dated, documented, and kept as records for the life of the project. Where SCSC has caused blast related damage it will provide appropriate compensation.			
Operation	N/A			N/A	N/A	N/A	N/A	N/A
Decommissioning	N/A			N/A	N/A	N/A	N/A	N/A
Rehabilitation/closure	N/A			N/A	N/A	N/A	N/A	N/A

TABLE 77: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO TRAFFIC IMPACT (ROAD DISTURBANCE AND TRAFFIC SAFETY)
(as summarised from Section 9.1.14)

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Planning and design/pre-construction	Transport systems	H	M	To prevent transport related accidents and/or injury to people and livestock.	The following actions will be taken by SCSC in order to reduce the impact of the project on surrounding traffic: • The proposed access road intersection (with the D869) will be upgraded to include additional slip lanes. This will include two 60 m slip lanes for vehicles turning onto the D680 (one in each direction), as well as a slip lane for vehicles entering the site from the east (Northam) and another slip lane for vehicles entering the site from the west (Swartklip). This intersection will be stop-controlled where the project access road meets the main D869. Free-flow on the D869 will continue. • Pedestrian walk ways will be developed at the proposed intersection. • SCSC will make use of high passenger capacity busses and taxis for staff transport. • SCSC will co-operate with surrounding mines, industry and the provincial roads department with regards to service levels and safety of the broader road network	As required	As required	Engineering and operations manager and environmental manager
Construction	Transport systems							
Operation	Transport systems					On-going	On-going	Engineering and operations manager and environmental manager
Decommissioning	Transport systems					On-going	On-going	Engineering and operations manager and environmental manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					used by project related traffic. • SCSC drivers and those of sub contractors will receive awareness training on the safety related dangers associated with traffic and road use in and around the proposed project. The following actions should be taken by the relevant roads authority (irrespective of the proposed project) in order to reduce the impact of the project on surrounding traffic: • Detailed investigations should be conducted in conjunction with the relevant road authority in terms of the existing quality and potential life span of the existing road surface layers of the roads where processed product, incoming ore and raw materials, consumables and workers might be transported. • A road maintenance plan should be prepared in conjunction with the relevant road authority and other major road using stakeholders on public roads where			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					trucks will operate as soon as the project has been approved in order to ensure that the processed product, incoming ore and raw materials, consumables and workers can be transported at all times. • The intersection of the D869 and R510 should be upgraded • The intersection of the Swartklip Road and D869 should be upgraded to include a 60 m slip lane for vehicles entering from the west and an additional slip lane for vehicles entering from the east. This intersection should be stop-controlled			
Rehabilitation/closure	Maintenance and aftercare of rehabilitated areas				During the rehabilitation/closure phase, inspections will be undertaken to ensure that the management/mitigation actions as described in the phases above have satisfied the objectives of the closure plan as summarised in Section 19 and detailed in Appendix T.	On-going	On-going	Engineering and operations manager and environmental manager

TABLE 78: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO VISUAL IMPACTS
(as summarised from Section 9.1.15)

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Planning and design/pre-construction	All activities	H	M (L at closure)	To limit negative visual impacts.	*Planning and site development* With the construction of the smelter and its associated infrastructure, the minimum amount of existing vegetation and topsoil must be removed. All natural vegetation will be retained and incorporated into the site rehabilitation especially in line of sight from viewers to the south-west and north-east of the project area. All topsoil that occurs within the proposed footprint of an activity will be removed and stockpiled for later use. The stockpile will be vegetated and used as a screening berm for views from the west. *Earthworks* Earthworks will be executed in such a way that only the footprint and a small 'construction buffer zone' around the activities are exposed. In all other areas, the natural occurring vegetation (more importantly the indigenous vegetation) will be retained, especially along the periphery of the site. Dust suppression techniques will be in place at all times during all phases of the project, where required. *Landscaping and ecological approach*	As required	As required	Engineering and operations manager and environmental manager
Construction	Site preparation Earthworks Civil works							
Operation	Smelter plant Transport systems Power supply Water supply Mineralised waste Non-mineralised waste management Support services					On-going	On-going	Engineering and operations manager and environmental manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
	General site management Rehabilitation				Indigenous vegetation will be introduced to complement existing vegetation and to screen nearby receptors as mentioned above. An ecological approach to rehabilitation and vegetative screening measures, as opposed to a horticultural approach to landscaping will be adopted. *Smelter plant and associated infrastructure* SCSC will (where possible and/or feasible) paint buildings and structures with colours that reflect and compliment the natural colours of the surrounding landscape. To further reduce the potential of glare, the external surfaces of buildings and structures will (where possible and/or feasible) be articulated or textured to create interplay of light and shade. *Lighting* Light pollution will be seriously and carefully considered and kept to a minimum wherever possible. The following are measures that will be considered in the lighting design of the SCSC project are as follows:			
Decommissioning	Smelter plant Transport systems Power supply Water supply Mineralised waste Non-mineralised waste management Support services General site management Demolition Rehabilitation					As required	As required	Engineering and operations manager and environmental manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					• Install light fixtures that provide precisely directed illumination to reduce light “spillage” beyond the immediate surrounds of the project area. • Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on illegal entry to the project area. • Minimise the amount of light fixtures to the bare minimum, including security lighting. • With the construction of the proposed mineralised waste facilities security lighting will only be used where absolutely necessary and carefully directed, preferably away from sensitive viewing areas. • Lights will be directed downwards so as to avoid illuminating the sky. • Install a ‘baffle’ (where possible and/or feasible) at the top of the stacks and around the flares to screen the flame frorm views.			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					• At closure, mineralised waste facilities will be rehabilitated (as far as is practically possible) in a manner which reduces the visual impacts associated therewith.			
Rehabilitation/closure	Maintenance and aftercare of rehabilitated areas				During the rehabilitation/closure phase, inspections will be undertaken to ensure that the management/mitigation actions as described in the phases above have satisfied the objectives of the closure plan as summarised in Section 19 and detailed in Appendix T.	As required	As required	Engineering and operations manager and environmental manager

TABLE 79: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO DESTRUCTION OF HERITAGE, PALAEONTOLOGICAL AND CULTURAL RESOURCES

(as summarised from Section 9.1.16)

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties

Phase of operation	**Activities (see** Table 50)	**Impact significance**		**Standard to be achieved (Impact management statement/outcome/objectives)**	**Technical and management actions and compliance with standards**	**Action plan**		
		UM	**M**			**Timeframe**	**Frequency**	**Responsible parties**
Planning and design/pre-construction	All activities	**M**	**L**	to prevent the loss of heritage and palaeontological resources that may be caused by project related activities.	Project infrastructure, activities and related disturbance will be limited to those specifically identified and described in this report. Where future plans require a change in project footprint, a project specific heritage and palaeontological study will be done to identify any project specific heritage and cultural resources that may be affected and to detail the mitigation plan where required. If removal or damage to resources is unavoidable, the necessary authorisations will be obtained from SAHRA prior to the removal or damage occurring. In the event that new heritage and/or palaeontologcal resources are discovered during the construction, operation and decommissioning phases, SCSC will follow a chance find emergency procedure prior to damaging or moving these, which includes the following: • Work at the find will be stopped to prevent damage.	As required	As required	Environmental Manager
Construction	Site preparation Earthworks Civil works							
Operation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised					On-going	On-going	Environmental Manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
	waste management Support services General site management Rehabilitation				• An appropriate heritage specialist will be appointed to assess the find and related impacts. • Permitting applications will be made to SAHRA, if required.			
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services General site management Demolition Rehabilitation				In the event that any graves are discovered during the construction, operational or decommissioning phases, prior to damaging or destroying any identified graves, permission for the exhumation and relocation of graves will be obtained from the relevant descendants (if known) and the relevant local and provincial authorities.	As required	As required	Environmental Manager
Rehabilitation/closure	Maintenance and aftercare of rehabilitation areas				N/A	NA	NA	NA

TABLE 80: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO INWARD MIGRATION AND NEGATIVE SOCIAL IMPACTS

(as summarised from Section 9.1.17)

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Planning and design/pre-construction	All activities	H	M	To limit inward migration and related social impacts.	*Recruitment procedures to enhance local employment* • SCSC will advertise the number and details of available positions, as well as the minimum requirements to qualify for jobs. Adverts will state that preference will be given to people originating from local municipalities. • Communication about employment needs and the criteria for employment will be undertaken well in advance of the construction and operation phases. SCSC to prepare a fact sheet for use by all those engaging with stakeholders. Sharing of this information can take many forms (eg. formal and informal engagement activities, radio interviews/ adverts, printed media/ adverts, amongst others). • Local employment will be maximised to reduce the extent of influx. SCSC will	As required	As required	Environmental manager and stakeholder manager
Construction	Site preparation Earthworks Civil works							
Operation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised					On-going	On-going	Environmental manager and stakeholder manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
	waste Non-mineralised waste management Support services General site management Rehabilitation				confirm the percentage commitment to local employment (this figure will be as high as possible). The company's commitment to employing local people will be communicated in all advertisements and public meetings. • No hiring will take place 'at the gate', only formal recruitment channels will be followed. SCSC to identify and use suitable local and national recruitment channels. • Contractors will be required to apply the same recruitment measures to maximise the employment of local people. • All recruitment procedures to be undertaken in accordance with South African relevant legislative requirements and IFC Performance Standard 2 of Labour and Working Conditions (2012). *Planning and partnering to alleviate pressure* • SCSC will engage with all relevant government departments to confirm the needs and constraints, and to establish the areas in which direct and indirect			
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services General site management Demolition Rehabilitation					As required	As required	Environmental manager and stakeholder manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					proposed Project activities will increase pressure to an extent that the municipalities are unable to accommodate. To date these have been identified as water, sewage, roads, electricity, healthcare and policing, however these will be confirmed. • SCSC will engage with relevant authorities and planners in both Project affected municipalities to discuss the housing situation and establish whether the proposed Project will place additional pressure on housing capacity (directly and indirectly). • Based on the outcome of interactions with the authorities, plans will be established that aim to minimise the growth of informal settlements. SCSC will focus on initiatives that will support construction and operation phase workers. SCSC to implement and monitor these plans. • SCSC will develop a strategy and associated implementation plans to address the identified areas of need.			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					These will be developed in consultation with the relevant government departments and businesses and aligned with the Integrated Development Plans (IDPs) and other relevant plans. The plans will outline objectives, specific commitments, partnerships and monitoring procedures. The strategy and the plans will: ○ Define objectives that commit to making contributions that strive for sustainability ○ Define a process for selecting projects ○ Outline processes for consulting with relevant stakeholders to identify key needs ○ Present accurate budgets and identify additional resource requirements ○ Outline a Project implementation schedule in agreement with the authorities and other partners ○ Specify planned partnerships, including roles and responsibilities			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					(can be in the form of signed Memorandums of Understanding) o Identify how the plan will be communicated to beneficiaries as a way of managing expectations o Describe monitoring measures for all interventions. • SCSC will update these plans on an annual basis and make them available to the authorities for their input and final approval. • SCSC to participate in existing and future working groups and task teams initiated by government or other businesses that address infrastructure and service constraints. These should be identified in consultation with authorities and potential partners. One known forum is the Northam Sewage and Waterworks Task Team. • SCSC will clearly communicate with communities within the ambit of SCSC responsibilities versus those of government and other business. • SCSC will keep records of all meetings,			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					commitments and results. _Corporate Social Investment/ Local Economic Development_ • SCSC to identify corporate social investment (CSI)/ local economic development (LED) opportunities that strive to improve infrastructure and services available in the project area. These are to be identified in collaboration with the relevant authorities and the IDPs. • Detailed implementation plans to be developed to guide implementation activities, schedules, resource needs, monitoring activities, and communication with relevant stakeholders. SCSC to implement the Projects identified in a manner that maximises efficiencies and benefits. • SCSC to commit resources, financial and other (as required) to undertake these Projects. _Ongoing engagement and grievance_			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					management • SCSC to develop a Stakeholder Engagement Plan (SEP) that is revised and updated on an annual basis. The SEP should be aligned with the requirements of the Equator Principles (2013) and the IFC Performance Standards (2012). The plan should cover (but not be limited to) the following: o Outline the aim and objectives of ongoing engagement o Describe all internal and external stakeholder groups (including levels of support and influence) Describe all stakeholder issues and concerns as known currently (this will require exploratory meetings with each stakeholder group) o Define engagement techniques and protocols for each stakeholder group o Present a schedule that includes all identified stakeholders and topics o Outline resources required for implementation, timeframes, responsible people, monitoring			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					○ mechanisms; and ○ Layout process for undertaking and documenting engagement, including a clear process for ○ Registering and responding to issues and concerns raised. • SCSC to implement a grievance procedure that is easily accessible, culturally appropriate and scaled to the potential risks and impacts of the project, through which complaints related to contractor or employee behaviour can be lodged and addressed. SCSC would respond to all such complaints. The grievance procedure should be aligned with the requirements of the Equator Principles, 2013 and the IFC Performance Standards, 2012. Key steps of the grievance mechanism include: ○ Circulation of contact details of 'grievance officer' or other key contact ○ Awareness raising among stakeholders regarding the grievance procedure and how it works.			

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
					○ Establishment of an electronic grievance register which SCSC will update, including all escalation actions, responses and response times. *Workforce support* Following discussions with the authorities, SCSC to develop and implement a local housing strategy and plan that aims to provide some support to its direct project workers. The purpose of the plan should be to limit the likelihood of SCSC workers constructing and living in informal dwellings.			
Rehabilitation/closure	Maintenance and aftercare of rehabilitated areas				During the rehabilitation/closure phase, it will be ensured that the management/mitigation actions as described in the phases above have satisfied the objectives of the closure plan as summarised in Section 19 and detailed in Appendix T.	As required	As required	Environmental manager and stakeholder manager

TABLE 81: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO ECONOMIC IMPACT

(as summarised from Section 9.1.18)

Phase of	Activities (see	Impact		Technical and management actions and	Action plan

operation	Table 50)	significance		Standard to be achieved (Impact management statement/outcome/objectives)	compliance with standards	Timeframe	Frequency	Responsible parties
		UM	M					
Planning and design/pre-construction	All activities	H+	H+	To enhance the positive economic impacts and limit the negative economic impacts. Part of this objective is to enhance the contribution to the local economy in particular.	Siyanda will implement the commitments in the EMP to avoid/mitigate/manage all environmental, social and economic impacts. In so doing the potential negative impact on surrounding land use and values will be limited. Prior to construction, a base case valuation of land surrounding the project area will be done by an independent valuator. This valuation will provide a basis for future compensation negotiations if landowners are of the view that SCSC related impacts have caused a decrease in land value. Specifically, during all project phases, SCSC will ensure the following mitigation measures are implemented to minimise potential negative economic impacts and to optimise positive economic impact that may result from the proposed project: • Where possible, hire local people from the closest communities. • Extend formal bursary and skills development programmes to the closest	As required	As required	Environmental manager and stakeholder manager
Construction	Site preparation Earthworks Civil works					As required	As required	Environmental manager and stakeholder manager
Operation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management					On-going	On-going	Environmental manager and stakeholder manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
	Support services General site management Rehabilitation				communities to increase the number of local skilled people and thereby increase the potential local employee base. • Where possible, ensure procurement of local goods and services from the closest communities. • Implement a procurement mentorship programme which provides support to local businesses from the enquiry to project delivery stages. • Include the incorporation of economic considerations into closure planning from the outset. • Closure planning considerations should cover the skilling of employees for the downscaling, early closure and long term closure scenarios. • Identify and develop sustainable business opportunities and skills, independent from the project for members of the local communities to ensure continued economic prosperity beyond the life of project.			
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services General site management Demolition Rehabilitation					As required	As required	Environmental manager and stakeholder manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Rehabilitation/closure	Maintenance and aftercare of rehabilitated areas				During the rehabilitation/closure phase, it will be ensured that the management/mitigation actions as described in the phases above have satisfied the objectives of the closure plan as summarised in Section 19 and detailed in Appendix T.	As required	As required	Environmental manager and stakeholder manager

TABLE 82: ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO LAND USE IMPACTS

(as summarised from Section 9.1.19)

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Planning and design/pre-construction	All activities	**H**	**M (L at closure)**	To prevent unacceptable negative impacts on surrounding land uses.	SCSC will implement mitigation measures as laid out from Table 64 to Table 82 so as to minimise the environmental and social impacts.	As required	As required	Environmental manager and stakeholder manager

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
Construction	Site preparation Earthworks Civil works				Managing impacts on land users requires both communication and collaboration between the project team and land users. In this regard, SCSC will hold quarterly stakeholder meetings for landowners and other relevant stakeholders in addition to the stakeholder management measures set out in Table 80.	As required	As required	Environmental manager and stakeholder manager
Operation	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services General site management Rehabilitation					On-going	On-going	Environmental manager and stakeholder manager
Decommissioning	Smelter plant Transport systems					As required	As required	Environmental manager and stakeholder

Phase of operation	Activities (see Table 50)	Impact significance		Standard to be achieved (Impact management statement/outcome/objectives)	Technical and management actions and compliance with standards	Action plan		
		UM	M			Timeframe	Frequency	Responsible parties
	Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services General site management Demolition Rehabilitation							manager
Rehabilitation/closure	Maintenance and aftercare of final landforms				During the rehabilitation/closure phase, it will be ensured that the management/mitigation actions as described in the phases above have satisfied the objectives of the closure plan as summarised in Section 19 and detailed in Appendix T.	As required	As required	Environmental manager and stakeholder manager

27 PLANNED MONITORING AND EMP PERFORMANCE ASSESSMENT

In accordance with Appendix 4 of the 2014 EIA Regulations, this section covers the following:

- Method of monitoring the implementation of impact management actions.
- Frequency of monitoring the implementation of impact management actions.
- The mechanism for monitoring compliance with the impact management actions.
- A programme for reporting on compliance.

27.1 PLANNED MONITORING OF ENVIRONMENTAL ASPECTS

Environmental impacts requiring monitoring are listed below in Table 83. If for any operational or monitoring reasons, the location(s) of monitoring points and/or parameters and/or frequencies need to be altered, this monitoring programme makes provision for alterations with the input of relevant specialists and/or the relevant authorities.

TABLE 83: MONITORING OF COMPLIANCE AND PERFORMANCE IN TERMS OF EMPR

Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
Site preparation Earthworks Civil works Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Support services Demolition Rehabilitation Maintenance and	Hazardous infrastructure	Mineralised waste facilities and water dams will be monitored to ensure stability, safety and prevention of environmental impacts. The findings will be documented for record-keeping and auditing purposes and addressed where relevant to achieve the stated objectives.	Qualified engineer	The frequency of the monitoring and the qualification of the monitoring personnel will be determined on an infrastructure specific basis. Monitoring will be undertaken for the duration of the project and for a period thereafter where final landforms remain

Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
aftercare				on site.
Earthworks Civil works Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Demolition Rehabilitation Maintenance and aftercare	Alteration of natural drainage patterns	An operational water balance for the development needs to be developed from recorded flow measurements and production figures. This is done by an appropriately qualified person. The water balance is used to check on an on-going basis that the capacity of the dirty water holding facilities is adequate.	Environmental Department	Updated on a monthly basis for the duration of the project.
Earthworks Civil works Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Demolition Rehabilitation Maintenance and aftercare	Contamination of surface water resources	Monitoring of surface water quality should be undertaken when there is water in the surface water monitoring points (SWA, SWB and SWC as illustrated in Figure 27). Water quality analyses results should be classified in terms of the DWAF Guidelines Domestic Water Supply (1999), the DWAF guidelines for livestock watering, IFC mining Effluent Limits, WHO guidelines and SANS guideline limits. The parameters that need to be tested as part of the monitoring programme are as a minimum those outlined in the groundwater monitoring programme (these could be amended in the WUL process). The monitoring results should be assessed by a suitably-qualified professional registered with the South African Council for Natural Scientific Professional (SACNASP). All of the above may be amended to comply with the WUL conditions.	Environmental Department	Monitoring reports need to be submitted to the DWS as per the conditions of the WULA. Monitoring will be undertaken quarterly if and when there is water in the surface water monitoring points (SWA, SWB and SWC as illustrated in Figure 27). This should be done for the duration of the project and for at least five years after closure.
Earthworks Civil works Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste	Contamination of groundwater resources	Monitoring of groundwater quality should be undertaken at points illustrated in Figure 27. Modification to these points is possible in consultation with a qualified specialist taking pratictal considerations into account (e.g. dry/damaged borehole etc.). Water quality analyses results should be classified in terms of the DWAF Guidelines Domestic Water Supply (1999), the DWAF guidelines for livestock watering, IFC mining Effluent Limits, WHO guidelines and SANS guideline limits. The parameters that should be monitored are tabulated below.	Environmental Department	Groundwater quality should be monitored quarterly for the duration of the project and for at least five years after closure. Groundwater quantity should

<table>
<tr><th>Activity</th><th>Impacts requiring monitoring</th><th>Functional requirements for monitoring</th><th>Roles and responsibilities</th><th>Monitoring and reporting frequency and time period for management actions</th></tr>
<tr><td>Non-mineralised waste
Support services
General site management
Demolition
Rehabilitation
Maintenance and aftercare</td><td></td><td>
<table>
<tr><td>pH</td><td>Sodium</td></tr>
<tr><td>Electrical conductivity</td><td>Potassium</td></tr>
<tr><td>Akalainity</td><td>Calcium</td></tr>
<tr><td>Chloride</td><td>Nitrate as N</td></tr>
<tr><td>Fluoride</td><td>Magnesium</td></tr>
<tr><td>Sulphate</td><td>Manganese</td></tr>
<tr><td>Total dissolved solids</td><td>ICP-OES scan - dissolved metals (groundwater)</td></tr>
<tr><td>Bicarbonate as HCO_3</td><td>ICP-OES scan - total metals (surface water)</td></tr>
<tr><td>Carbonate as CO_3</td><td></td></tr>
</table>
The monitoring results should be assessed by a suitably-qualified professional registered with the South African Council for Natural Scientific Professional (SACNASP). All of the above may be amended to comply with the WUL conditions.</td><td></td><td>be monitored on a quarterly basis for the duration of the project and for at least five years after closure.

The monitoring programme should be implemented at least one year prior to operation.

Groundwater monitoring reports need to be submitted to the DWS as per the conditions of the WUL.</td></tr>
<tr><td>Site preparation
Earthworks
Civil works
Smelter plant
Transport systems
Power supply and use
Mineralised waste
Non-mineralised waste
Support services
General site management
Demolition
Rehabilitation
Maintenance and aftercare</td><td>Air pollution</td><td>SCSC will ensure the implementation of an air quality monitoring programme for the proposed project. Monitoring will include dust fallout, PM_{10}, $PM_{2.5}$ and NO_2, SO_2 and VOC. The location of air quality monitoring points (and parameters to be monitored at each point are illustrated in Figure 27). Modification to these points is possible in consultation with a qualified specialist taking pratictal considerations into account (e.g theft /damage to equipment).

Under Section 21 of the NEM:AQA it is compulsory to measure and report annually, Cr^{6+} emissions from the primary fume capture systems of ferrochrome furnaces. It further requires the holder of an AEL to submit an emission report in the format specified by the National Air Quality Officer or Licensing Authority on an annual basis. Annual emission testing for PM, SO_2 and NO_x will also be conducted on an annual basis. See table below for recommended stack emissions testing.
<table>
<tr><th>Source</th><th>Annual Emission Testing</th><th>Pollutants</th></tr>
<tr><td>Raw materials dust extraction baghouse stack</td><td>Yes</td><td>PM</td></tr>
<tr><td>Reductant/flux drier baghouse stack</td><td>Yes</td><td>PM, SO_2 and NO_x (Cr^{6+} to be included if furnace off gas is</td></tr>
</table></td><td>Environmental Department</td><td>Ambient monitoring to be undertaken on a monthly basis. Stack testing to be undertaken annually (subject to AEL conditions)

Monitoring reports need to be uploaded onto the National Emissions Inventory System on an annual basis.

Monitoring reports (in support of AEL) to be submitted to National Air Quality Officer or Licensing Authority on an annual basis.</td></tr>
</table>

<table>
<tr><th>Activity</th><th>Impacts requiring monitoring</th><th>Functional requirements for monitoring</th><th>Roles and responsibilities</th><th>Monitoring and reporting frequency and time period for management actions</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td></td><td></td><td>used as an energy source)</td></tr>
<tr><td>Concentrate drier baghouse stack</td><td>Yes</td><td>PM, SO_2 and NO_x (Cr^{6+} to be included if furnace off gas is used as an energy source)</td></tr>
<tr><td>Secondary furnace fume extraction baghouse stacks</td><td>Yes</td><td>PM, $Cr^{6+,}$ SO_2 and NO_x</td></tr>
<tr><td>Pre-heater stack(s) if applicable</td><td>Yes</td><td>PM, Cr^{6+}, SO_2 and NO_x</td></tr>
<tr><td>Clean gas furnace flare stacks</td><td>No</td><td>-</td></tr>
<tr><td>Raw gas furnace flare stacks</td><td>No</td><td>-</td></tr>
</table>
It should be noted that stack emissions testing on cleaned/raw furnace off-gas before is impractical and dangerous due to the high CO content. If flared, emissions from primary furnace off gas must rather be estimated from emission factors, limits and or mass balance methods. Since it is likely that cleaned furnace off gas will be combusted and utilised for drying and preheating emission testing at the outlet of these process can be sampled safely.</td><td></td><td></td></tr>
<tr><td>Site preparation
Earthworks
Civil works
Smelter plant
Transportation
Power supply and use
Mineralised waste
Non-mineralised waste
Support services
Demolition
Rehabilitation</td><td>Noise pollution</td><td>In the event that SCSC receives noise related complaints during either construction or operation, SCSC will consider conducting short term (24-hour) ambient noise measurements as part of investigating the complaints. The results of the measurements will be used to inform any follow up interventions. The following procedure will be adopted for all noise surveys if required:
• Any surveys will be designed and conducted by a trained specialist.
• Sampling will be carried out using a Type 1 sound level meter (SLM) that meets all appropriate International Electrotechnical Commission (IEC) standards and is subject to annual calibration by an accredited laboratory.
• The acoustic sensitivity of the SLM will be tested with a portable acoustic calibrator before and after each sampling session.
• Samples of at least 24 hours in duration and sufficient for statistical analysis will be taken with the use of portable SLM's capable of logging data continuously over the time period. Samples representative of the day- and night-time acoustic climate will be taken.
• The following acoustic indices will be recorded and reported:
o LAeq (T)
o Statistical noise level LA90
o LAmin and LAmax
o Octave band or 3rd octave band frequency spectra.
• The SLM will be located approximately 1.5 m above the ground and no closer than 3 m to any reflecting surface.
• Efforts will be made to ensure that measurements are not affected by the residual noise and</td><td>Environmental Department</td><td>Noise monitoring should be done for a month in the event of a noise related complaint.</td></tr>
</table>

Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
		extraneous influences, e.g. wind, electrical interference and any other non-acoustic interference, and that the instrument is operated under the conditions specified by the manufacturer. It is good practice to avoid conducting measurements when the wind speed is more than 5 m/s, while it is raining or when the ground is wet. • A detailed log and record will be kept. Records will include site details, weather conditions during sampling and observations made regarding the acoustic climate of each site.		
Site preparation Earthworks Civil works Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services General site management Demolition Rehabilitation Maintenance and aftercare	Physical destruction and general disturbance of biodiversity	SCSC will implement an alien/invasive/weed management programme to control the spread of these plants onto and from disturbed areas. This will be achieved by active eradication and the establishment of natural species and through on-going monitoring and assessment. The use of herbicides will be limited and focussed and will only be used under strict controls. Herbicides will be selected to ensure least residual harm. Herbicides will be administered by suitably qualified people.Continued monitoring will be undertaken to ensure that the alien invasive species have been eradicated and are controlled for both controlled sites as well as rehabilitated areas. For each area requiring rehabilitation specific landscape functionality objectives will be set with expert input and the associated targets and monitoring program will follow accordingly. On-going aquatic biomonitoring will take place on an annual basis in the high flow season by a suitably qualified assessor focusing on aquatic macro-invertebrates, habitat integrity and biota specific water quality. Recommended biomonitoring locations are illustrated in Figure 27.	Environmental Department	The alien/invasive/weed management programme should be undertaken on an annual basis for the duration of the project. After closure, repeat surveys should be carried out annually for at least the first three years post-rehabilitation to ensure that vegetation is recovering and that pioneer and alien/invasive species are not becoming an ecological problem
Site preparation Earthworks Civil works	Blasting impacts (fly rock, air blasts and ground vibrations) associated with construction phase activities only	Monitoring of each blast will be taken as part of the proposed project if construction phase blasting is undertaken. Points for off-site vibration fly rock and airblast monitoring will be identified in consultation with surrounding landowners and a blast monitoring specialist. The monitoring results will be documented and maintained for record-keeping and auditing purposes.	Qualified blasting specialist	Blast monitoring will take place for the duration of blasting activities (construction phase only)
Site preparation Earthworks Civil works Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste	Concurrent rehabilitation	As part of concurrent rehabilitation, the following will be ensured: • Hazardous infrastructure/excavations will be decommissioned and rehabilitated if not required at any stage throughout the life of the project • Soil resources will be adequately managed in accordance with Siyanda's soils management principles outlined in Table 54. • Biodiversity destruction and disturbance will be limited and monitored in accordance with the monitoring requirements outlined above	Environmental Department	For the duration of the project

Activity	Impacts requiring monitoring	Functional requirements for monitoring	Roles and responsibilities	Monitoring and reporting frequency and time period for management actions
Support services General site management Demolition Rehabilitation Maintenance and aftercare		• Air quality will be monitored in accordance with the requirements as laid out above. • Surface water will be monitored in accordance with the requirements as laid out above. • Groundwater will be monitored in accordance with the requirements as laid out above.		

27.2 FREQUENCY OF PERFORMANCE ASSESSMENT REPORT AND REPORTING

The environmental manager will conduct internal management audits against the commitments in the EMP. These audits will be conducted on an on-going basis until final closure. The audit findings will be documented for both record keeping purposes and for informing continual improvement. The site's compliance with the provisions of the EMP and the adequacy of the EMP report relative to the on-site activities will be assessed in the performance assessment.

As a minimum, the following documents will be submitted to the relevant authorities from the start of construction until closure:

- EMP performance assessment, submitted in accordance with DEA record of decision.
- Water monitoring reports, submitted to DWS in accordance with water use license.
- Air quality monitoring reports, submitted to the relevant authority in accordance with the departmental requirements.
- Detailed plan for decommissioning/closure, submitted in accordance with DEA requirements before deocomissioning and closure.

FIGURE 27: MONITORING PLAN

28 ENVIRONMENTAL AWARENESS PLAN

28.1 MANNER IN WHICH APPLICANT INTENDS TO INFORM EMPLOYEES OF THE ENVIRONMENTAL RISKS

This section includes an environmental awareness plan for the proposed project. The plan describes how employees will be informed of environmental risks which may result from their work, the manner in which the risk must be dealt with in order to avoid pollution or degradation of the environment and the training required for general environmental awareness and the dealing of emergency situations and remediation measures for such emergencies.

All contractors that conduct work on behalf of SCSC are bound by the content of the EMPr and a contractual condition to this effect will be included in all such contracts entered into by SCSC. If contractors are used, the responsibility for ensuring compliance with the EMP will remain with SCSC.

The purpose of the environmental awareness plan is to ensure that all personnel and management understand the general environmental requirements of the site. In addition, greater environmental awareness must be communicated to personnel involved in specific activities which can have a significant impact on the environment and ensure that they are competent to carry out their tasks on the basis of appropriate education, training and/or experience. The environmental awareness plan should enable SCSC to achieve the objectives of the environmental policy.

28.1.1 ENVIRONMENTAL POLICY

SCSC will display the environmental policy. To achieve world class environmental performance in a sustainable manner SCSC is currently committed to:

- Integrating environmental management into all aspects of our business.
- Complying with all applicable legislation and other requirement to which SCSC subscribes.
- Practising responsible stewardship by adopting world class standards.
- Proactively identifying and managing significant environmental aspects in order to:
  - Minimise emissions to atmosphere.
  - Minimise the release of effluent.
  - Optimise resource consumption.
  - Mitigate our impacts on climate change.
  - Minimise waste.
  - Rehabilitate disturbed land and protect environmental biodiversity.
  - Protect cultural heritage resources.

- Ensuring environmental awareness and appropriate competency among employees and promoting environmental awareness in the community.
- Engaging with all IAPs towards the shared goal of improving the environment.
- Setting objectives and, where possible, quantitative targets, to determine continual improvement in environmental performance and the prevention of pollution.

28.1.2 STEPS TO ACHIEVE THE ENVIRONMENTAL POLICY OBJECTIVES

SCSC's environmental policy will be realised by setting specific and measurable objectives. It is proposed that new objectives are set throughout the life of the project, but initial objectives are as follows:

- Management of environmental responsibilities:
    - SCSC will establish and appoint Managers at senior management level at each site, who will be provided with all necessary resources to carry out the management of all environmental aspects of the site irrespective of other responsibilities, for example:
        - Compliance with environmental legislation and EMP commitments.
        - Implementing and maintaining an environmental management system with the assistance of the appointed EMS Area Coordinator and the Area Waste Coordinator.
        - Developing environmental emergency response procedures and coordinating personnel during incidents.
        - Manage routine environmental monitoring and data interpretation.
        - Environmental trouble shooting and implementation of remediation strategies.
        - Closure planning.
- Communication of environmental issues and information:
    - Meetings, consultations and progress reviews will be carried out, and specifically SCSC will:
        - Set the discussion of environmental issues and feedback on environmental projects as an agenda item at all company board meetings.
        - Provide progress reports on the achievement of policy objectives and level of compliance with the approved EMP to the DEA.
        - Ensure environmental issues are raised at monthly management executive committee meetings and all relevant meetings at all levels.
        - Ensure environmental issues are discussed at all general liaison meetings with local communities and other interested and affected parties.
- Environmental awareness training:
    - SCSC will provide environmental awareness training to individuals at a level of detail specific to the requirements of their job, but will generally comprise:

  - Basic awareness training for all prior to granting access to site (e.g. short video presentation requiring registration once completed). Employees and contractors who have not attended the training will not be allowed on site.
  - General environmental awareness training will be given to all employees and contractors as part of the Safety, Health and Environment induction programme. All non-SCSC personnel who will be on site for more than three days will undergo the SHE induction training.
  - Specific environmental awareness training will be provided to personnel whose work activities can have a significant impact on the environment (e.g. workshops, waste handling and disposal, sanitation, etc.).
- Review and update the environmental topics already identified in the EMPr which currently includes the following purpose
  - Topography (hazardous excavations).
  - Soil and land capability management (loss of soil resource).
  - Management of biodiversity.
  - Surface water management (alteration of surface drainage and pollution of surface water).
  - Groundwater management (reduction in groundwater levels/availability and groundwater contamination).
  - Management of air quality (dust generation).
  - Noise (specifically management of disturbing noise).
  - Visual aspects (reduction of negative visual impacts).
  - Surrounding land use (traffic management, land use loss).
  - Heritage resources (management of sites) (only should sites be discovered).
  - Socio-economic impacts (management of positive and negative impacts).
- The SCSC project will be designed to minimise impact on the environment and to accomplish closure/rehabilitation objectives.
- SCSC will maintain records of all environmental training, monitoring, incidents, corrective actions and reports.

28.1.3 TRAINING OBJECTIVES OF THE ENVIRONMENTAL AWARENESS PLAN

The environmental awareness plan ensures that training needs are identified and that appropriate training is provided. The environmental awareness plan should communicate:

- The importance of conformance with the environmental policy, procedures and other requirements of good environmental management.
- The significant environmental impacts and risks of individuals work activities and explain the environmental benefits of improved performance.
- Individuals roles and responsibilities in achieving the aims and objectives of the environmental policy

- The potential consequences of not complying with environmental procedures.

28.1.3.1 **General Contents of the Environmental Awareness Plan**

To achieve the objectives of the environmental awareness plan the general contents of the training plans are as follows:

- Module 1 – Basic training plan applicable to all personnel entering the site:
  - Short (15 min) presentation to indicate the site layout and activities at specific business units together with their environmental aspects and potential impacts.
  - Individuals to sign off with site security on completion in order to gain access to the site.
- Module 2 – General training plan applicable to all personnel at the site for longer than 3 days:
  - General understanding of the environmental setting of the site (e.g. local communities and industries and proximity to natural resources such as watercourses).
  - Understanding the environmental impact of individuals activities on site (e.g. excessive production of waste, poor housekeeping, energy consumption, water use, noise, etc.).
  - Indicate potential site specific environmental aspects and their impacts.
  - SCSC's environmental management strategy.
  - Identifying poor environmental management and stopping work which presents significant risks.
  - Reporting incidents.
  - Examples of poor environmental management and environmental incidents.
  - Procedures for emergency response and cleaning up minor leaks and spills.
- Module 3 – Specific training plan:
  - Environmental setting of the workplace (e.g. proximity of watercourses, vulnerability of groundwater, proximity of local communities and industries, etc.).
  - Specific environmental aspects such as:
    - Spillage of hydrocarbons at workshops.
    - Poor waste management such as mixing hazardous and general wastes, inappropriate storage and stockpiling large amounts of waste.
    - Poor housekeeping practices.
    - Poor working practices (e.g. not carrying out vehicle maintenance in designated bunded areas).
    - Excessive noise generation and unnecessary use of hooters.
    - Protection of heritage resources (including palaeontological resources) if such resources are discovered.
  - Impact of environmental aspects, for example:
    - Hydrocarbon contamination resulting in loss of resource (soil, water) to downstream users.
    - Groundwater contamination also resulting in loss of resource due to potential adverse aesthetic, taste and health effects.

  - Air quality impacts on local communities (nuisance and health implications).
- SCSC duty of care (specifically with respect to waste management).
- Purpose and function of SCSC's environmental management system.

Individuals required to complete Module 3 (Specific training module) will need to complete Modules 1 and 2 first. On completion of the Module 3, individuals will be subject to a short test (written or verbal) to ensure the level of competence has been achieved. Individuals who fail the test will be allowed to re-sit the test after further training by the training department.

The actual contents of the training modules will be developed based on a training needs analysis.

Key personnel will be required to undergo formal, external environmental management training (e.g. how to operate the environmental management system, waste management and legal compliance).
In addition to the above SCSC will:

- Conduct refresher training/presentations on environmental issues for employees (permanent and contractors) at regular intervals.
- Promote environmental awareness using relevant environmental topic posters displayed at strategic locations on the site. These topics will be changed monthly, and will be reviewed annually by the Environmental Manager to ensure relevance.
- Participate and organise events which promote environmental awareness, some of which will be tied to national initiatives e.g. National Arbour Week, World Environment Day and National Water Week.

28.2 MANNER IN WHICH RISKS WILL BE DEALT WITH TO AVOID POLLUTION OR DEGRADATION

28.2.1 ON-GOING MONITORING AND MANAGEMENT MEASURES

The monitoring programme as described in Section 27 will be undertaken to provide early warning systems necessary to avoid environmental emergencies.

28.2.2 PROCEDURES IN CASE OF ENVIRONMENTAL EMERGENCIES

Emergency procedures apply to incidents that are unexpected and that may be sudden, and which lead to serious danger to the public and/or potentially serious pollution of, or detriment to the environment (immediate and delayed). Procedures to be followed in case of environmental emergencies are described in the table below (Table 84).

28.2.2.1 **General emergency procedure**

The general procedure that should be followed in the event of all emergency situations is as follows.

- Applicable incident controller defined in emergency plans will be notified of an incident upon discovery.
- Area to be cordoned off to prevent unauthorised access and tampering with evidence.
- Undertake actions defined in emergency plant to limit/contain the impact of the emergency.
- If residue facilities/dams, stormwater diversions, etc., are partially or totally failing and this cannot be prevented, the emergency siren is to be sounded (nearest one available). After hours the Operations Engineer on shift will be notified.
- Take photographs and samples as necessary to assist in investigation.
- Report the incident immediately to the environmental department for emergencies involving environmental impacts or to the safely department in the case of injury.
- The Environment department will comply with Section 30 of the National Environmental Management Act (107 of 1998) such that:
  - The Environmental department will immediately notify the Director-General (DWS), the South African Police Services, the relevant fire prevention service, the head of the local municipality, the head of the regional DWS office and any persons whose health may be affected of:
    - The nature of the incident.
    - Any risks posed to public health, safety and property.
    - The toxicity of the substances or by-products released by the incident.
    - Any steps taken to avoid or minimise the effects of the incident on public health and the environment.
- The Environment department will as soon as is practical after the incident:
    - Take all reasonable measures to contain and minimise the effects of the incident including its effects on the environment and any risks posed by the incident to the health, safety and property of persons.
    - Undertake clean up procedures.
    - Remedy the effects of the incident.
    - Assess the immediate and long term effects of the incident (environment and public health);
  - Within 14 days the Environmental department will report to the Director-General DWS and DEA, the head of the local and district municipality, the head of the regional DWS office such information as is available to enable an initial evaluation of the incident, including:
    - The nature of the incident.
    - The substances involved and an estimation of the quantity released.
    - The possible acute effects of the substances on the persons and the environment (including the data needed to assess these effects).
    - Initial measures taken to minimise the impacts.
    - Causes of the incident, whether direct or indirect, including equipment, technology, system or management failure.

- Measures taken to avoid a recurrence of the incident.

28.2.2.2 **Identification of Emergency Situations**

The site wide emergency situations that have been identified together with specific Emergency Response Procedures are outlined in Table 84.

28.2.3 TECHNICAL, MANAGEMENT AND FINANCIAL OPTIONS

Technical, management and financial options that will be put into place to deal with the remediation of impacts in cases of environmental emergencies are described below.

- The applicant will appoint a competent management team with the appropriate skills to develop and manage an operation of this scale and nature.
- To prevent the occurrence of emergency situations, SCSC will implement as a minimum the plan and mitigation measures as included in this EMPr report.
- SCSC has an environmental management system in place where all operation identify, report, investigate, address and close out environmental incidents.
- As part of its annual budget, SCSC will allow a contingency for handling of any risks identified and/or emergency situations.
- Where required, SCSC will seek input from appropriately qualified people.

TABLE 84: EMERGENCY RESPONSE PROCEDURES

Item	Emergency situation	Response in addition to general procedures
1	Spillage of chemicals, engineering substances and waste	Where there is a risk that contamination will contaminate the land (leading to a loss of resource), surface water and/or groundwater, SCSC will: • Notify residents/users downstream of the pollution incident. • Identify and provide alternative resources should contamination impact adversely on the existing environment. • Cut off the source if the spill is originating from a pump, pipeline or valve (e.g. refuelling bays) and the infrastructure 'made safe'. • Contain the spill (e.g. construct temporary earth bund around source). • Pump excess hazardous liquids on the surface to temporary containers (e.g. 210 litre drums, mobile tanker, etc.) for appropriate disposal. • Remove hazardous substances from damaged infrastructure to an appropriate storage area before it is removed/repaired.
2	Discharge of dirty water to the environment	Apply the principals listed for Item 1 above. To stop spillage from the dirty water system SCSC will: • Redirect excess water to other dirty water facilities where possible • Pump dirty water to available containment in the clean water system, where there is no capacity in the dirty water system • Carry out an emergency discharge of clean water and redirect the spillage to the emptied facility. • Apply for emergency discharge as a last resort.
3	Pollution of surface water (where relevant)	Personnel discovering the incident will inform the Environmental department of the location and contaminant source. Apply the principals listed for Item 1 above. Absorbent booms will be used to absorb surface plumes of hydrocarbon contaminants. Contamination entering the surface water drainage system should be redirected into the dirty water system. The Environmental department will collect in-stream water samples downstream of the incident to assess the immediate risk posed by contamination.
4	Groundwater contamination	Use the groundwater monitoring boreholes as scavenger wells to pump out the polluted groundwater for re-use in the process water circuit (hence containing the contamination and preventing further migration). Investigate the source of contamination and implement control/mitigation measures.
5	Burst water pipes (loss of resource and erosion)	Notify authority responsible for the pipeline (if not SCSC responsibility). Shut off the water flowing through the damaged area and repair the damage. Apply the principals listed for Item 1 above if spill is from the dirty/process water circuit.
6	Flooding from failure of surface water control or mineralised waste	Evacuate the area downstream of the failure. Using the emergency response team, rescue/recover and medically treat any injured personnel. Temporarily reinstate/repair stormwater diversions during the storm event (e.g. emergency supply of sandbags).

Item	Emergency situation	Response in addition to general procedures
	infrastructure	Close the roads affected by localised flooding or where a stormwater surge has destroyed crossings/bridges.
7	Risk of drowning from falling into water dams	Attempt rescue of individuals from land by throwing lifeline/lifesaving ring. Get assistance of emergency response team whilst attempting rescue or to carry out rescue of animals and or people as relevant. Ensure medical assistance is available to recovered individual.
8	Veld fire	Evacuate SCSC employees from areas at risk. Notify downwind residents and industries of the danger. Assist those in imminent danger/less able individuals to evacuate until danger has passed. Provide emergency fire fighting assistance with available trained SCSC personnel and equipment.
9	Falling into hazardous excavations	Personnel discovering the fallen individual or animal will mobilise the emergency response team to the location of the incident and provide a general appraisal of the situation (e.g. human or animal, conscious or unconscious, etc.). The injured party should be recovered by trained professionals such as the SCSC emergency response team. A doctor (or appropriate medical practitioner)/ambulance should be present at the scene to provide first aid and transport individual to hospital.
10	Road traffic accidents (on site or involving project related vehicles off site)	The individual discovering the accident (be it bystander or able casualty) must raise the alarm giving the location of the incident. Able personnel at the scene should shut down vehicles where it is safe to do so. Access to the area should be restricted and access roads cleared for the emergency response team. Vehicles will be made safe first by trained professionals (e.g. crushed or overturned vehicles). Casualties will be moved to safety by trained professionals and provided with medical assistance. Medical centres in the vicinity with appropriate medical capabilities will be notified if multiple seriously injured casualties are expected. A nearby vet should be consulted in the case of animal injury
11	Development of informal settlements	SCSC will inform the local authorities (municipality and police) that people are illegally occupying the land and ensure that action is taken within 24hrs.
12	Injury from fly rock from initial limited surface blasting for foundations (if required)	The person discovering the incident will contact the SCSC emergency response personnel to recover the injured person or animal and provide medical assistance. Whilst awaiting arrival of the emergency response personnel, first aid should be administered to the injured person by a qualified first aider if it is safe to do so.
13	Uncovering of graves and other heritage sites/resources	Personnel discovering the grave or heritage resources will inform the Environmental department immediately. Prior to damaging or destroying any of the identified graves or resources, permission for the exhumation and relocation of graves will be obtained from SAHRA, the relevant descendants (if known), the National Department of Health, the Provincial Department of Health, the Premier of the Province and the local Police. The exhumation process will comply with the requirements of the relevant Ordinance on Exhumations, and the Human Tissues Act,

Item	Emergency situation	Response in addition to general procedures
		65 of 1983.
14	Uncovering of fossils	Personnel discovering the fossil or potential site will inform the Environmental department immediately. Should any fossils be uncovered during the development of the site, a palaeontologist will be consulted to identify the possibility for research and SAHRA will be contacted and involved.
15	Stack ventilation	Under upset conditions where stack ventilation is required, the following procedure will be followed: • Plant manager to be notified • Isolation gate in stack to be closed • Furnace shut down • Vacate plant • Stakeholders to be notified • DEA and Municipality to be notified (in accordance with conditions of AEL)

29 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

The following documents will be submitted to the DEA from the start of construction until closure:

- In accordance with Section 34 of GNR. 982 of NEMA, the holder of an environmental permit needs to submit an environmental audit report, prepared by an independent person, to the DEA at intervals indicated in the environmental authorisation. The purpose of the environmental audit report is to ensure compliance with the conditions of the environmental authorisation and the EMP.
- The financial provision will be updated on an annual basis and submitted to the DEA.

30 REFERENCES

Airshed Planning Professionals (Pty) Ltd, Air Quality Specialist Report for the Proposed Siyanda Ferrochrome Smelter in the Limpopo Province, September 2016.

Airshed Planning Professionals (Pty) Ltd, Noise Impact Assessment for the Proposed Siyanda Ferrochrome Smelter in the Limpopo Province, August 2016.

Bruce Rubidge BPI, Palaeontological Desktop Study for the Siyanda Chrome Smelting Company Pty. Ltd, December 2015

Julius Pistorius cc, Heritage Impact Assessment for the proposed Siyanda Ferrochrome Smelter, Limpopo Province, August 2016

Mercury Financial Consultants, Economic Impact Assessment for the the proposed Siyanda Ferrochrome Smelter Project, August 2016

Newtown Landscape Architects (NLA) Visual Impact Assessment Report for the proposed Siyanda Ferrochrome Smelter Project, August 2016

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Siyazi, Traffic Impact Assessment for the Proposed Siyanda Ferrochrome Smelter to be located near Northam in the Limpopo Province, February 2016

SLR Consulting (Africa) (Pty) Ltd, Siyanda surface water study, September 2016

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SLR Consulting (Africa) (Pty) Ltd, Waste Type Assessment in support of the Environmental Impact Assessment for the Siyanda Ferrochrome Smelter project, August 2015

SLR Consulting (Africa) (Pty) Ltd, Groundwater Assessment for the Proposed Siyanda Ferrochrome Project, September 2016.

SLR Consulting (Africa) (Pty) Ltd, Closure Plan for the Proposed Siyanda Ferrochrome Project, September 2016.

Synergistics, Social Impact Assessment for the proposed Siyanda Ferrochrome Smelter, Limpopo Province, August 2016

Terra Africa Environmental Consultants, Siyanda Ferrochrome Smelter Project Soil, Land Use and Land Capability Report, March 2016.

Thabazimbi Local Municipality Spatial Development Framework (SDF), September 2014

Waterberg District Municipality Integrated Development Plan (IDP), 2015/16

APPENDIX A: PROOF OF EAP QUALIFICATIONS

APPENDIX B: CURRICULUM VITAE OF EAP

APPENDIX C: COMMENTS AND RESPONSE REPORT

APPENDIX D: STAKEHOLDER ENGAGEMENT DOCUMENTS

- NEMA/NEMWA application form (as amended following extension to timeframes granted by DEA in accordance with Regulation 3(7) of Chapter 2 of the Environmental Impact Assessment Regulations, 2014)
- Stakeholder database
- Notice of intent letter submitted to the DWS
- DEA acceptance letter of integrated application
- Background Information Document (BID) in English and Setswana
- Site notices in English and Setswana and photos of the site notices
- Advertisements placed in the Sowetan and Kwevoel newspapers
- Invitations sent to IAPs to notify them of the public/focussed scoping meeting(s)
- Invitations sent to Regulatory Authorities to notify them of the authorities scoping meeting and site visit
- Minutes of the public scoping meetings (including the attendance registers)
- Minutes of focussed scoping meeting with landowners (including the attendance registers)
- Minutes of the regulatory authorities scoping meeting and site visit (including the attendance register)
- Minutes of pre-application meeting held with DEA Integrated Permitting Division (including the attendance register)
- Minutes of pre-application meeting held with DEA Waste Directorate (including the attendance register)
- Correspondence from the land claims commissioner
- Summary document of the scoping report (in English and Setswana submitted to IAPs and regulatory authorities
- Proof of distribution of the scoping report and summaries to IAPs and regulatory authorities for review and comment
- Comments received during the review of the scoping report by IAPs and regulatory authorities
- DEA scoping report acceptance letter
- Additional information as requested in DEA scoping acceptance letter

APPENDIX E: SOILS AND LAND CAPABILITY ASSESSMENT REPORT (TERRA AFRICA, MARCH 2016)

APPENDIX F: BIODIVERSITY IMPACT ASSESSMENT REPORT (SAS, AUGUST 2016)

APPENDIX G: SURFACE WATER IMPACT ASSESSMENT REPORT (SLR, AUGUST 2016)

APPENDIX H: GROUNDWATER IMPACT ASSESSMENT REPORT (SLR, SEPTEMBER 2016)

APPENDIX I: AIR QUALITY IMPACT ASSESSMENT REPORT (AIRSHED, SEPTEMBER 2016)

APPENDIX J: NOISE IMPACT ASSESSMENT REPORT (AIRSHED, AUGUST 2016)

APPENDIX K: VISUAL IMPACT ASSESSMENT (NLA, AUGUST 2016)

APPENDIX L: TRAFFIC IMPACT ASSESSMENT REPORT (SIYAZI, FEBRUARY 2016)

APPENDIX M: HERITAGE/CULTURAL IMPACT ASSESSMENT REPORT (JULIUS PISTORIUS CC, AUGUST 2016)

APPENDIX N: PALAEONTOLOGICAL IMPACT ASSESSMENT REPORT (BRUCE RUBIDGE, DECEMBER 2015)

APPENDIX O: ECONOMIC LAND USE ANALYSIS (MERCURY FINANCIAL CONSULTANTS, AUGUST 2016)

APPENDIX P: SOCIAL IMPACT ASSESSMENT (SYNERGISTICS, AUGUST 2016)

APPENDIX Q: GEOCHEMISTRY REPORT (SLR, AUGUST 2016)

APPENDIX R: WASTE TYPE ASSESSMENT REPORT (SLR, AUGUST 2016)

APPENDIX S: ENGINEERING DESIGN REPORT FOR SLAG DUMP AND BAGHOUSE SLURRY FACILITY (SLR, SEPTEMBER 2016)

APPENDIX T: CLOSURE PLAN (SLR, SEPTEMBER 2016)

RECORD OF REPORT DISTRIBUTION

Project Number:	710.19057.00001
Title:	ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT FOR THE DEVELOPMENT OF THE PROPOSED SIYANDA FERROCHROME SMELTER
Report Number:	1
Proponent:	SLR Consulting (Africa) (Pty) Ltd

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