global environmental solutions

Proposed Siyanda Ferrochrome Smelter

Closure Plan for the proposed Siyanda Ferrochrome Smelter

SLR Project No.: 710.19057.00002

Report No.: 1

Rev 0

September 2016

Siyanda Chrome Smelting Company (Pty) Ltd

Proposed Siyanda Ferrochrome Smelter

Closure Plan for the proposed Siyanda Ferrochrome Smelter

SLR Project No.: 710.19057.00002

Report No.: 1

Rev 0

September 2016

Siyanda Chrome Smelting Company (Pty) Ltd

DOCUMENT INFORMATION

Title	Closure Plan for the proposed Siyanda Ferrochrome Smelter
Project Manager	S van Niekerk
Project Manager e-mail	svanniekerk@slrconsulting.com
Author	P Smit
Reviewer	S van Niekerk
Client	Siyanda Chrome Smelting Company (Pty) Ltd
Date last printed	2016/10/04 04:27:00 PM
Date last saved	2016/10/04 04:27:00 PM
Comments	Closure Plan Report forms part of overall EMP submission
Keywords	Siyanda, Ferrochrome, Smelter
Project Number	710.19057.00002
Report Number	1
Revision Number	Rev 0
Status	Final
Issue Date	September 2016

EXECUTIVE SUMMARY

This closure plan has been prepared in accordance with the Environmental Impact Assessment (EIA) Regulations of 4 December 2014 (EIA Regulations, 2014) and contains the information required as listed in Appendix 5 of the regulations.

At this stage of the project a closure plan is not actually required in terms of the EIA Regulations, but has none the less being provided for comment and review by interested and affected parties.

The closure plan objectives and principles have been developed against the background of the project location on the Western Limb of the Bushveld Igneous Complex in the Limpopo Province following:

- Environmental damage is minimised to the extent that it is acceptable to all parties involved.
- At closure, the land will be rehabilitated to achieve an end land use capability of arable land, with the Mineralised Waste Facility (MWF) having a land use capability of wilderness.
- All surface infrastructure and material stockpiles will be removed from site after rehabilitation and the MWFs will be covered by appropriately designed covers.
- Contamination beyond the smelter site by wind, surface run-off or groundwater movement will be prevented.
- Final closure is achieved efficiently, cost effectively and in compliance with the law.
- The social and economic impacts resulting from final closure are managed in such a way that negative socio-economic impacts are minimised.

Additional and more specific closure objectives (and/or alternative closure objectives e.g. grazing) 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 ongoing operations of the proposed smelter.

The table below details the requirements of Appendix 5 of the 2014 EIA regulations and also the relevant sections in the report where these requirements are addressed.

2014 EIA Regulations, Appendix 5		**Relevant section in the report**
1.(1)(a)(i)-(ii)	Details and expertise of specialist	Section 1.
1.(1)(b)	Closure objectives	Section 4.2.2.
1.(1)(c)	Monitoring compliance and reporting thereon	Section 11.
1.(1)(d)	Measures to rehabilitate impacted areas	Section 6.
1.(1)(e)	Avoidance, management and mitigation measures for impacts during closure	Section 3.2.
1.(1)(f)(i)-(iv)	Description of pollution management during closure process and ways to comply with legislation and standards	Section 4. & Section 6.
1.(1)(g)	Time line for implementation of the closure plan	Section 7.

1.(1)(h)	Process for managing pollution and excess water	Section 4. & Section 6.
1.(1)(i)(i)-(iv)	Details of public participation	Section 2.3.
1.(1)(j)	Details of financial provision for closure and post closure	N/A

CLOSURE PLAN FOR THE PROPOSED SIYANDA FERROCHROME SMELTER

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

Below a list of acronyms and abbreviations used in this report.

Acronyms / Abbreviations	Definition
BBKTA	Bakgatla-Ba-Kgafela Traditional Authority
BHD	Bag House Dust
BIC	Bushveld Igneous Complex
BPDM	Bojanala Platinum District Municipality
CV	Current Value
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
ECSA	Engineering Council of South Africa
EIA	Environmental Impact Assessment
EMP	Environmental Programme Management
FEPA	Freshwater Ecosystem Priority Area
GNR	Government Notice Regulation
IAPs	Interested and Affected Parties
IBA	Important Birding Area
LFA	Landscape Function Analyses
LP	Limpopo Province
MAR	Mean Annual Runoff
MKLM	Moses Kotane Local Municipality
MTA	Mmantserre Traditional Authority
MWF	Mineralised Waste Facility
NAAQS	National Ambient Air Quality Standard
NDCR	National Dust Control Regulation
NEM:WA	National Environmental Management: Waste Act (No. 59 of 2008).
NFEPA	National Freshwater Ecosystem Priority Area
NWP	North West Province
PCD	Pollution Control Dam
PES	Present Ecological State
PM	Particulate matter
RDL	Red Data Listed
RWD	Return Water Dam
SAS	Scientific Aquatic Services CC
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SCSC	Siyanda Chrome Smelting Company
SLR	SLR Consulting (Pty) Ltd
SMME	Small, medium and micro enterprise
SPLP	Synthetic Precipitation Leaching Procedure
TLM	Thabazimbi Local Municipality
WDM	Waterberg District Municipality
WMA	Water Management Area

CLOSURE PLAN FOR THE PROPOSED SIYANDA FERROCHROME SMELTER

1 SPECIALIST INPUT

1.1 SPECIALISTS THAT PREPARED THE CLOSURE PLAN

The details of the specialists who prepared this closure plan report are provided in Table 1-1 below:

TABLE 1-1: DETAILS OF THE SPECIALISTS

Details	Project Manager and Reviewer	Rehabilitation Specialist
Name:	Stephen van Niekerk	Piet Smit
Tel No.:	011 467 0945	+264 61 231 287
Fax No.:	011 467 0978	+264 61 231 289
E-mail address	svanniekerk@slrconsulting.com	psmit@slrconsulting.com

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

1.2 EXPERTISE OF THE SPECIALISTS

Stephen van Niekerk is a technical manager at SLR, holds a MSc Civil Engineering degree, has over 20 years of relevant experience and is registered as a Professional Engineer (#20010256) with the Engineering Council of South Africa (ECSA). Piet Smit holds a Honours Degree in Agriculture, specialising in Pasture Science and has 18 years of relevant experience.

2 CONTEXT OF THE PROJECT

2.1 MATERIAL INFORMATION

This closure plan has been prepared for Siyanda Chrome Smelting Company (Pty) Ltd (SCSC) in accordance with the 2014 EIA Regulations and contains the information required in Appendix 5 of these regulations. An independent firm of environmental consultants has been appointed by SCSC to undertake the environmental assessment process for the proposed project. This report forms further part of the assessment process.

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 2-1 and Figure 2-2 for the regional and local settings respectively.

The proposed smelter will 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 dam and related facilities such as material stockpiles, workshops, stores and various support infrastructure and services including powerlines, access and internal roads and pipelines.

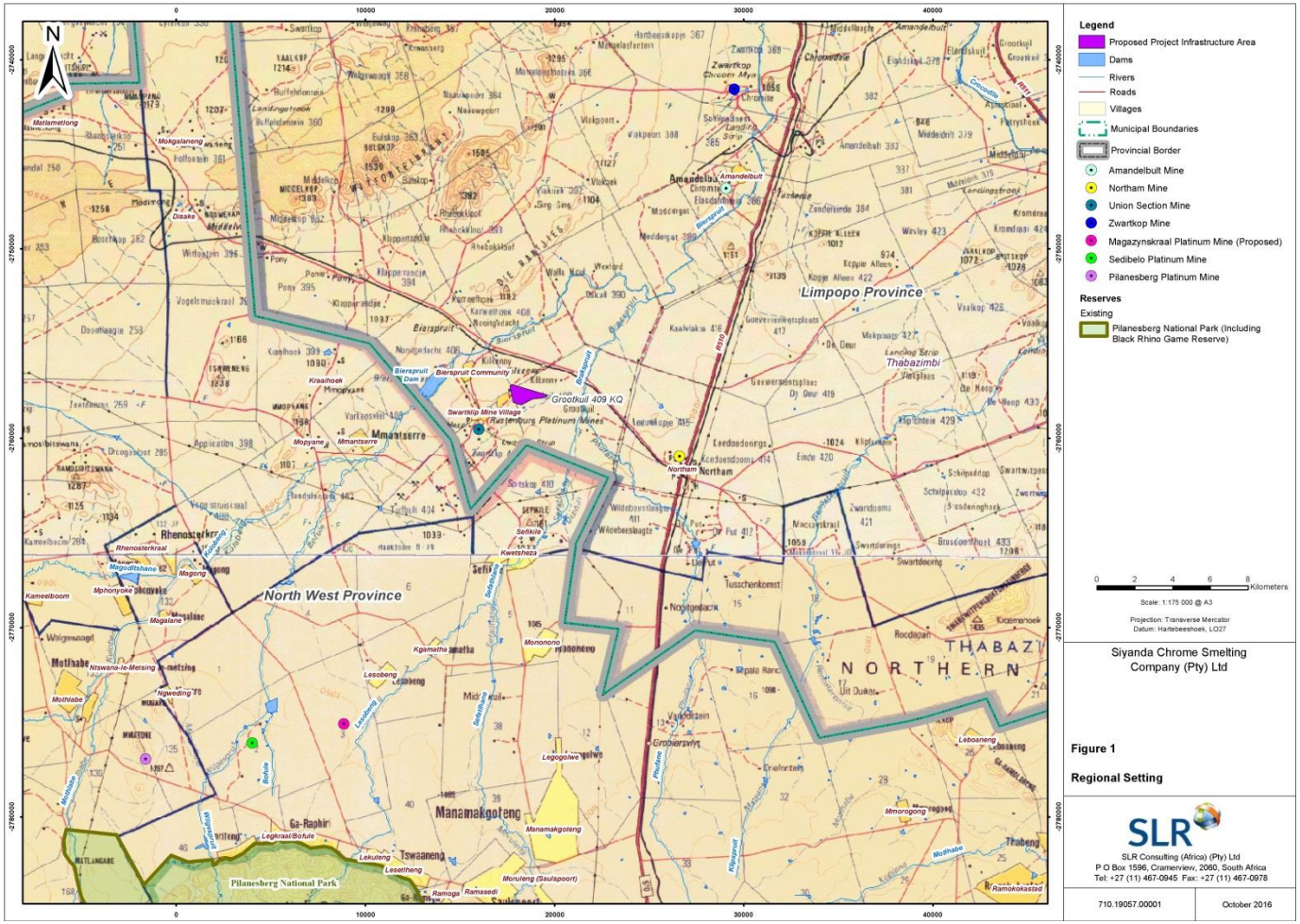


FIGURE 2-1: A MAP INDICATING THE REGIONAL LOCATION OF THE SIYANDA SMELTER SITE

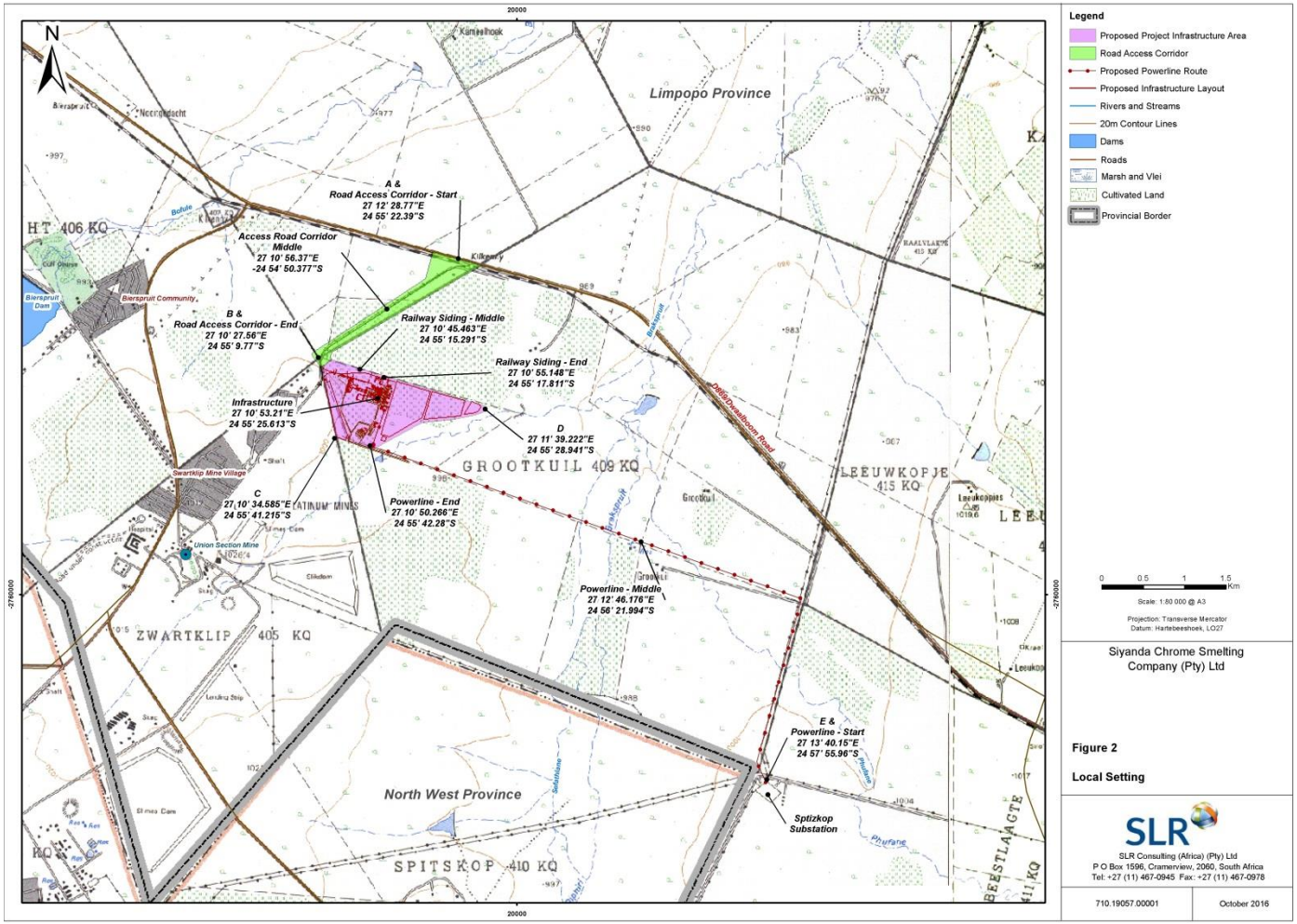


FIGURE 2-2: A MAP SHOWING THE SITE IN THE LOCAL SETTING.

2.2 ENVIRONMENTAL AND SOCIO-ECONOMIC OVERVIEW

The baseline environmental and socio-economic information is briefly summarised below. Additional information can be found in the EIA/EMP report.

2.2.1 TOPOGRAPHY

The elevation of the project area is approximately 1000 metres above mean sea level (mamsl). The site slopes gently to the east, towards drainage channels (Brakspruit tributary), with a relatively low gradient of 1:100 (SLR, 2016).

2.2.2 CLIMATE

The mean annual rainfall is 571mm per annum, falling mainly in the summer months between October and April. Rainfall normally occurs as thunderstorms with limited occurrence of hail in the area. Average daily maximum temperatures range from 32.2°C in December to 22.5°C in July, with daily minimum temperatures ranging from 19.7°C in December to 5.1°C in June. The area is mostly frost free. The mean annual (Lake) evaporation is approximately 1512 mm per annum, as calculated from Symons pan data (SLR, 2016). The predominant wind directions are from the southeast and south-southeast, with slight changes to north easterly winds in autumn (Airshed, 2016).

2.2.3 AIR QUALITY

The main sources likely to contribute to baseline particulate matter (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/pre-development air quality monitoring revealed the following:

- Low NO_2, SO_2, benzene and PM2.5 concentrations that are within National Ambient Air Quality Standard (NAAQS).
- PM10 concentrations at levels that likely exceed short term NAAQS.
- Low dust fall rates, still within the National Dust Control Regulation (NDCR) fall out limits for residential areas.

2.2.4 GEOLOGY

The Siyanda Project Area lies within the western limb of the Bushveld Igneous Complex (BIC), a large, pear-shaped, layered intrusion, located within the Transvaal.

An extract of the 1:250 000 geological map of the Siyanda Project Area (2426 – Thabazimbi) is presented as Figure 2-3. The key formations / lithologies identified in the figure are:

- Bierkraal Magnetite Gabbro
- Pyramid Gabbro-norite
- Mathlagame Norite-anorthosite (SLR, 2016)

Characteristics of the three formations / lithologies are presented in Table 2-1

TABLE 2-1 CHARACTERISTICS OF THE MAIN ROCK TYPES FOUND AT SIYANDA (SLR, 2016)

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%)

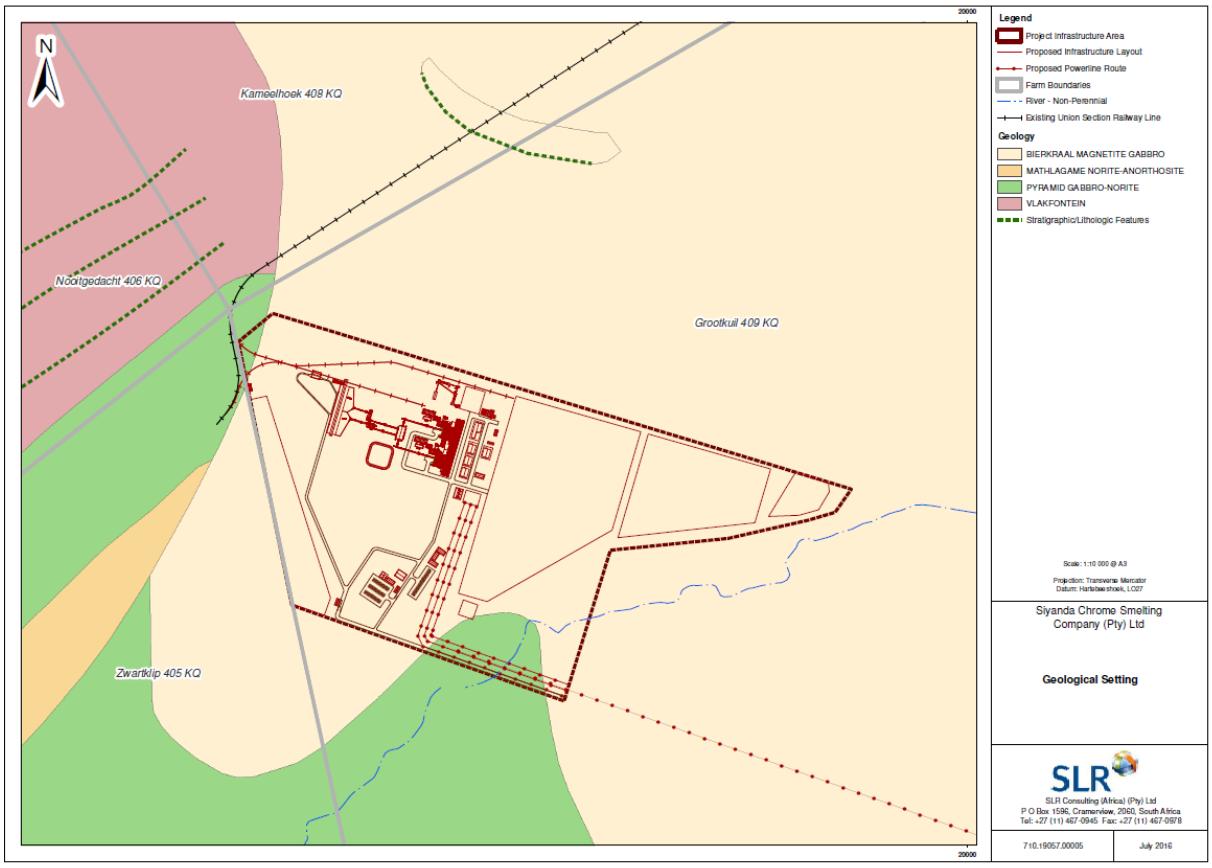


FIGURE 2-3: A MAP SHOWING THE GEOLOGICAL SETTING OF THE SIYANDA SMELTER

2.2.5 GEOCHEMISTRY

The two waste types that will be generated through the ferrochrome smelting process; slag and baghouse dust (BHD) was subjected to leach tests to determine the source term for the groundwater model and to determine other potential hazards that could be posed by the MWFs in which it will be disposed of.

Three slag samples from three different taps done during laboratory test work were analysed:

- Tap 42 was generated during the smelting of the low grade chromite with 13% limestone addition and no silica.
- Tap 75 was generated during smelting of the low grade chromite with a 5% limestone addition.
- Tap 82 was generated during fluxless smelting of the low grade chromite (0% flux) (SLR, 2016).

A BHD sample was obtained from Mogale Alloys, which uses the same smelting process with chrome concentrates from the BIC. It is regarded as indicative of the BHD that can be expected from the Siyanda Smelter (SLR, 2016).

The slag was found to have a low total sulphur content (Maximum of 0.13%) with high neutralizing potential that would offset the acid generating potential. It is regarded is non-potentially acid generating, with a paste pH that is alkaline and only Aluminum being a metal of concern in the Synthetic Precipitation Leaching Procedure (SPLP) test. All three slag samples are regarded as a type 3 waste that requires a Class C liner, based on mostly arsenic (As), barium (Ba), nickel (Ni) and fluorine (F) exceeding the total concentration limit value (SLR, 2016).

The BHD sample had a high (1.8%) total sulphur content together with insufficient neutralising potential to offset the acid potential. It is regarded as potentially acid generating, but has a neutral paste pH. And the chemicals of concern identified in the SPLP leachate were manganese (Mn), lead (Pb), zinc (Zn) and sulphate (SO_4). The baghouse dust is regarded as a Type 1 waste, requiring a Class A liner due to the high total concentration value for Zinc (SLR, 2016).

Both source terms developed for the waste types, as well as the waste characterisation were used in the groundwater modeling and taken into account in the design of the MWFs.

2.2.6 SOILS

The majority of the proposed site (93.7%) is covered by the Arcadia soil form, which consists of a well-developed vertic A-horizon – very well structured clay soils up to 1.5m deep. Small patches (6.3%) of the Bonheim soil form covers the rest of the site – a melanic A-horizon on a pedocutanic B-horizon. The soil fertility for the site is what could be expected, with no salinity or sodicity problems indicated by the chemical analyses. Metal analyses of the soils, which was compared to Soil Screening Values (SSV) as published in GNR 331, does indicate potential risk for copper and manganese contamination (Terra Africa Consult, 2016). The copper and manganese levels listed in the soil specialist report will be used during monitoring after closure to check if increases occurred. It is important to note that closure operations will not be attempting to lower the copper and manganese concentrations.

2.2.7 LAND USE CAPABILITY

The dominating soil form on site is suitable for crop production under dry land – especially cotton and sunflower production. It would also be suited for crop production under irrigation and has a fair carrying capacity for grazing, and; therefore, animal production. The Bonheim soil form, which is the better suited soils for crop production, makes out too small a percentage of the area to be influencing land use capability (Terra Africa Consult, 2016). The current land use for the site is dryland crop production and animal production and the land capability is arable land.

2.2.8 WETLANDS

No soil forms typically associated with wetlands were found on the proposed site by the soil scientist (Terra Africa Consult, 2016). The wetland studies revealed the existence of a riparian system including an unchannelled wetland type feature (partially artificial due to a dam overflow close by).

The feature has a PES category D (largely modified) while the Tributary of Brakspruit and Phufane riparian systems scored as category C/D and C respectively (moderately modified) (SAS, 2016). The background study by SAS (2016) found that the sub-water management area is not regarded as important for fish sanctuaries, rehabilitation or corridors; needed for translocation and relocation zones for fish; and is not listed as a fish Freshwater Ecosystem Priority Area (FEPA).

2.2.9 BIODIVERSITY

The proposed development will be located within the Savanna Biome, the Central Bushveld Bioregion and within the Dwaalboom Thornveld vegetation type (Mucina & Rutherford, 2006 as cited in SAS, 2016), which is considered to be Least Threatened. The site does not fall inside any listed threatened ecosystem; neither does it fall inside any protected areas. The central and eastern portions of the site is located inside a Critical Biodiversity Area 1 (SAS, 2016).

Four broad habitat units were identified by SAS (2016) within the proposed area of development, these being: The Transformed Habitat Unit; The Secondary Bushveld Habitat Unit; The Bushveld Habitat Unit; and, The Wetland/ Riparian Habitat Unit. The Bushveld Habitat Unit takes up the largest area and has been sub-divided into sub-units: 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 important role in flood control within the subject property; Turf Thorn Bushveld; and Mixed Bushveld.

The Wetland/ Riparian Habitat Unit is located in the west and centre of the proposed site and consists of a wetland feature within the west (comprising both natural and artificial portions) and two rivers, namely the Brakspruit River and its associated tributaries and the Phufane River. An ephemeral depression feature is present within the area, as well as several artificial, off-channel dams associated with the Phufane River (SAS, 2016).

Previously disturbed areas that have undergone a measure of natural revegetation, has been regarded as Secondary Bushveld Habitat, while Transformed Habitat is made up out of currently disturbed area of established infrastructure and cultivated land (SAS, 2016).

The following Vegetation Index Scores were allocated to the habitat units by SAS (2016):

- Bushveld Habitat Unit: Class C (Moderately modified); and
- Wetland/ Riparian Habitat Unit: Class C (Moderately modified);
- Secondary Bushveld Habitat Unit: Class D (Largely modified); and
- Transformed Habitat Unit: Class E (The loss of natural habitat extensive);

No national Red Data Listed (RDL) floral species are listed by the South African National Biodiversity Institute (SANBI) to occur in the quarter degree square in which the site is located, though two SANBI RDL floral species, listed as "declining", namely *Vachellia erioloba* (Camel thorn) and *Crinum macowanii*, were encountered within the Bushveld and Wetland/ Riparian Habitat Unit respectively. No *V. erioloba* trees are present within the proposed smelter footprint area, but a number of these species have been encountered within the proposed powerline footprint area. No *C. macowanii* specimens were encountered within the proposed smelter or powerline footprint area. *Bophane disticha*, a SANBI listed RDL species, listed as "declining" has a high probability of occurring on the site. Some species with medicinal value occurs on the site, but these are very common for the area. Some Category 1b alien invasive species were noted, especially occurring in the disturbed areas (SAS, 2016).

The site does not fall inside an Important Birding Area (IBA) but borders on one, with the most significant bird species occurring being the Yellow-throated Sandgrouse (*Pterocles gutturalis*). No RDL listed mammals or other mammal Species of Conservation Concern (SCC) were observed during the field studies. The African Wild Cat could potentially occur on site. Three avifaunal SCC listed as internationally, nationally or regionally threatened were also observed within the boundaries of the proposed development site. These species are *Polemaetus bellicosus* (Martial Eagle) which is listed by the International Union for the Conservation of Nature (IUCN) as Vulnerable, *Coracias garrulous, which* (European Roller), which is listed by the IUCN as Near Threatened and *Pteocles gutturalis* (Yellow-throated Sandgrouse), which is considered to be Near Threatened on a regional scale. The cultivated lands form the preferred habitat for two of the three avifaunal SCC encountered, namely *P. gutturalis* (Yellow-throated Sandgrouse) and *P. bellicosus* (Martial Eagle). Other avifaunal SCC species that may be present within the subject property, either permanently or occasionally, are *Torgos tracheliotos* (Lappet-faced Vulture), *Gyps africanus* (White-backed Vulture), *Gyps coprotheres* (Cape Vulture), *Sagittarius serpentarius* (Secretary bird), *Falco biarmicus* (Lanner Falcon) and *Glareola nordmanni* (Black-winged Pratincole). Although no amphibian SCC were encountered, there exists a possibility that the regionally threatened species, *Pyxicephalus adspersus* (Giant Bullfrog), may occur within the Wetland/ Riparian Habitat Unit. Very low reptile species diversity exists in the area and the only SCC reptile species that could potentially occur is the South African Python (*Python natalensis*) (SAS, 2016).

No invertebrate SCC were observed during the field assessment and literature indicates none to be occurring. SCC arachnid species are not expected to be on the site, due to none being listed for Limpopo Province.

2.2.10 SURFACE WATER

The proposed development site falls within the Bushveld Basin Aquatic Ecoregion and is located within two quaternary catchments, namely A24E and A24F. All wetlands and riparian areas identified are located within quaternary catchment A24E. The NFEPA (2011) database was consulted by SAS (2016) to define the aquatic ecology of the wetland or river systems close to or within the site and it falls within the Crocodile (West) and Marico Water Management Area (WMA). The Sub-Water Management Area indicated for the proposed location is the Lower Crocodile sub-WMA.

Two non-perennial rivers are indicated by the NFEPA database to traverse the proposed site area, namely the Sefathlane River and the Phufane River. These two rivers are tributaries of the Brakspruit River that is situated north of the site (SAS, 2016). The total catchment area of A24E is 688 km^2 and it has a net Mean annual Runoff (MAR) of 9.86 million cubic meters (mcm). There are no quaternary catchments upstream of A24E. An unnamed tributary (referred to from here onwards as the Brakspruit tributary) flows past the southern site boundary to a confluence with the Brakspruit 2km east of the project area (SLR, 2016).

The Brakspruit tributary flows through the Union Mine (located west of the Siyanda project), which features various tailings facilities, waste rock dumps and other surface infrastructure. At the eastern boundary of the Union Mine site, a large return water dam (RWD) exists, which is divided into two compartments and collects all runoff from the Union Mine site. Water from the dam is used as makeup water within the processing plant. A concrete spillway in the dam wall allows for discharges to the Brakspruit tributary, which flows through the Siyanda site. It is assumed that storm water from operational areas estimated to be at least 4.5km^2, will be collected and re-used in accordance with typical best practice. Downstream of the Union Mine, the Brakspruit tributary features several small scale agricultural dams, which typically impound any flow within the watercourse, which will occur following significant rainfall (SLR, 2016).

2.2.11 GROUNDWATER

The Bushveld Igneous Complex (BIC) typically comprises of two aquifer systems:

- 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 (SLR, 2016).

The shallow weathered aquifer can vary in thickness, typically between 12 to 30m (average 15m). It 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, which demonstrates low permeability and can reduce infiltration unless preferential flow paths are opened by vertical desiccation cracks (SLR, 2016).

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 (SLR, 2016).

2.2.12 SOCIAL

Limpopo Province (LP) hosts the farm on which the proposed development will take place, but it is very close to the North West Province border. It falls inside the Waterberg District Municipality (WDM) boundary, and is located in Ward 5 of the Thabazimbi Local Municipality (TLM) with other wards located within a 10km radius of the proposed project being Wards 7 and 8 in TLM, and Wards 5, 7 and 8 in Moses Kotane Local Municipality (MKLM) (Synergistics Environmental Services, 2016). The proposed development site is not located inside an area under control of traditional leaders, but located close to the Bakgatla-Ba-Kgafela Traditional Authority (BBKTA) and Mmantserre Traditional Authority (MTA).

WDM is geographically, the largest municipality in the LP but has the smallest population compared to the other districts. The WDM population constitutes 12.6% of the total population of LP, with an average household size of 3.5.

The TLM constitutes approximately 12.5% of the total population of the WDM with an average household size of 2.8. Between 2001 and 2011, the population growth rate was 0.8% at the Provincial level followed by 1.2% at the District level and TLM has the highest growth rate of 2.6% (Synergistics Environmental Services, 2016). The Bojanala Platinum District Municipality (BPDM) population constitutes 42% of the population of NWP with an average household size of 2.9 and a 2.2% growth rate. The MKLM population constitutes approximately 16% of the BPDM population with an average household size of 3.2 and 0.2% growth rate.

The overall population in LP is young with the majority (60%) being below 35 years of age and there are more females than males (54% and 46%, respectively). At the municipal levels, the population is also young, where approximately 65% are younger than 35 years of age. There are more males in WDM (50.5% of the population) and TLM (58.5% of the population). According to StatsSA (Census 2011 as cited in Synergistics Environmental Services, 2016), Black Africans comprise the majority of the population (96.8%) in the LP followed by Whites (2.6%), and Coloureds and Indian/Asians (0.3%). A similar pattern is observed at the municipal levels. The majority of the population in LP, WDM and TLM (59.8%, 64.3% and 63%, respectively) is within the working age group (15 to 64 years); there is a notably higher percentage at the District and Local Municipality levels, probably linked with in-migration in search of employment opportunities (Census 2011 as cited in Synergistics Environmental Services, 2016). Dependency ratios in LP, WDM and TLM are estimated to be 67.3%, 55.5% and 30.8%, respectively; the significant difference in dependency is likely to reflect the high number of migrants in TLM.

The population of NWP, BPDM and MKLM is also young with an average of 58% being under 35 years of age. There are also more male residents in the NWP (50.7% of the population) and in BPDM (57.8% of the population). There are marginally more females in MKLM (50.2%). Black Africans comprise the majority population group in the NWP (90%) followed by Whites (7.3%), Coloureds (2%), and Indian/Asians (0.6%). The majority of the population in NWP, BPDM and MKLM (64.7%, 68% and 63%, respectively) is within the working age group. Dependency ratios in NWP, BPDM and MKLM are estimated at 54.5%, 47.3% and 58.6% respectively; these are quite different to those observed in LP, WDM and TLM. Given the diversity in the area resulting from in-migration, many languages are spoken. The general levels of education in the area are low, though slightly higher than the education levels reported for the total province (Synergistics Environmental Services, 2016).

2.3 STAKEHOLDER ISSUES AND COMMENTS

A summary of the issues and concerns raised by interested and affected parties (IAPs) and regulatory authorities (taken from the final scoping report and updated in the EIA) that have specifically informed the closure plan is provided in Table 2-2 below.

TABLE 2-2 SUMMARY OF ISSUES RAISED BY IAPS AND REGULATORY AUTHORITIES

ISSUE RAISED	BY WHOM AND WHEN	RESPONSE GIVEN BY PROJECT TEAM (as amended/incorporated for the purposes of the scoping report submission)
Groundwater and Surface Water issues		
What will happen if groundwater and surface water is contaminated by the proposed smelter plant?	Comment raised by Sello Mogale at scoping meeting, Mmansterre, 21 July 2015	It is not expected that the project will result in surface water contamination.
Are you saying that there will not be any pollution in the rivers?	Comment raised by Sandy McGill, Mr and Mrs Schoeman at the scoping meeting, Swartklip Rec Centre, 21 July 2015	
Biodiversity issues		
I feel lucky to come home/retire in place that has such rich biodiversity, and this is being destroyed by projects in the area.	Comment raised by Hannes Olckers at scoping meeting, Northam Town Hall, 23 July 2015	It is expected that potential biodiversity impacts associated with the project will be limited with correct mitigation/management measures.
We are concerned about the biodiversity. It does not just include the larger more easily visible animals. What about the bees and those parts of nature which are not easily seen?	Comment raised by Adri Young at scoping meeting, Northam Town Hall, 23 July 2015	

ISSUE RAISED	BY WHOM AND WHEN	RESPONSE GIVEN BY PROJECT TEAM (as amended/incorporated for the purposes of the scoping report submission)
I am concerned about the conservation of the rich birdlife in the area. On our farm, there is a bird species of Fluff-tail which is found nowhere else in the country.	Comments raised by Sandy McGill, Mr and Mrs Schoeman at the scoping meeting, Swartklip Rec Centre, 21 July 2015	
There are more protected trees in this area than you mentioned in your presentation.	Comments raised by Sandy McGill, Mr and Mrs Schoeman at the scoping meeting, Swartklip Rec Centre, 21 July 2015	It should be noted that during the scoping level public engagement phase of the project, specialist studies had not yet been completed and in this regard most of the baseline environment details were sourced from national databases. With the subsequent completion of the specialist studies (for the purposes of the EIA), greater depth and detail on the current biodiversity status has been sourced.
Air quality issues		
We are concerned about air quality impacts	Comment by Philip Schoeman and Pier De Vries during focused scoping meeting with Union Mine, 13 May 2015	On the issue of air quality impacts, it is expected that with the correct mitigation/management measures (such as dust suppression, covering of materials handling points, tarring of the access road etc.), air quality impacts can be reduced to acceptable levels. The issue of veld condition is linked to dust fallout impacts. With excessive fallout veld condition can deteriorate. It is expected that with the correct mitigation/management measures (such as dust suppression, covering of materials handling points, tarring of the access road etc.), dust fallout impacts can be reduced to acceptable levels
I am concerned about the air quality impacts and how far the pollution will travel from the proposed smelter.	Comment raised by William Segone at scoping meeting, Mmansterre, 21 July 2015	
We are concerned about the dust fallout and the impacts that it might have on the receiving environment.	Comments raised by Sandy McGill, Mr and Mrs Schoeman at the scoping meeting, Swartklip Rec Centre, 21 July 2015	
Dust from existing mines is already an issue for neighbouring farmers. There is active monitoring done by the mines however according to the regulations the mine dust is under the exceedance limits. This does not make sense because we still experience veld deterioration due to the dust.		

ISSUE RAISED	BY WHOM AND WHEN	RESPONSE GIVEN BY PROJECT TEAM (as amended/incorporated for the purposes of the scoping report submission)
Soil issues		
It is common knowledge that a Ferrochrome Smelter is associated with, amongst others: ground pollution.	Comment raised by Ernst Burger (on behalf of the Schoeman family, the beneficiaries of a Testamentary Trust) – draft scoping report comments, received on the 04 May 2016	Information on baseline soil conditions in the area is provided in Section 2.2.6 of this report. It is expected that with correct management and mitigation measures (such as limiting the area of disturbance, correct stockpiling of topsoil resources etc.), soil related impacts will be limited.

2.4 SMELTER OPERATIONAL PLAN AND SCHEDULE

The proposed Siyanda project is a greenfield project that will be initiated by a construction phase. The following operations are planned during this initial phase:

- Site establishment of construction phase 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
- Collection, storage and removal of construction related waste
- Construction of all infrastructure required for the operational phase
- Transportation of construction phase materials and staff (via existing roads and roads to be built for the purposes of the project) (SLR, 2016)

The construction phase will be followed by the operational phase, which is planned for 30 years of operation and will entail two 70MW DC furnaces that will be used to process approximately 850 000 tons per annum of UG2 chrome concentrate from nearby chrome recovery plants. Table 2-3 below summarises the activities associated with the smelting process. A simplified conceptual flow diagram is illustrated in Figure 2-4.

The following infrastructure will be in place:

- 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 dam
- Pollution Control dam
- Substation
- Filter Yard
- Storm water management infrastructure
- Emergency fire water tank
- Process water dam
- 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 stockpile

- Sewage treatment /containment facility.
- Reverse osmosis water treatment plant
- Fencing.

TABLE 2-3: 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 after which clean gas will be emitted to the atmosphere. Baghouse dust which cannot be emitted to the atmosphere 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 after which clean gas will be emitted to the atmosphere. Baghouse dust which cannot be emitted to the atmosphere will be returned to the raw materials system for processing.
Pre-heating	Smelter feed material will be pre-heated prior to smelting. Baghouse dust which cannot be cleaned and flared will be collected and disposed onto a mineralised waste facility (MWF) or 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 various plant processes and remaining off-gas will be flared. Baghouse dust which cannot be flared or used as a source of energy will be collected, moistened and disposed onto a MWF.
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 transported to a MWF.
Crushing and screening	The tapped metal will then move through a crushing and screening plant where it will be broken into sizeable ingots (weighing approx.6 tons) and allowed to cool.
Transportation of product	Product will be loaded at the railway siding and dispatched to market via train.
Tapping of slag and containment of baghouse dust (and disposal onto slag dump and baghouse slurry dam)	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 dust from taphole extraction (as well as the furnace off-gas) will be transported to a baghouse dust disposal facility. Prior to disposal, water will be added to the baghouse dust material (in an agitator) and the slurried material will be pumped via a pipeline to the baghouse slurry dam.

ACTIVITY	DESCRIPTION
Dust suppression	Dust suppression will be utilised at all material handling transfer points, as required.

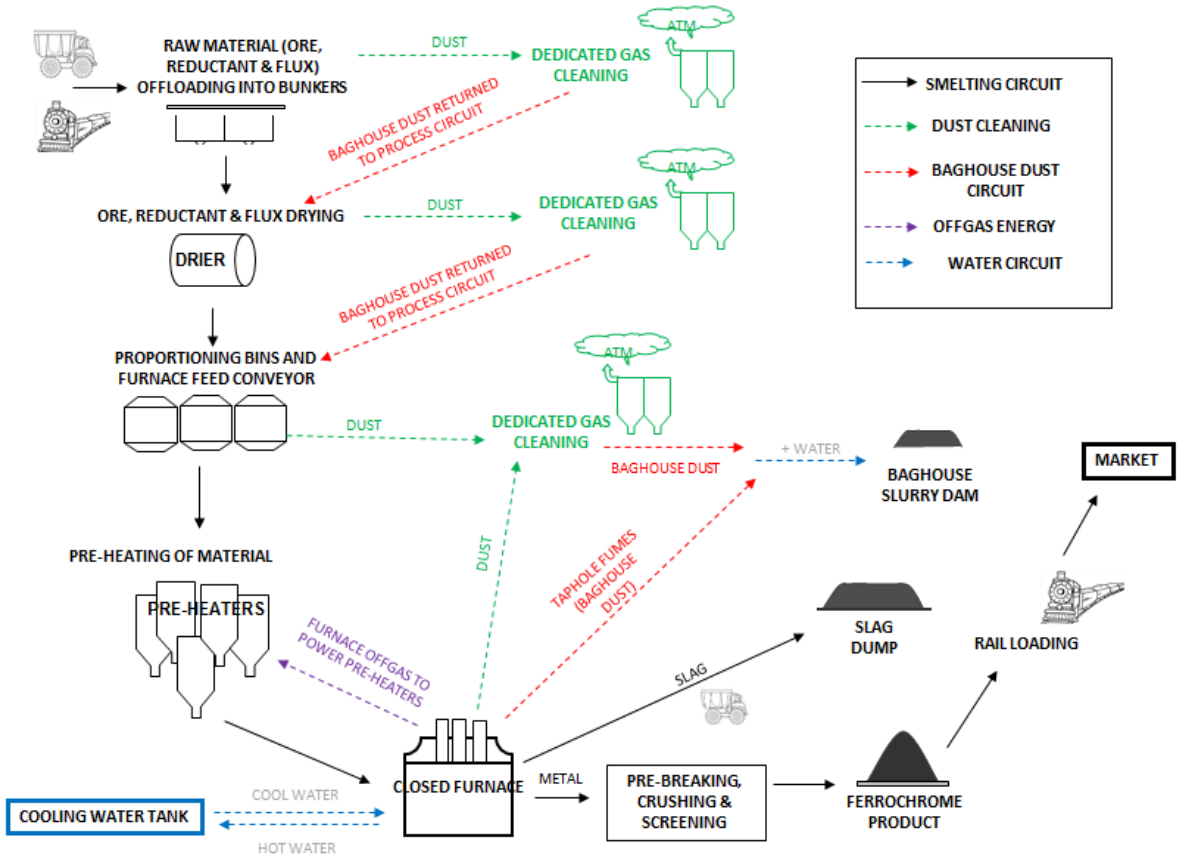


FIGURE 2-4 A FLOW DIAGRAM OF THE SMELTER ACTIVITIES TO BE UNDERTAKEN DURING THE OPERATIONAL PHASE (SLR, 2016)

The total surface area of disturbance for the operational footprint is roughly 110.77 ha. This is broken down as indicated in Table 2-4.

TABLE 2-4: A LIST OF INFRASTRUCTURE FOR THE OPERATIONAL PHASE OF THE SIYANDA SMELTER PROJECT AND THE AREAS COVERED BY IT:

Infrastructure	Area disturbed
Furnaces	12 630 m^2
Crushing and screening plant	800 m^2
Ingot cooling pad	4 875 m^2
Service yard	1 000 m^2

Stores	1 000 m^2
Workshops	1 950 m^2
Diesel, lubricants and propane gas storage	200 m^2
Laboratory	250 m^2
Slag dump	224 025 m^2
Baghouse slurry dam	108 650 m^2
Return water dam	17 075 m^2
Substation	875 m^2
Filter Yard	2 000 m^2
Storm water management infrastructure	Included in paved areas
Emergency fire water dam	100 m^2
Process water dam	6 400 m^2
Potable water reservoir/tank	100 m^2
Change house	750 m^2
Clinic	400 m^2
Offices	1 600 m^2
Raw materials offloading area	750 m^2
Railway siding	1 800 m
Roads (access road incl.)	62 820 m^2
Powerline	8 230 m
Conveyors	1 500 m
Pipelines	4 020 m
Cooling system (tanks and fans)	Included in furnace structures
Topsoil stockpile	65 988 m^2
Sewage treatment/containment facility	2 500 m^2
Fencing	5 050 m
Other indirectly disturbed areas inside the development footprint	166 135 m^2

2.4.1 LIFE OF SMELTER

The life of the smelter is planned for 30 years at this stage (SLR, 2016).

2.4.2 AREAS OF DISTURBANCE

The proposed areas of disturbance associated with the Siyanda Project are shown in Figure 2-5, Table 2-4 (and Appendix A).

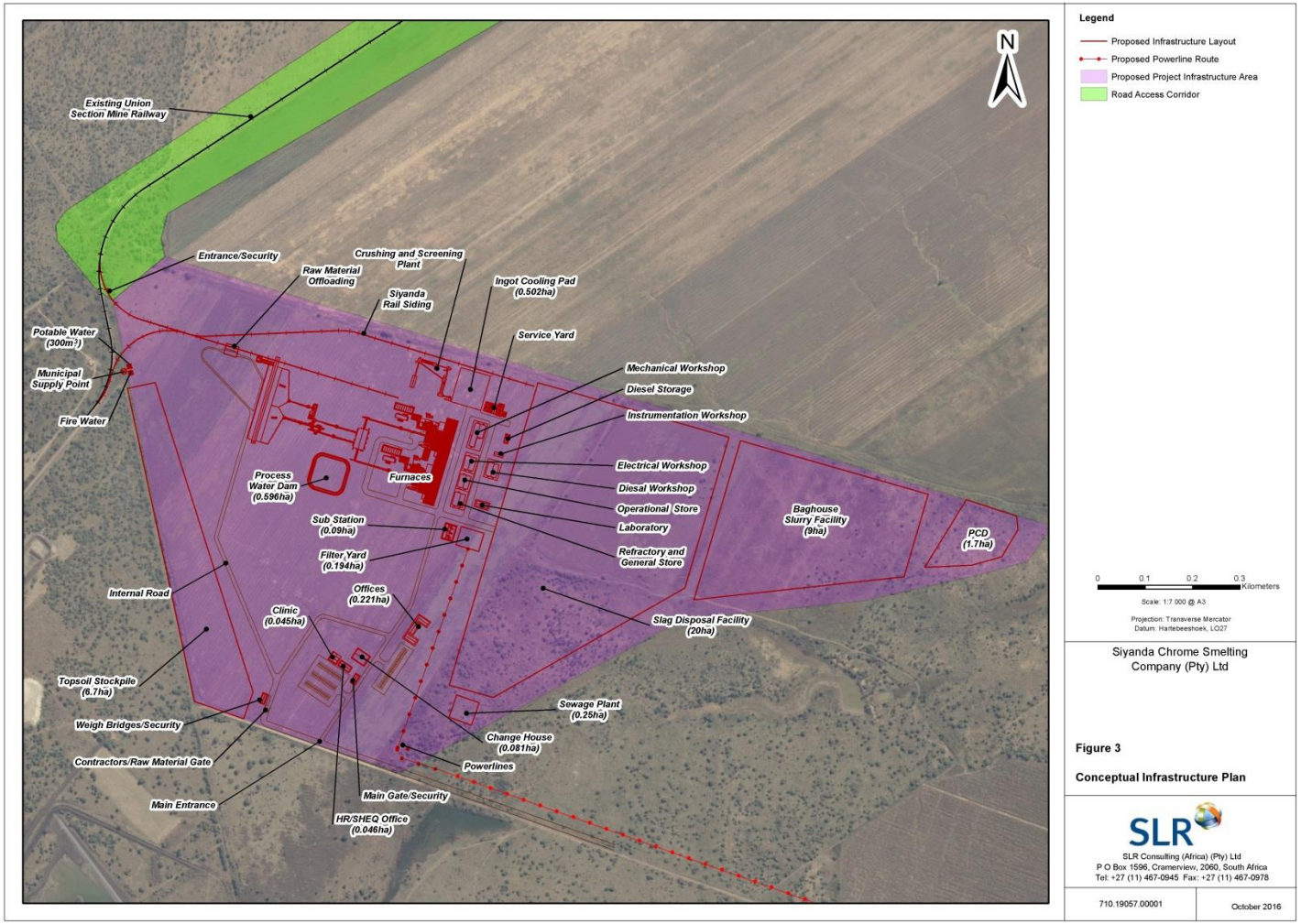


FIGURE 2-5: INFRASTRUCTURE LAYOUT FOR THE SIYANDA SMELTER PROJECT

3 ENVIRONMENTAL RISK ASSESSMENT

3.1 RISK ASSESSMENT METHODOLOGY

An Environmental Impact Assessment is being carried out for the ferrochrome smelter project. Potential environmental impacts were identified by SLR and other stakeholders, and considered in a cumulative manner such that current baseline conditions on site and in the surrounding area were discussed and assessed together.

The assessment methodology used (see Section 9 of the EIA/EMP report) enabled the assessment of environmental impacts, looking at the severity of impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of the impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated.

The findings of the EIA indicated that all potential impacts can be prevented or reduced to acceptable levels by mitigation.

3.2 IDENTIFICATION OF STRATEGIES TO MANAGE AND MITIGATE THE IMPACTS AND RISKS

The environmental impacts at the Decommissioning and Closure phases:

- Hazardous excavations and infrastructure
- Loss and sterilization of mineral resources
- Loss of soil resources and land capability through contamination
- 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 resources
- Air pollution
- Noise pollution
- Road disturbance and traffic safety
- Negative visual impacts
- Loss of or damage to heritage/cultural and palaeontological resources
- Positive socio-economic impacts (Economic impact)
- Negative socio-economic impacts (Inward migration)
- Change in land use

The assessment of these impacts and associated risk, in the unmitigated and mitigated scenario, are presented in Table 3-1. If all the mitigation measures as per the EIA/EMP report are successfully implemented, then it is anticipated that there will be no latent or residual environmental impacts.

Adherence to the mitigation measures identified in Table 3-1 are the drivers that will result in the elimination and/or reduction of these impacts and the associated risks.

TABLE 3-1: POTENTIAL IMPACT SUMMARY DURING DECOMMISSIONING AND CLOSURE, INCLUDING MITIGATION MEASURES

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO THE LOSS AND STERILISATION OF MINERAL RESOURCES					
Decommissioning	Mineralised waste	**H**	**L**	To avoid sterilisation of mineral resources to prevent unacceptable mineral sterilisation.	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.
Rehabilitation /closure	Maintenance and aftercare of rehabilitated areas				
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO HAZARDOUS EXCAVATIONS AND INFRASTRUCTURE					
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Support services Demolition Rehabilitation	**H**	**L**	To prevent physical harm to third parties and animals from potentially hazardous excavations and infrastructure.	During the decommissioning planning, provision will be made to address long term safety risks in the decommissioning and rehabilitation phases.
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 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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH CONTAMINATION					
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Support services General site management Demolition Rehabilitation	**H**	**L**	To prevent soil pollution as a first priority and to remedy any pollution should it occur.	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. During the decommissioning phase, a land contamination assessment must be conducted. SCSC will ensure that the handling and disposal of general and hazardous waste is undertaken in accordance with the waste management procedures.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
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. During the rehabilitation/closure phase, inspections will be undertaken to ensure that the management/mitigation actions as described have satisfied the objectives of the closure plan.
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO LOSS OF SOIL RESOURCES AND LAND CAPABILITY THROUGH PHYSICAL DISTURBANCE					
Decommissioning	Power supply and use Water supply and use Mineralised waste Support services General site management Demolition Rehabilitation	**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 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 and the detailed SCSC soils management procedure. • To prevent the erosion of topsoils, management measures may include berms, soil traps, hessians and storm water 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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
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 have satisfied the objectives of the closure plan.
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO PHYSICAL DESTRUCTION OF BIODIVERSITY					
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services Demolition Rehabilitation	**H**	**M**	To prevent the unacceptable loss of biodiversity and related ecosystem functionality through physical destruction.	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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
					○ 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 from 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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		○ 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 will 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. • 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. • 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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		• Soils ○ Soils will be managed in accordance with the mitigation measures/actions outlined in the EMP. • Waste ○ Waste will be managed in accordance with the measures outlined in the EMP. • 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. ○ 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. ○ 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 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 LEDET or the DEA respectively.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		• Fire o Informal fires in the vicinity of development construction areas will be prohibited. • Fauna o 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. o 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 o 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. o 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. o 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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	**M**		
					○ 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 ensure that wetland and riparian functions are re-instated to at least pre-development conditions.
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 have satisfied the objectives of the closure plan.
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO PHYSICAL DESTRUCTION OF BIODIVERSITY					
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services Demolition Rehabilitation	**H**	**M**	To prevent the unacceptable loss of biodiversity and related ecosystem functionality through physical destruction.	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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		○ 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 from 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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		○ 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. • Soils ○ Soils will be managed in accordance with the mitigation measures/actions outlined in 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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
					○ 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. • Vehicles: ○ Vehicles will 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. • 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 the EMP • 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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		○ 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 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

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
					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. ○ 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 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. This issue will be revisited as part of the detailed closure planning for the project.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	**M**		
					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.
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO GENERAL DISTURBANCE OF BIODIVERSITY					
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste Support services Demolition Rehabilitation	**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 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. • 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 described for dust control lower down. • Noise related impacts will be managed in accordance with mitigation measures/actions described lower down. • Impacts relating to littering will be managed in accordance with mitigation measures/actions described in the EMP.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
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. In addition, post closure monitoring will be undertaken in accordance with the monitoring requirements.
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO ALTERATION OF NATURAL DRAINAGE PATTERNS					
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services Demolition Rehabilitation	**H**	**M to L**	To prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow.	In all 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. Prevention of contamination and containment of potential pollution sources will be achieved as described in the EIA. Water management facilities for the control of storm water 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, which would be are applicable to the storm water 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

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
					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 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 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.
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO POLLUTION OF SURFACE WATER RESOURCES					
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management	**H**	**L**	To prevent pollution of surface water resources and related harm to surface water users.	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. Prevention of contamination and containment of potential pollution sources will be achieved.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
	Support services Demolition Rehabilitation				The clean and dirty water systems 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 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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
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. In addition, post closure monitoring will be undertaken in accordance with the monitoring requirements.
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO REDUCTION OF GROUNDWATER LEVELS AND AVAILABILITY					
Decommissioning	Water supply and use	**L**	**L**	To prevent water losses to third party water users.	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.
Rehabilitation /closure	N/A				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. In addition, post closure monitoring will be undertaken in accordance with the monitoring requirements.
ACTION PLAN – CONTAMINATION OF GROUNDWATER					
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services Demolition	**M**	**L**	To prevent pollution of groundwater resources and related harm to water users (people, animals and biodiversity).	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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
	Rehabilitation				• 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 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 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. In addition, post closure monitoring will be undertaken in accordance with the monitoring requirements.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO AIR POLLUTION					
Decommissioning	Smelter plant Transport systems Power supply and use Mineralised waste Non-mineralised waste management Support services Demolition Rehabilitation	**H**	**M**	To manage the generation of air quality impacts such that third party receptors do not experience air pollution exceedances.	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: ○ 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).

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		• Dust Control Options for Paved Roads ○ In selecting a suitable sweeper, close attention will be paid to the PM10 collection efficiency of the machine. Factors in addition to PM10 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 manoeuvrability. 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, Cr6+ 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. 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 sources as part of equipment maintenance schedules. • Ambient Air Quality Monitoring ○ As a minimum continuous dust fallout, PM10, PM2.5 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. ○ The same methods employed for baseline/pre-development sampling are recommended. These include:

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
					▪ 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 PM10 and PM2.5 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.
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.
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO NOISE POLLUTION					
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services Demolition Rehabilitation	**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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
Rehabilitation /closure	Maintenance and aftercare of rehabilitated areas				• 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: o Minimizing individual vehicle engine, transmission and body noise/vibration. This is achieved through the implementation of an equipment maintenance program. o Minimise slopes by managing and planning road gradients to avoid the need for excessive acceleration/deceleration. o Maintain road surface regularly to avoid corrugations, potholes etc. o Avoid unnecessary idling times. o 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 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. • Operational hours o 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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	**M**		
					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.
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO TRAFFIC IMPACT (ROAD DISTURBANCE AND TRAFFIC SAFETY)					
Decommissioning	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 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:

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
					• 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.
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.
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO VISUAL IMPACTS					
Decommissioning	Smelter plant Transport systems Power supply Water supply Mineralised waste Non-mineralised waste management Support services	**H**	**M to L**	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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
	General site management Demolition Rehabilitation				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: o Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the project area. o 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. o Minimise the amount of light fixtures to the bare minimum, including security lighting.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
					○ 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 from views. At closure, mineralised waste facilities will be rehabilitated 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.
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO DESTRUCTION OF HERITAGE, PALAEONTOLOGICAL AND CULTURAL RESOURCES					
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	**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 palaeontological 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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	**M**		
					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.
Rehabilitation /closure	Maintenance and aftercare of rehabilitation areas				N/A
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO INWARD MIGRATION AND NEGATIVE SOCIAL IMPACTS					
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	**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 (e.g. 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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		• 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

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
					○ 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 within 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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		• 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

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
					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.
Rehabilitation /closure	Maintenance and aftercare of rehabilitated areas				During the rehabilitation/closure phase, it will be ensured that the management/mitigation actions as described above have satisfied the objectives of the closure plan.
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO ECONOMIC IMPACT					
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management Support services General site management	**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

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	**M**		
	Demolition Rehabilitation				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.
Rehabilitation /closure	Maintenance and aftercare of rehabilitated areas				During the rehabilitation/closure phase, it will be ensured that the management/mitigation actions as described above have satisfied the objectives of the closure plan.
ACTION PLAN FOR THE POTENTIAL IMPACT RELATING TO LAND USE IMPACTS					
Decommissioning	Smelter plant Transport systems Power supply and use Water supply and use Mineralised waste Non-mineralised waste management	**H**	**M to L**	To prevent unacceptable negative impacts on surrounding land uses.	SCSC will implement mitigation measures described in the table above 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.

Phase of operation	Activities	Impact Significance		Standard to be achieved (Impact management statement /outcome /objectives)	Technical and management actions and compliance with standards
		UM	M		
	Support services General site management Demolition Rehabilitation				
Rehabilitation /closure	Maintenance and aftercare of final landforms				During the rehabilitation/closure phase, it will be ensured that the management/mitigation actions as described above have satisfied the objectives of the closure plan.

3.3 IDENTIFICATION OF INDICATORS

Five key indicators have been defined which will facilitate evaluation of closure objectives having been met by Siyanda. These key indicators can be evaluated through analysis of ongoing monitoring results and are:

- Surface water quality
- Groundwater quality
- Air quality
- Dump cover stability / Land Function Analyses score
- Vegetative cover/agronomic production.

The first indicator, surface water quality, is an important measure of the overall effectiveness of mitigation activities (for the entire smelter site, and particularly for the latent environmental impact of any seepage water migration and contaminated storm water from the MWF) and for protecting the health and safety of neighbouring and/or downstream land users, livestock and wildlife.

The second indicator, groundwater quality, is an important measure of the effectiveness of mitigation activities (particularly for the latent environmental impact of groundwater associated with the seepage of contaminated water from the MWF) and for protecting the health and safety of neighbouring and/or groundwater users, including livestock and wildlife that might be reliant on groundwater.

Air quality will be important to monitor, supplying information on the effectiveness of the MWF covers to stop wind entrained pollution from the site. It also will have a secondary role indicating whether rehabilitation measures for the rest of the site has adequately stabilised soil surfaces.

While dump cover stability will to a large extent be evaluated by the above three indicators, it will, be important to specifically check the dump cover on a regular basis for ensuring early corrective action can be taken once problems are identified. The use of Landscape Function Analyses, calibrated for dump covers, would give a trackable indication of cover function changes over time and whether adequate improvement occurs as the cover matures.

The final indicator, vegetative cover/agronomic production, is highly correlated with all the other major environmental parameters of the area, including erosion, dust, physical stability, chemical stability, soil quality and hydrology. Good vegetative cover results in a reduction in the volume of surface runoff, increases soil and slope stability, and leads to the formation of an organic layer. In addition, vegetative growth is visually correlated with successful rehabilitation (and/or protection of the surrounding environment).

Vegetative cover is an extremely important indicator because it provides a simple, very effective and relevant measure of the lands' current (and/or future) capability. Agronomic production figures in line with the regional production potential will indicate successful arable land use capability being reinstated.

The monitoring plan for rehabilitation can be viewed in Appendix B.

3.4 REASSESSMENT OF RISKS

An environmental monitoring programme will be implemented during the life of the project to provide early warning systems necessary to avoid environmental emergencies, and for informing continual improvement of the smelter closure plan. The following will be monitored in relation to closure:

- Soil resources
- Surface water resource quality
- Groundwater resource quality
- Air quality
- Biomonitoring of surface water sources
- Soil and slope stability

The SHE manager will ensure that internal management audits against the commitments in the EMP gets done. These audits will be conducted on an on-going basis until final closure. The audit findings will be documented, with corrective actions assigned and tracked for progress.

4 CLOSURE DESIGN PRINCIPLES

4.1 LEGAL AND GOVERNANCE FRAMEWORK

This smelter closure plan has been drafted in accordance with the 2014 EIA regulations and complies with the requirements of Appendix 5 of these regulations, for inclusion in the Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP) report being submitted for the proposed Siyanda Project.

4.2 VISION, OBJECTIVES AND TARGETS FOR CLOSURE

The vision, objectives and targets for closure have been developed against the local environmental and socio-economic context of the proposed project, as well as, regulatory requirements and perceived stakeholder expectations.

Stakeholders will continuously be involved in the closure planning process throughout the smelter life. The smelter will strive to maintain a good working relationship with stakeholders and the local communities in which it operate. Agreements and final approval will be sought from authorities as closure approaches.

4.2.1 VISION FOR CLOSURE

The vision for closure is to minimise the impacts associated with the closure and decommissioning of the smelter and to restore the land to a useful land use. At this stage, the proposed post closure land use capability (for areas disturbed by the smelter activities) will be a combination of arable and wilderness, recreating habitat for the Yellow-throated Sandgrouse (*Pterocles gutturalis*).

4.2.2 OBJECTIVES FOR CLOSURE

The closure plan objectives and principles have been developed against the background of the project location in the Limpopo Province on the western limb of the BIC, and include the following:

- Environmental damage is minimised to the extent that it is acceptable to all parties involved.
- At closure, the land will be rehabilitated to achieve an end use of arable and wilderness.
- All surface infrastructure and material stockpiles will be removed from site after rehabilitation, with exception of the mineralised waste facilities.
- Mineralised Waste Facilities will be covered appropriately according to best practice.
- Contamination beyond the smelter site by surface run-off, groundwater movement and wind will be prevented.
- Final closure is achieved efficiently, cost effectively and in compliance with the law.
- The social and economic impacts resulting from final closure are managed in such a way that negative socio-economic impacts are minimised.

Additional and more specific closure objectives (and/or alternative closure objectives e.g. grazing) 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 ongoing operations of the proposed smelter.

4.2.3 TARGETS FOR CLOSURE

The closure target outcomes for the proposed smelter project site are therefore assumed to be as follows:

- Achieve chemical, physical and biological stability for an indefinite, extended time period over all disturbed landscapes and residual mining infrastructure.

- Protect surrounding surface water, groundwater, soils and other natural resources from loss of current utility value or environmental functioning.
- Maximise visual 'harmony' with the surrounding landscape.
- Create a final land use that has economic, environmental and social benefits for future generations that outweigh the long term aftercare costs associated with the smelter.

4.3 ALTERNATIVE CLOSURE OPTIONS

The closure options that have been considered at this stage are presented in Table 4-1. The options currently selected are highlighted in grey.

TABLE 4-1: A LIST OF ALTERNATIVE CLOSURE OPTIONS CONSIDERED FOR THE SMELTER

Aspect	Options Considered	
Post closure land-use of smelter footprint areas	A	Arable
	B	Wilderness
	C	Grazing
	D	Leave heavy infrastructure for other post closure heavy industry
Workshop, stores, other smelter buildings	A	Leave for small business development (e.g. light engineering, baking, laundry services, paper recycling, taxi operations, timber products etc.)
	B	Demolish and rehabilitate area
Mineralised waste facilities	A	Wilderness
	B	Re-use/Sale of mineralised waste
	C	Grazing
Administrative block	A	Leave for small business development (e.g. call center, centralized office services, teaching and training college etc.)
	B	Demolish and rehabilitate area
Main and internal access roads	A	Retain for access and/or to support post closure land use
	B	Demolish and rehabilitate area
Water holding facilities	A	Retain for use after closure
	B	Demolish and rehabilitate area

Option currently selected

4.4 MOTIVATION FOR PREFERRED CLOSURE OPTION

4.4.1 POST CLOSURE LAND USE

The bulk of the proposed smelter project surface use area currently comprises cultivated land which borders a riparian system. The area can to a large extent be returned to this land use capability, once all infrastructure has been removed and the fields should be cultivated as soon as possible after closure, creating habitat for the Yellow-throated Sandgrouse (*Pterocles gutturalis*). The mineralised waste facilities will be rehabilitated to a wilderness land use capability.

4.4.2 TREATMENT OF DECANT WATER

No decant water should be associated with the project after closure.

4.4.3 ALTERNATIVE POST CLOSURE OPTIONS FOR INFRASTRUCTURE

No alternative closure and post closure options for smelter infrastructure have been considered at this stage (e.g. industrial development, SMME development, housing, recreational facilities, forestry, electricity generation etc.). Any alternative and practical closure and post closure options for smelter infrastructure will be further investigated during the ongoing operations of the proposed smelter.

The feasibility of alternative closure options will need to be considered in terms of: sustainability of land use, engineering and environmental aspects, monitoring requirements, capital costs, post closure support services and available institutional capacity and skills.

4.5 MOTIVATION FOR CLOSURE AND POST CLOSURE PERIOD

Since the bulk of the area to be disturbed is currently cultivated fields, it makes sense to restore this capability as far as possible on the disturbed smelter footprint.
It will be extremely difficult to restore a land use capability better than wilderness on the mineralised waste facilities, though cover options that could improve on this will be researched during the 30 years life of the facility.

4.6 ONGOING RESEARCH FOR PROPOSED CLOSURE OPTIONS

Further research regarding the proposed closure options will only be initiated during the ongoing operations of the proposed smelter and would focus on cover options for the mineralised waste facilities.
One of the options being explored already by SCSC is the reuse and/or sale of the mineralised waste as potential products. Should this be a viable option, the post closure land use options could significantly change.

4.7 CLOSURE PLAN ASSUMPTIONS

The following assumptions are made for the development of the Closure Plan at this stage of the project:

- 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 offsite at an appropriate facility.
- Details and recommendations regarding a social closure plan can be found in Siyanda's socio-economic impact assessment report by Synergistics Environmental Services (August 2016). Currently it suggests that a social assessment should be done 10 years before closure of the operation.
- No extra MWFs 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 indicate metals content below limit values for contaminated land and those that are exceeding limit values currently, are still similar after cessation of operations.

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 as is guided by best practice.

5 POST-CLOSURE LAND USE

As discussed and elaborated on previously, and in the absence of additional stakeholder input at this stage of the project, the preferred final post-closure land use will be arable land for the bulk of the smelter footprint and wilderness for the mineralised waste facilities.

The methodology used to identify final post closure land use, as well as, the generation of a detailed map showing the final post closure land uses will be further developed during the ongoing operations of the proposed smelter.

6 CLOSURE ACTIONS

The closure actions are as follows:

- Surface infrastructure will be demolished and removed.
- Areas where infrastructure has been removed will be levelled and restored in terms of soil horizons (as far as practical), vegetation and drainage.
- There will be no material stockpiles and overburden dumps remaining post closure.
- The mineralised waste facilities will be clad in a store and release cover composed of topsoil, rock and growth medium as per the civil design.

6.1 SPECIFIC TECHNICAL SOLUTIONS

Specific technical solutions related to the preferred closure option for the infrastructure and mineralised waste facilities are detailed below.

6.1.1 BUILDINGS, PLANT AND SMELTER INFRASTRUCTURE

Buildings, processing plant and smelter infrastructure (conveyors, water supply pipelines etc.) will all be dismantled, and salvageable elements will be sold and removed from site. Inert non-salvageable elements including concrete, brickwork, etc. will be dismantled or broken up and buried more than 1m deep on site.

Any contaminated soil from the decommissioned areas (that cannot be remediated) will be excavated and disposed of on the MWF. Contaminated soils will typically include those contaminated by hydrocarbons (i.e. diesel, oil, grease etc.) and non-biodegradable chemicals (i.e. reagents, chemicals, dust suppressants etc.). Where applicable bio-remediation of hydrocarbon contaminated areas will be done.

All the decommissioned areas will be landscaped and levelled so that natural storm water flow is restored and that there is no ponding of water. The decommissioned areas will be covered with topsoil/growth medium material (i.e. whatever was initially stripped from the area prior to construction) and revegetated. Arable land will be reinstated in economically functional blocks and used for agronomic production.

6.1.2 MINERALISED WASTE FACILITIES

Two Mineralised waste facilities will be on site - the slag dump and the bag house dust slurry dam. These facilities are designed with a 20 year life. If no alternative uses/waste minimisation methods are identified, additional facilities will have to be designed, approved and constructed to enable the smelter to operate for more than 20 years. If alternative waste minimisation uses/waste minimisation methods are identified, then the facilities (as designed) may be more than sufficient to cater for the full life of the smelter. Table 6-1 lists the sizing features of the facilities, while the sections below describe the deposition and cover methods.

6.1.2.1 Slag Dump

The slag will be tapped from the furnace via a slag launder into a molten pot carrier at a temperature of between 1650 -1700°C. The disposal of slag will be done utilising molten pot haulers, which will transport the molten slag in pots to the slag dump area, where the pots will be emptied and returned to the furnace ready for the next slag tap.

Due to the slag being deposited in molten form, the extremely high temperatures would cause damage to the underlying containment barrier system, if not adequately protected from the slag. A 1m thick thermal protection layer has been included to protect the Class C barrier system from the high temperatures of the slag. There will also be an additional solidified slag layer covering the thermal protection layer in order to provide additional protection. The details of the thermal protection layer(s) will need to be confirmed during further design stages.

The slag dump will progressively be raised using the upstream construction method in 5m lifts in order to allow the slag to be contained at all times. Deposition will commence along the inner crest of the embankment wall a gradually progress inwards towards the basin of the facility after the complete perimeter of the embankment has been covered (SLR, 2016).

6.1.2.2 Baghouse dust disposal facility

Based on the grading curve of the BHD sample it can be concluded that the material is extremely fine which needed to be taken account for when choosing a suitable deposition method. Due to the nature of the material it was decided that the material should be slurried to prevent it from drying out and dusting while being transported to, and deposited on, the MWF. The baghouse dust disposal facility will be built from de-watering bags, also in an upstream method. The first layer of bags will be placed directly on top of a stone leachate collection system. Once the first layer of bags has been placed, an overlaying geogrid layer will be installed before the subsequent bag raise commences. The bags will have sufficient time to de-water, sun dry and partially consolidate prior to the placement of the next layer (SLR, 2016).

TABLE 6-1: A LIST OF THE KEY SIZING FEATURES OF THE MWFs FOR THE SMELTER (SLR, 2016)

Slag Dump - Class C liner system	
- Slag dump area	± 21ha
- Maximum slag dump facility height	Approx. 33m
- Slag storage capacity	7.04 million tonnes
BHD Disposal Facility - Class A liner system	
- BHD disposal area	± 10ha
- Maximum BHD disposal facility height	Approx. 20m
- BHD storage capacity	960 000 m³
Total stockpile area	± 6.5ha
PCD area	± 1.8ha

6.1.2.3 Barrier systems

Figure 6-1 shows the typical construction layers of a Class A barrier system, which will be installed for the BHD MWF, while Figure 6-2 shows the Class C barrier system for the Slag Dump.

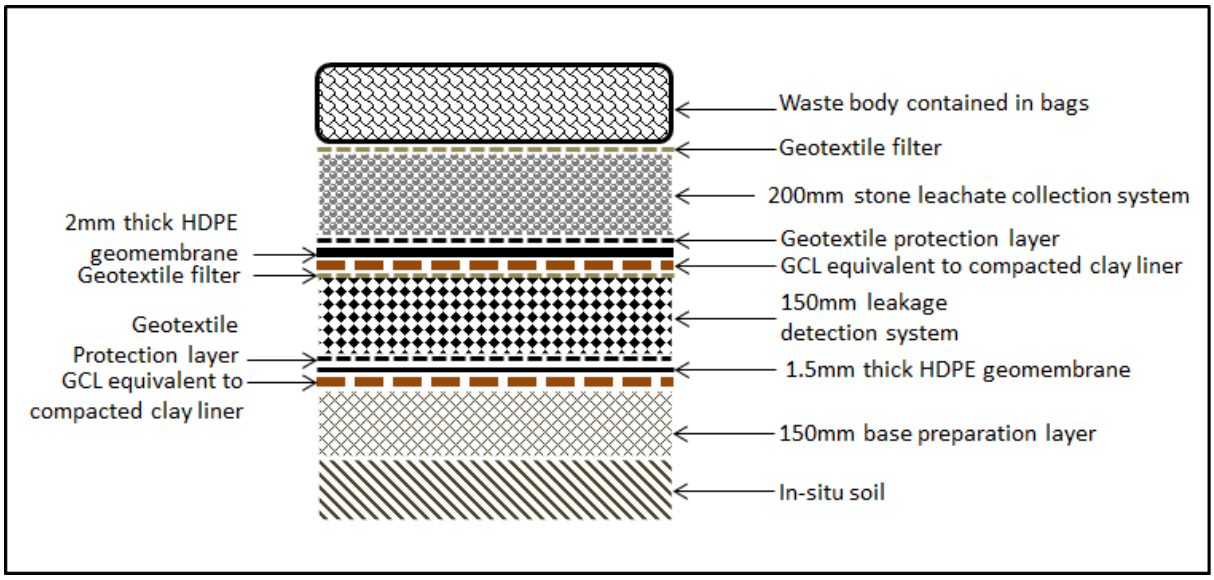


FIGURE 6-1: AN ILLUSTRATION OF THE CLASS A BARRIER SYSTEM TO BE INSTALLED FOR THE BHD SLURRY FACILITY (SLR, 2016)

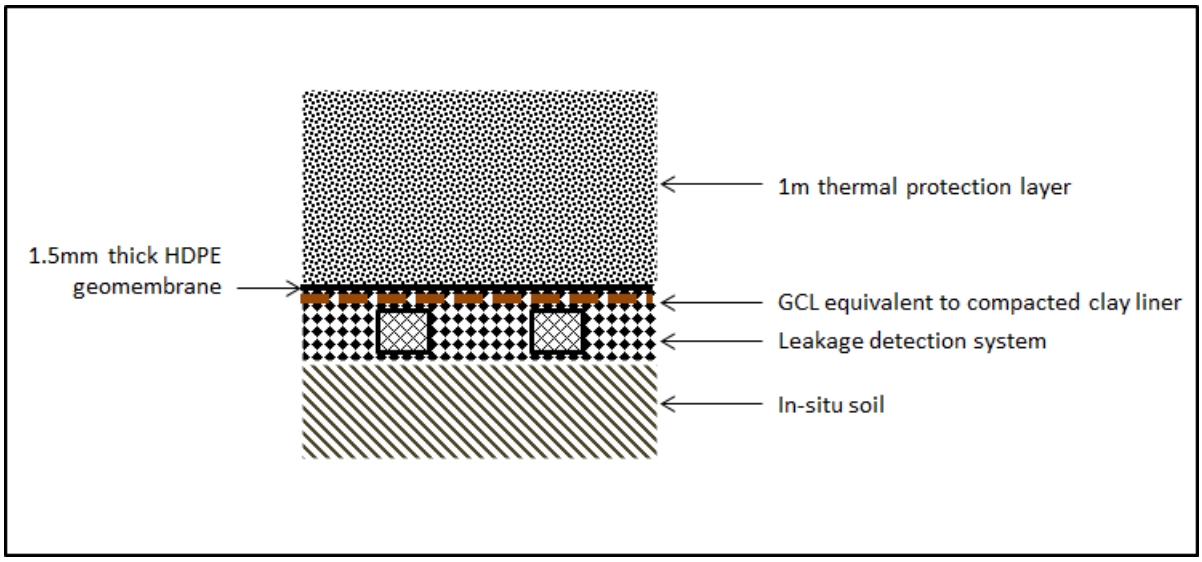


FIGURE 6-2: AN ILLUSTRATION OF THE CLASS C BARRIER SYSTEM TO BE INSTALLED FOR THE SLAG DUMP (SLR, 2016)

6.1.2.4 Covers

The MWFs will be concurrently rehabilitated with every raise of the outer walls to fall in line with international best practice guidelines (see Figure 6-3). The rehabilitation approach adopted will comprise of the construction of a vegetated final cover to the outer side slopes of the MWFs, as part of the on-going wall raising operations

As with the rehabilitation of the side slopes, the top surface will receive a cover which consists of a mix of soil, rock and growth medium, which will also be vegetated.

The purpose of the top cover will be to limit the ingress of water into the MWFs, while providing a substrate for the establishment of vegetation. The top will be reshaped at closure to create a mesh of paddocks that will assist in collecting rain water and increase evaporation of the dumps (SLR, 2016).

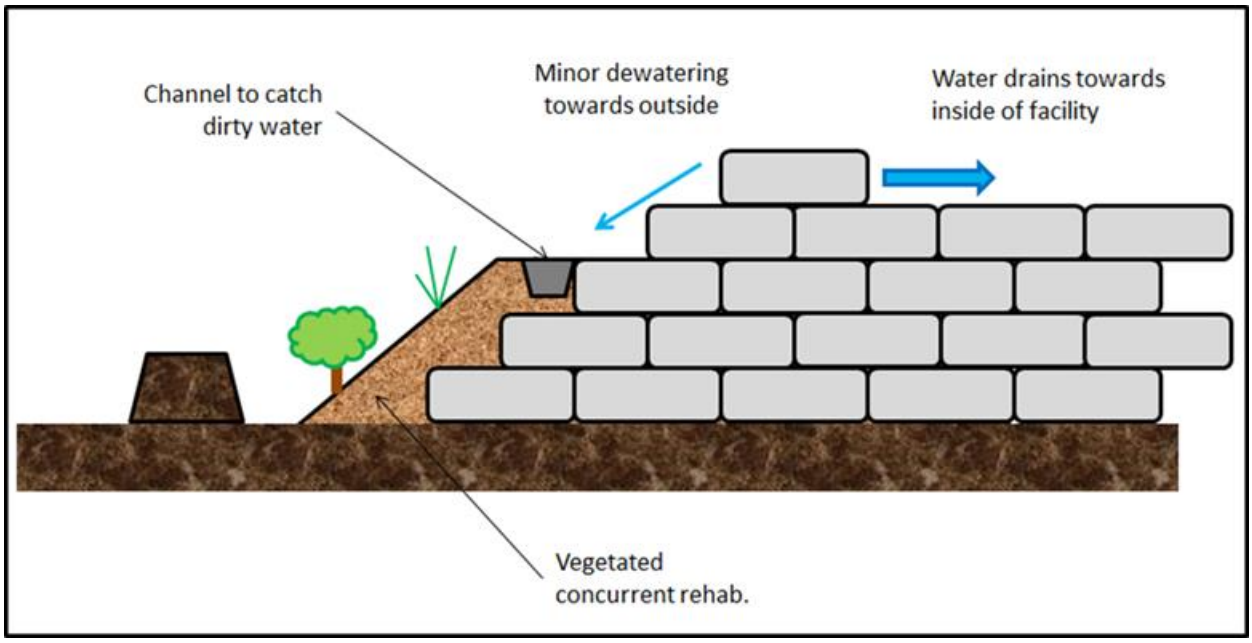


FIGURE 6-3: A SCHEMATIC ILLUSTRATION OF THE CONCURRENT REHABILITATION FOR THE BHD MWF (SLR, 2016)

6.1.3 ROAD NETWORK

Gravel roads no longer required for post closure use will be reshaped for free drainage, ripped and covered with stockpiled topsoil. Tarred roads no longer required for post closure use will first have the top layer works removed (and carted to a safe disposal facility), and then rehabilitated as per gravel roads.

All concrete lined drainage channels, sumps and culverts associated with closed roads will be broken up and disposed of with other building rubble.

6.1.4 FENCING

Fencing no longer required for post closure use will be removed and recycled for scrap. Inert material such as concrete foundations will be disposed of with other building rubble.

6.1.5 POWERLINES

Powerlines no longer required for post closure use will be removed and recycled for scrap. Inert material such as concrete foundations will be disposed of with other building rubble.

6.1.6 STORM WATER MANAGEMENT

The existing storm water management plan will be updated to identify what storm water management structures are required post closure and which can be decommissioned. All the decommissioned areas of the smelter site will be levelled and shaped so that the areas are free draining and there is no ponding of water. MWF covers will be designed to manage storm water adequately and some operational structures might be left intact for some time after closure.

It is currently anticipated that the pollution control dam will not be required post closure, and hence this facility and associated infrastructure can be decommissioned (as for concrete foundations, inert liner material, etc. as mentioned previously). Any accumulated silt in the pollution control dam (that is typically classified as hazardous) will need to be safely disposed of onto the MWF.

The remaining depressions /voids of the pollution control dams may however still prove useful during the maintenance and aftercare phase to act as settling dams and/or silt traps (and can thereafter be filled in and/or shaped to be free draining, and the area revegetated).

6.1.7 REVEGETATION

Revegetation of disturbed areas will be undertaken by replacing the previously stockpiled topsoil and growth medium materials and planting with indigenous grasses and trees/shrubs (i.e. mechanical seeding and hand planting of trees/shrubs).

Areas requiring revegetation will be shaped and landscaped to ensure that they are free draining (reinstate original drainage lines if practical), steep slopes in excess of 1V:4H are avoided (where practical) and all unnecessary remnants (e.g. building rubble and material stockpiles) are removed and/or buried.

Grass and tree species to be used for revegetation will need to be carefully selected based upon their soil building capabilities, erosion protection characteristics, natural occurrence in the area, social/commercial value, and wildlife habitat value. Revegetation activities need to be carefully undertaken so as not to unnecessarily introduce any alien and/or invasive plant species into the area.

It is recommended that seed and plant harvesting be undertaken using vegetation from the surrounding area. Grass seeds in particular should be harvested as well as seeds from non-woody legume species.
An on-site nursery might be established if it is found feasible to cultivate native species on site for rehabilitation purposes. Most of the trees in the area would be available from commercial nurseries and the requirement for an onsite tree nursery not needed.

Arable land blocks will be leased to nearby farmers to start agronomic production as soon as possible after rehabilitation.

6.1.8 MAINTENANCE AND AFTERCARE

All the rehabilitated areas will require some form of aftercare and maintenance to ensure closure success. These activities will typically include erosion control; filling of erosion gulley's and repairing covers/armouring; fertilising of struggling rehabilitated areas; monitoring of key indicators; control and eradication of alien plants; maintaining firebreaks; etc.

It is currently anticipated that most of the maintenance and aftercare activities will be undertaken in the first 3 years following closure (the active maintenance period), and thereafter the frequency of activities is expected to stop (in areas where vegetation is considered self-sustaining) and/or in decline (passive maintenance period). The passive maintenance period is a further 2 years of monitoring with a reduced frequency.

6.1.9 SURFACE WATER AND GROUNDWATER MANAGEMENT

Monitoring of surface water quality and groundwater quality post closure will be undertaken during the 5 year active and passive maintenance and aftercare periods, in order to prove that agreed water quality standards will not be exceeded at monitored locations, and that surface water and groundwater on (and immediately downstream of) the rehabilitated areas are suitable for post closure land users.

6.2 OPPORTUNITIES ASSOCIATED WITH THE CLOSURE OPTION

Opportunities exist to currently engage with the surrounding community to get buy-in and support for the smelting operations and the subsequent post closure environment. There is an opportunity to investigate alternative post closure options (see Table 4-1). The option of selling the mineralised waste as a product is already being investigated and will further be investigated during the operational life of the smelter.

Opportunities also exist to currently engage with all the employees and contractors associated with the smelter:

- To inform and educate them around the need to not unnecessarily pollute and/or disturb the environment,
- To follow good operational, decommissioning and rehabilitation practices and procedures, and
- To support the operations executive, environmental department and stakeholder engagement forums to adhere to the commitments made in the EIA/EMP report.

6.3 THREATS ASSOCIATED WITH CLOSURE OPTION

The post closure land use of arable and wilderness is feasible, provided the topsoil management plans are adhered to. It is critical for the project staff to ensure topsoil is stripped adequately and protected properly in stockpiles.

Poor management of the mineralised waste facilities after closure is a significant threat to the sustainability of the proposed options.

If the mineralised waste cannot be sold as a product, additional disposal space will be needed.

The effects of climate change on the future local environment are unknown and may present a threat (or opportunity) for the preferred post closure land use.

6.4 UNCERTAINTIES ASSOCIATED WITH CLOSURE OPTION

It is currently assumed that all infrastructure will be demolished and removed from site. This assumption should be confirmed with post closure stakeholders, since there may be some post closure use for certain infrastructure (e.g. offices, workshops, roads, water treatment facilities, electrical reticulation etc.).

It is assumed that viable sales and/or reuse of volumes of mineralised waste as a product from the operation will be achieved.

The availability of adequate volumes of the correct quality cover material to rehabilitate the mineralised waste facilities.

7 SCHEDULE OF CLOSURE ACTIONS

Decommissioning and rehabilitation will commence at the end of operations and will most likely be completed within a period of 8 to 18 months. Concurrent rehabilitation during operations will occur wherever practical (e.g. open areas around the perimeter of buildings and available side slopes on the waste facilities).

A preliminary schedule of the decommissioning and rehabilitation activities is shown in Figure 7-1.

The main driver for the preliminary schedule is the decommissioning of the furnaces and demolishing of large infrastructure. The next critical item will be the final cover of the mineralized waste facilities.

FIGURE 7-1: PRELIMINARY SCHEDULE OF DECOMMISSIONING AND REHABILITATION ACTIVITIES

Closure Action	Operational Life of the smelter (30 years)				Closure year 1				Closure year 2				Closure year 3				Closure year 4				Closure year 5				Closure year 6				Closure year 7			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Smelting operations at peak production																																
Concurrent rehabilitation of available sites																																
Closing down of smelter operations																																
Demolition of infrastructure																																
Install covers on MWFs																																
Active maintenance and after care																																
Passive maintenance and after care																																
Monitoring																																
Relinquishment																																

8 ORGANISATIONAL STRUCTURE AND ROLES

Typical key personnel to ensure compliance to the Closure Plan and associated commitments will be the operations executive, the SHE manager and the consultants. As a minimum, these roles as they relate to the implementation of monitoring programmes and management activities will include:

- Senior Operational Manager and SHE Manager
  - Ensure that commitments in the Closure Plan are developed and implemented timeously.
  - Ensure that the monitoring programmes and audits are scoped and included in the annual budget.
  - Identify and appoint appropriately qualified specialists/engineers to undertake the programmes.
  - Appoint specialists in a timeous manner to ensure work can be carried out to acceptable standards.
  - Liaise with the relevant structures in terms of the commitments in the Closure Plan.
  - Establish and maintain good working relations with surrounding communities and landowners.
  - Facilitate stakeholder communication, information sharing and a grievance mechanism.

8.1 CAPACITY BUILDING

SCSC has the in-house capacity to undertake final closure activities or will ensure that the personnel with the correct capacity and experience will be employed. The need for internal capacity building is therefore unlikely.

SCSC however, recognises that there is likely to be the need to build the capacity of the local communities who will be influenced by the activities of the Siyanda Project and who would be considered project stakeholders. Siyanda will embark on a capacity building program with stakeholders so that stakeholders are in a position to understand the risks that may exist at closure and limitations around risk mitigation strategies and that the stakeholders are able to provide meaningful input to engagements around possible post closure land use.

9 GAP IDENTIFICATION

Current gaps (and/or known unknowns) associated with the closure plan, that will be addressed once the smelter is operational include:

- Confirm the demolition and removal of all infrastructure (including buildings, powerlines, water supply and treatment, access roads etc.).
- Confirmation that there is a market and/or alternative use for the mineralised waste that can take significant volumes of waste off-site.

- Engineered capping solutions (i.e. optimisation of the proposed store and release covers) for the mineralised waste facilities.

10 RELINQUISHMENT CRITERIA

Relinquishment criteria will be developed in communication with the regulatory authorities and project stakeholders to define specific end-points that demonstrate the closure objectives have been met.

Five key indicators have been defined and are listed and discussed in Section 3.3 of this report.

Additional to this a soil metals content screening will be done to ensure that the soils on site are still within the baseline metals values as determined during the EIA phase.

A summary of the criteria to be utilized for evaluation of rehabilitation success for each of the selected key indicators is provided in the following sections.

Details of the decommissioning and rehabilitation monitoring program designed to provide the data necessary to evaluate rehabilitation success, including monitoring methods and frequency, are provided in Appendix B.

10.1 SURFACE WATER QUALITY EVALUATION SYSTEM

To utilise surface water quality as an indicator for rehabilitation success Siyanda will:

- Identify sampling locations for operations, rehabilitation, and post-rehabilitation periods;
- Determine which water quality analyses are required and the required frequency of sampling;
- Establish a detailed field sampling methodology; and
- Analyse and compare the results of chemical analyses of surface water samples to the agreed standards to provide proof of compliance, and therefore verification of rehabilitation success, over the agreed monitoring period.

The proposed surface water quality monitoring program for Siyanda's closure is described in detail in Appendix B, including methods of analysis, monitoring schedule, and definition of rehabilitation success in terms of the monitoring program.

10.2 GROUNDWATER QUALITY EVALUATION SYSTEM

To utilise groundwater quality as an indicator of rehabilitation success Siyanda will:

- Identify sampling locations for operations, rehabilitation, and post-rehabilitation periods;

- Determine which water quality analyses are required and the required frequency of sampling;
- Establish a detailed field sampling methodology;
- Update the groundwater model to track any potential pollution plume migration; and,
- Analyse and compare the results of chemical analyses of groundwater samples to the agreed standards to provide proof of compliance, and therefore verification of rehabilitation success, over the agreed monitoring period.

The proposed groundwater quality monitoring program for Siyanda's closure is described in detail in Appendix B.

10.3 AIR QUALITY EVALUATION SYSTEM

Air quality will be measured as an ongoing practise from the operational phase, using dust fall-out as the main indicator of improvement due to rehabilitation success. The major sources of air pollution that would be left after closure will be bare ground and the MWF, both of which will be mainly sources of fall out dust. No PM10 or PM2.5 monitoring will be required.

The proposed dust fall out monitoring program for closure is described in detail in Appendix B.

10.4 DUMP COVER STABILITY / LANDSCAPE FUNCTION ANALYSES

The MWF will be the most significant environmental liability left on site for SCSC. The cover designed for the rehabilitation of the facility needs to last for hundreds of years into the future. Two separate facilities will be on site and the same basic principles apply to the covers to be installed:

- Limit water ingress
- Stabilize material against cover erosion
- Prevent off-site contamination of surface water and groundwater

The stability of the cover can be determined by landscape function analyses (LFA), which evaluates the cover for a number of parameters and then list three indices that can be tracked over time to see if the system is improving. If the LFA scores have been calibrated for the area, using indicative reference scores, a final score for each parameter index can be set to use as the relinquishment state.

Geotechnical side slope stability assessments will also have to be done in the first 3 years on an annual basis and a factor of safety of better than 1.5 achieved.

The proposed stability monitoring program for closure is described in detail in Appendix B.

10.5 VEGETATIVE COVER / AGRONOMIC PRODUCTION EVALUATION SYSTEM

The degree to which the vegetation cover is effective at reducing erosion is a function of the height and continuity of the plant canopy, the density of the ground contact cover, and the root density. The vegetation contact cover dissipates the energy from surface water runoff, thereby decreasing erosional forces. An increase in the vegetation cover also results in an increase in both the evapo-transpiration rate and the infiltration rate leading to changes in the water balance.

Wildlife diversity (and/or livestock populations) respond positively to an increase in available habitat and food supply that is brought on by the establishment of vegetative cover. Additionally, the success of vegetative cover reflects the chemical and physical suitability of soils to develop and maintain a productive ecosystem that will support a post-closure land use of wilderness.

Three parameters will be measured to evaluate vegetative cover on rehabilitated land:

- The percentage of basal cover,
- The tree/shrub (woody species) density, and
- The presence of alien invasive species.

The percentage basal cover is the parameter which best represents the overall success of revegetation efforts given all relevant considerations. It is proposed that the line point method be utilized to determine the percentage basal cover in representative transects of more than 200 points on representative sections of rehabilitated land. This method is utilized worldwide and is advantageous because it is simple and reliable, produces valid results, which are easily interpreted, and does not require any expensive equipment. It also gives species composition and basal cover results in one monitoring action. Tree/shrub density will be evaluated by direct field count in the same representative line transects sued for the basal cover assessment. Live, rooted woody stems with one meter either side of the line will be counted and expressed as woody plants per ha as well as the species composition.

The vegetative cover monitoring program for Siyanda's closure is described in detail in Appendix B.

It is proposed that rehabilitation success for vegetative cover is demonstrated when monitoring of basal cover in rehabilitated areas at Siyanda indicates that:

- The percentage basal cover on rehabilitated areas is greater than or equal to 8%;
- The density of tree/shrub species (woody species) on rehabilitated areas is between 150 and 200 woody plants per ha;
- Species composition is similar to the species composition of nearby reference sites; and
- No category 1 declared weeds occurs on site.

The production from the arable areas will be monitored and recorded as tons of product produced per hectare. Production figures from rehabilitated areas will be compared to that from the surrounding farms on similar soils and successful rehabilitation will be deemed to have been achieved once production similar to that from surrounding farms has been repeatedly achieved.

11 MONITORING, AUDITING AND REPORTING

11.1 PRE-CLOSURE MONITORING, AUDITING AND REPORTING

The environmental officer 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. EMP performance assessments must be undertaken in accordance to the conditions of the environmental authorisation. 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.

A monitoring schedule will also be established once the smelter is operational, and will include a surface water quality, surface water biomonitoring, groundwater quality and air quality monitoring programme. Additional monitoring programmes (e.g. mineralised waste facility covers) may also be established during the ongoing operations of the smelter. Monitoring will be the responsibility of the environmental department, and will most likely be carried out by the environmental officers.

Although not a regulatory requirement, the smelter could do annual audits of its closure plan and develop annual rehabilitation plans, which would the also be audited against for compliance.

11.2 POST-CLOSURE MONITORING, AUDITING AND REPORTING

A preliminary post-closure monitoring and reporting programme has been developed as part of this closure plan. It makes provision for:

- Monthly surface water sampling for the first three years
- Monthly groundwater level monitoring for the first three years
- Quarterly groundwater sampling for the first three years.
- Monthly dust fallout monitoring for the first three years
- Six monthly cover stability monitoring on MWF for the first three years
- Annual LFA on MWF for five years
- Annual vegetation monitoring for the first three years
- A small on-site maintenance team over a period of 3 years (active maintenance and aftercare period only).

The normal auditing and reporting will be continued as described in the EMP.

12 RECOMMENDATIONS

This closure plan for the Siyanda Project, can be improved by addressing the uncertainties associated with the proposed closure option (see Section 6.2) and also addressing the currently identified gaps (see Section 9), namely:

- Confirm the demolition and removal of all infrastructure (including buildings, powerlines, water supply and treatment, access roads etc.).
- Confirmation that there is a market and/or alternative use for the mineralised waste that can take significant volumes of waste off-site.
- Engineered capping solutions (i.e. optimisation of the proposed store and release covers) for the mineralised waste facilities.

13 CONCLUSION

This closure plan has been generated based on existing information currently available for the proposed Siyanda Project, and as documented in the EIA/EMP and supporting specialist study reports.

Additional and more specific closure objectives (and/or alternative closure objectives e.g. grazing) 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 ongoing operations of the proposed smelter.

Steve Van Niekerk	**Piet Smit**
Reviewer	**Author**

REFERENCES

Airshed Planning Professionals (Pty) Ltd, March 2016. *Air Quality Specialist Report for the Proposed Siyanda FeCr Project near Northam, Limpopo Province*

Scientific Aquatic Services (SAS), February 2016. *Floral, Faunal, Wetland and Aquatic Ecological Assessment as part of the Environmental Assessment and Authorisation Process for the proposed construction of a Ferrochrome Smelter near Northam, Limpopo Province.*

SLR Consulting. July 2016. *Scoping Report for the Proposed Development of the Siyanda Ferrochrome Smelter.*

SLR Consulting. July 2016. *Siyanda Chrome Smelter Surface Water Study.*

SLR Consulting, June 2016. *Siyanda Ferrochrome Project Groundwater Impact Assessment.*

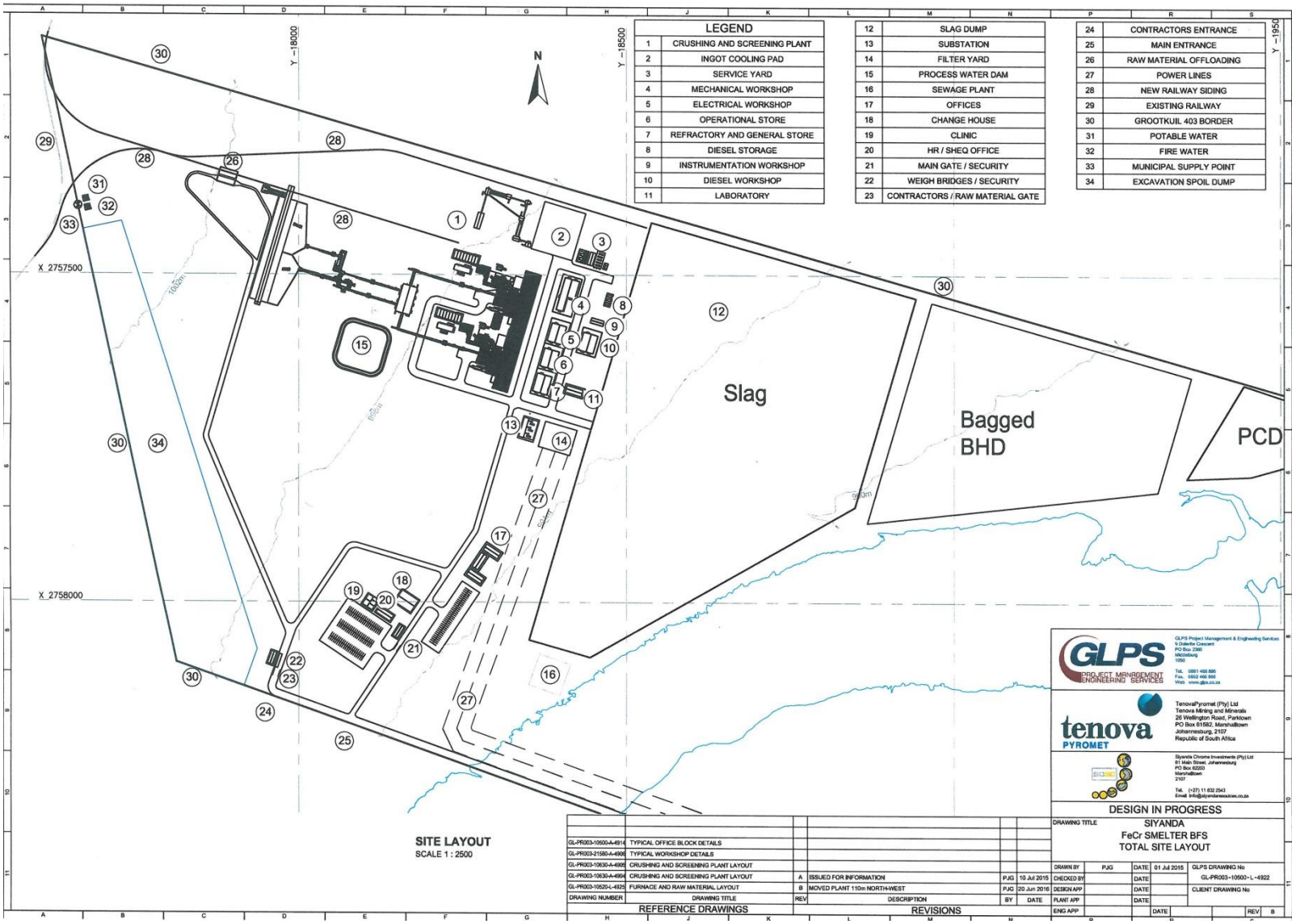
SLR Consulting, September 2016. *Siyanda Ferrochrome Smelter Conceptual Design of Mineralised Waste Disposal Facilities.*

SLR Consulting, October 2016. *Environmental Impact Assessment and Environmental Management Programme Report for the development of the proposed Siyanda Ferrochrome Smelter.*

Synergistics Environmental Services, August 2016. *Social Impact Assessment Report for the Proposed Siyanda Ferrochrome Smelter on the farm Grootkuil 409 KQ near Northam.*

Terra Africa Consult, March 2016. *Soil, Land Use and Land Capability Report for the Proposed Development of the Siyanda Ferrochrome Smelter.*

APPENDIX A: SITE LAYOUT AND DETAILS FOR PROJECT SIYANDA


LEGEND
1 CRUSHING AND SCREENING PLANT
2 INGOT COOLING PAD
3 SERVICE YARD
4 MECHANICAL WORKSHOP
5 ELECTRICAL WORKSHOP
6 OPERATIONAL STORE
7 REFRACTORY AND GENERAL STORE
8 DIESEL STORAGE
9 INSTRUMENTATION WORKSHOP
10 DIESEL WORKSHOP
11 LABORATORY
12 SLAG DUMP
13 SUBSTATION
14 FILTER YARD
15 PROCESS WATER DAM
16 SEWAGE PLANT
17 OFFICES
18 CHANGE HOUSE
19 CLINIC
20 HR / SHEQ OFFICE
21 MAIN GATE / SECURITY
22 WEIGH BRIDGES / SECURITY
23 CONTRACTORS / RAW MATERIAL GATE
24 CONTRACTORS ENTRANCE
25 MAIN ENTRANCE
26 RAW MATERIAL OFFLOADING
27 POWER LINES
28 NEW RAILWAY SIDING
29 EXISTING RAILWAY
30 GROOTKUIL 403 BORDER
31 POTABLE WATER
32 FIRE WATER
33 MUNICIPAL SUPPLY POINT
34 EXCAVATION SPOIL DUMP
Y = 18000
Y = 18500
Y = 19500
N
X 2757500
X 2758000
Slag
Bagged BHD
PCD
SITE LAYOUT
SCALE 1 : 2500
GLPS
PROJECT MANAGEMENT ENGINEERING SERVICES
tenova PYROMET
DESIGN IN PROGRESS
DRAWING TITLE
SIYANDA
FeCr SMELTER BFS
TOTAL SITE LAYOUT
GL-PR003-10600-A-4914 TYPICAL OFFICE BLOCK DETAILS
GL-PR003-21580-A-4906 TYPICAL WORKSHOP DETAILS
GL-PR003-10630-A-4905 CRUSHING AND SCREENING PLANT LAYOUT
GL-PR003-10630-A-4904 CRUSHING AND SCREENING PLANT LAYOUT
GL-PR003-10520-L-4925 FURNACE AND RAW MATERIAL LAYOUT
DRAWING NUMBER DRAWING TITLE
REFERENCE DRAWINGS
REV DESCRIPTION BY DATE
A ISSUED FOR INFORMATION PJG 10 Jul 2015
B MOVED PLANT 110m NORTH-WEST PJG 20 Jun 2016
REVISIONS
DRAWN BY PJG DATE 01 Jul 2015
CHECKED BY DATE
DESIGN APP DATE
PLANT APP DATE
ENG APP DATE
GLPS DRAWING No GL-PR003-10600-L-4922
CLIENT DRAWING No
REV B

APPENDIX B: REHABILITATION EVALUATION CRITERIA

1 INTRODUCTION

This appendix presents a description of criteria to be utilised in the evaluation of rehabilitation success on rehabilitated areas and a suggested monitoring program to be implemented for this evaluation. The monitoring program is designed to measure the success of decommissioning and rehabilitation measures in terms of the rehabilitation success indicators defined in the Closure Plan.

The monitoring program will include evaluation of:

- Groundwater
- Surface water
- Air quality
- Dump cover stability / Land Function Analyses score
- Vegetative cover/agronomic production

2 GENERAL REHABILITATION MONITORING

In addition to the specific monitoring activities described in the sections below, the post-rehabilitation monitoring program will include regular general inspections of rehabilitated areas to assess their condition and to determine any maintenance requirements. These inspections will include noting the condition of:

- Storm water and erosion control features including drainage channels and diversions
- Soil erosion
- Faunal habitation of rehabilitated areas
- Biological productivity
- Evidence of poaching
- Protected access, fences and signs erected for public safety
- Site security
- Unusual conditions in any rehabilitated area

Climatic data - minimum/maximum temperatures, frost occurrence and rainfall will be recorded and kept for correlation to field observations.

General inspections of all rehabilitated areas will be completed at a minimum of quarterly intervals for the aspects defined. Records of all the monitoring and maintenance activities undertaken will be kept.

If the general site condition monitoring activities reveal the requirement for any maintenance or repair of rehabilitated areas, then the necessary works will proceed in a timely fashion to minimise the potential for damage to rehabilitated areas, such as soil loss, plant loss and drainage channel disturbance. Should a condition be identified in any rehabilitated area which has the potential to cause serious environmental damage, or which threatens the health and safety of post closure land users, then the relevant Authorities (DEA & DWS) will be immediately notified of this condition and the remedial measures being undertaken to reduce the potential for harm.

3 GROUNDWATER MONITORING

The groundwater quality monitoring program is designed to verify that groundwater quality downstream of potential sources of pollution, such as the MWF, complies with agreed standards. To address this, the focus will be on pH, salts and metals.

3.1 GROUND WATER SAMPLING

Groundwater will be sampled from monitoring boreholes as determined by the groundwater specialists during the EIA process and where identified during operations. These will be in line with the requirements of the water use license issued for the site. Samples will be taken by an adequately trained person and submitted to an accredited laboratory for analyses

Samples will be taken quarterly, unless otherwise instructed by the groundwater specialist.

3.2 GROUNDWATER QUALITY ANALYSIS

The physical and chemical parameters to be included in laboratory analyses of groundwater samples has been selected based upon site criteria/characteristics and geochemical results to date. A list of recommended parameters is given in Table B-1. This may expand following further geochemical analysis and collection of baseline data.

TABLE B-1: RECOMMENDED GROUNDWATER QUALITY ANALYSIS PARAMETERS (SLR, 2016)

Au	Mg	Ti
B	Mn	Zn
Ba	Na	pH (pH unit)
Ca	Ni	Total Alkalinity as $CaCO_3$
Cr	Pb	Cl
Fe	Se	SO_4
K	Si	Ti
Li	Sr	Zn

Should statistical analysis of groundwater monitoring results for the five year (active and passive maintenance and aftercare) period, following completion of decommissioning and rehabilitation activities, indicate that agreed standards for protection of groundwater quality will not be met for a particular area, then a study will be commissioned to determine the causes of such failure, the potential for harm to the environment and/or post closure land users, the need for remedial measures, and to recommend practicable remedial measures if required.

3.3 REHABILITATION SUCCESS CRITERIA FOR GROUNDWATER QUALITY INDICATORS

Rehabilitation success for the groundwater quality indicators will be demonstrated when statistical analysis (and trends) of source term monitoring results, for the five year (active and passive maintenance and aftercare) period following the completion of decommissioning and rehabilitation activities, indicate that agreed water quality standards for groundwater will not be exceeded at monitored locations. Achievement of the rehabilitation success criteria for groundwater quality will ensure that groundwater on (and immediately downstream of) the rehabilitated areas are suitable for post closure land users.

4 SURFACE WATER MONITORING

The surface water quality monitoring program is designed to verify that surface water quality downstream of all rehabilitated areas complies with agreed standards and focusses on turbidity (suspended solids), pH, salts and metals. Biological integrity of the surface water sources will also be checked through biomonitoring.

4.1 SURFACE WATER SAMPLING

Surface water will be sampled monthly at pre-determined points, selected by the hydrology specialist. These will be in line with the requirements of the water use license issued for the site. Samples will be taken by an adequately trained person and submitted to an accredited laboratory for analyses.

4.2 SURFACE WATER QUALITY ANALYSIS

The physical and chemical parameters to be included in laboratory analyses of surface water samples has been selected based upon site criteria/characteristics and geochemical results to date. A list of current minimum recommended parameters is given in Table B-2. This may expand following further geochemical analysis and collection of baseline data.

TABLE B-2: RECOMMENDED SURFACE WATER QUALITY ANALYSIS PARAMETERS (SLR, 2016)

Au	Mg	Ti
B	Mn	Zn
Ba	Na	pH (pH unit)
Ca	Ni	Total Alkalinity as $CaCO_3$
Cr	Pb	Cl
Fe	Se	SO_4
K	Si	Ti
Li	Sr	Zn

Should statistical analysis of surface water monitoring results, for the five year (active and passive maintenance and aftercare) period following completion of decommissioning and rehabilitation activities, indicate that agreed standards for protection of surface water quality will not be met for a particular area, then a study will be commissioned to determine the causes of such failure, the potential for harm to the environment and/or post closure land users, the need for remedial measures, and to recommend practicable remedial measures if required.

4.3 BIOMONITORING

Biomonitoring will be conducted at pre-selected surface water points twice per annum (once in the dry season and once in the wet season) for the first three years after closure. These points will be selected by the biodiversity specialist to cover the upstream and downstream impacts on the resource and will be in line with the requirements of the water use license issued to the site.

An appropriately qualified specialist will do the biomonitoring and report their findings to the manager responsible for rehabilitation.

4.4 REHABILITATION SUCCESS CRITERIA FOR SURFACE WATER INDICATORS

Rehabilitation success for the surface water quality indicators will be demonstrated when statistical analysis (and trends) of monitoring results for the five year (active and passive maintenance and aftercare) period following the completion of decommissioning and rehabilitation activities, indicate that agreed water quality standards for surface water will not be exceeded at monitored locations. These criteria will include suitable biomonitoring results. Achievement of the rehabilitation success criteria for surface water quality and biodiversity will ensure that surface water on (and immediately downstream of) the rehabilitated areas are suitable for post closure land users.

5 AIR QUALITY MONITORING

Air quality monitoring after closure will focus on fall out dust monitoring, since this would be the only potential air pollution associated with the site once smelting operations stop.

5.1 FALL OUT DUST SAMPLING

Dust buckets will be installed according to the recommendations of the air quality specialist and will be sampled on a monthly basis. Monitoring results will be recorded and trends analysed. Trends of increasing dust fall out or significant exceedances of the residential fall out dust limits will be investigated to determine the reason for these. The investigation will also look into mitigation measures to be implemented to correct these trends.

5.2 REHABILITATION SUCCESS CRITERIA FOR AIR QUALITY INDICATORS

Pre-operational monitoring results are available for the site and fall out dust levels similar to the baseline will be regarded as being adequate for successful closure.

6 DUMP COVER STABILITY / LANDSCAPE FUNCTION ANALYSES SCORE

The MWF will be the most significant environmental liability left on site for SCSC. The cover designed for the rehabilitation of the facility needs to last for hundreds of years into the future. Two separate facilities will be on site and the same basic principles apply to the covers to be installed:

- Limit water ingress
- Stabilize material against cover erosion
- Prevent off-site contamination of surface water and groundwater

The stability of the cover can be determined by landscape function analyses (LFA), while slope stability can be determined by geotechnical factor of safety calculations.

6.1 LANDSCAPE FUNCTION ANALYSES

Landscape function analyses is a transect based method that assess landscape function parameters and then list the analyses outcome in three indices, namely:

- Stability
- Infiltration
- Nutrient cycling

Indices are calculated by preprogrammed formulae that derives outcomes from the following measured parameters:

- Soil cover
- Basal cover of perennial grass
- Litter cover and litter cover origin and degree of decomposition

- Cryptogam cover
- Crust brokenness
- Erosion type and severity
- Deposited materials
- Micro topography
- Surface resistance to disturbance
- Soil slake test
- Soil texture

The measurement of the parameters listed is normally done by a trained field technician and can be done fairly quickly once the site is known.

These indices can be tracked over time to see if the system is improving. If the LFA scores have been calibrated for the area by using indicative reference scores, a final score for each index can be set to use as the relinquishment state.

6.2 SIDE SLOPE STABILITY ASSESSMENT

Side slope stability assessments are done by geotechnical engineers. The assessment uses site collected data, such as slope angles, state of consolidation of material, shear strengths, etc. An up to date site survey with relevant contours is needed for the assessment. Computer models are then used to calculate the factor of safety, which express the risk of potential failure of the slope.

Geotechnical side slope stability assessments will also have to be done in the first 3 years on an annual basis and a factor of safety of better than 1.5 achieved.

7 VEGETATIVE COVER/AGRONOMIC PRODUCTION

The vegetative cover monitoring programme is designed to verify that rehabilitated areas are successfully developing a productive, self-sustaining ecosystem, which facilitates the post closure land use.

The success of the vegetative cover is an important aspect in rehabilitation because of its impact on other parameters such as the extent of soil development, soil chemistry and surface erosion. The degree to which the vegetation cover is effective in reducing erosion is a function of the height and continuity of the plant canopy, the density of the ground contact cover, and the root density.

The vegetation contact cover also dissipates the energy from surface water runoff, thereby decreasing erosion forces. An increase in the vegetation cover results in an increase in both the evapo-transpiration rate and the infiltration rate leading to changes in the water balance. Finally, wildlife diversity and populations respond positively to an increase in available habitat and food supply that is brought on by the establishment of vegetative cover.

The major potential concerns with vegetative cover on rehabilitated areas are related to the adequacy of ground contact cover, the overall density of tree/shrub (woody) species, indigenous species composition and the presence of alien invasive species.

Agronomic production records will give an indication of the production potential of the arable land capability that has been reinstated. These can be compared to production records of surrounding farms.

7.1 BASAL COVER MONITORING

7.1.1 BASAL COVER PERCENTAGE ANALYSIS

The adequacy of vegetative ground contact cover in providing effective erosion control, habitat establishment and soil building for post closure land uses is related to the percentage basal cover of the site and species composition. Basal cover is a measurement of the contact cover of live rooted vegetation expressed as a percentage of the number of points assessed. A minimum of 200 points per transect is normally required for reliable results and one of the most effective methods of measurement is using the line-point method. This method also allows for measuring species composition and woody plant density at the same time.

Basal cover very seldom exceeds 25% and is correlated to rainfall and species composition. High rainfall can sustain a higher density of plants leading to higher basal cover. Plants with a creeping growth form dominating a site, also tends to lead to higher basal cover.

No biomass assessments will be done.

7.1.2 TREE/SHRUB DENSITY ANALYSIS

The density of tree and shrub (woody) species on rehabilitated areas provides an indication of the success of efforts in re-establishing a diverse savannah environment for post closure land use. A direct count of woody species within belt transects is utilised to determine the density of woody species on rehabilitated areas.

Selected transects used in the rehabilitated areas for measuring basal cover percentage will be utilised for determining woody species density. A count of all rooted, live woody plant within one meter on either side of the line will done.

No biomass assessments will be done.

7.1.3 SPECIES COMPOSITION ANALYSIS

The composition of species occurring will be measured by noting species names of the live rooted plant closest to each point in the basal cover assessment. Each species will be listed as to its desirability in the specific veld type. Alien invasive species will be listed where ever they occur on site, and not just in the assessment transects.

The percentage presence of each species will be depicted after each year's monitoring and trends tracked to see if the climax species starts to dominate in the area. A representative presence of climax species on the rehabilitated site, similar to that found in reference sites of the same veld type will indicate rehabilitation success.

7.1.4 HISTORIC RECORD SAMPLING IN REFERENCE AREAS

Representative vegetation reference plots (with similar/identical land uses as per the proposed post closure land use of rehabilitated mine areas in the same veld type) will be marked in areas near rehabilitated sites for determining the degree of achievement of rehabilitation success. This procedure, known as historic record sampling, provides an indication of the cover and diversity found in undisturbed areas.

Vegetative cover and diversity on reference plots will be compared with that on rehabilitated areas. These reference areas will be at least 2500 m^2 in size. Cover and diversity assessments will be done on reference sites at the same time of assessing the rehabilitated sites and will be compared to the results obtained from the rehabilitated sites.

7.2 VEGETATIVE COVER MONITORING SCHEDULE

Vegetative cover monitoring will begin one year after completion of revegetation activities and continue annually until rehabilitation success for vegetative cover is achieved. Assessments will be done by trained staff under the supervision of a qualified professional. Vegetative cover monitoring will be completed each year during the seasonal period of peak standing biomass.

Should vegetative cover monitoring after the first year of the aftercare period on any rehabilitated area indicate that the vegetation in that area is not developing in a manner that will lead to achieving vegetative cover success criteria, then necessary remedial measures will be undertaken to enhance vegetative growth in that area to the extent that required standards can be expected to be met.

7.3 REHABILITATION SUCCESS CRITERIA FOR VEGETATIVE COVER INDICATORS

Rehabilitation success for the vegetative cover will be demonstrated when the following criteria are met:

- The percentage basal cover on rehabilitated areas is greater than or equal to 8%;
- The density of tree/shrub species (woody species) on rehabilitated areas is between 150 and 200 woody plants per ha;
- Species composition is similar to the species composition of nearby reference sites; and,
- No category 1 declared weeds occurs on site.

Achievement of the rehabilitation success criteria for vegetative cover will ensure that a productive, self-sustaining vegetative community has been established which facilitates a sustainable post closure land use.

7.4 AGRONOMIC PRODUCTION

All areas rehabilitated to arable land capability will be used for crop production as soon as possible after rehabilitation. The production from these areas will be monitored and recorded as tons of product produced per hectare. Production figures from rehabilitated areas will be compared to that from the surrounding farms and successful rehabilitation will be deemed to have been achieved once production similar to that from surrounding farms has been repeatedly achieved.

RECORD OF REPORT DISTRIBUTION

SLR Reference:	710.19057.00002
Title:	Closure Plan for the proposed Siyanda Ferrochrome Smelter
Site name:	Proposed Siyanda Ferrochrome Smelter
Report Number:	1
Client:	Siyanda Chrome Smelting Company (Pty) Ltd

Name	Entity	No. of copes	Date issued	Issuer

COPYRIGHT

global environmental solutions

JOHANNESBURG

Fourways Office
P O Box 1596, Cramerview, 2060,
SOUTH AFRICA

Unit 7, Fourways Manor Office Park,
1 Macbeth Ave (On the corner with Roos Street), Fourways, Johannesburg,
SOUTH AFRICA

T: +27 (0)11 467 0945