PROPOSED ESTABLISHMENT OF AN OPEN CAST PGM MINE ON THE FARM VOLSPRUIT 326 KR AND THE FARM ZOETVELD 294KR, MOKOPANE DISTRICT, LIMPOPO PROVINCE

PAN PALLADIUM LTD

SYLVANIA PLATINUM LIMITED

FINAL SCOPING REPORT

LEDET EIA reference number: 12/1/9/2-W11
DEA waste licence reference number: 12/9/11/L582/5

October 2011

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INCLUDING FURTHER REVIEW BY PUBLIC AND OTHER STAKEHOLDERS

October 2011

1. EXECUTIVE SUMMARY

Sylvania Platinum Limited (Sylvania) as the primary holding company, with subsidiary company Pan Palladium South Africa (Pty) Ltd (Pan Palladium), has commissioned the services of EScience Associates (hereinafter referred to as 'ESA') to undertake a scoping and Environmental Impact Assessment (S&EIA) process to assess the environmental feasibility and impact of the possible establishment of a new open cast Platinum Group Metals (PGMs) mine near Mokopane in the Limpopo Province.

Pan Palladium proposes the mining of two (2) separate ore bodies through open cast mining on the farm Volspruit 326 KP, Mokopane, Limpopo Province. In addition, following consultation with the surface right owners, areas of the Farm Zoetveld 294 KR may be considered for the establishment of supporting above ground infrastructure. The mining of these two (2) ore bodies will result in two separate open cast pits to be established, the so-called "North Pit" and the "South Pit". It is estimated that the ore reserves underlying the site equal approximately 28 million tonnes, which suggests that the mine will be in operation for approximately 18-20 years. It is proposed that PGMs will be mined to a depth of approximately 180m at the North Pit and 180m at the South Pit. The site is currently a 'Green-fields' site under intense agriculture and all relevant surface infrastructure and other infrastructural requirements for the project will need to be developed. The development is expected to include access roads, administration buildings, workshops, storage/lay-down yards, sewage treatment plants, open cast pits, a processing plant, conveyors, a slimes dam, return water dams, electricity substations, electricity generation plant(s), a smelter complex, a Chemical Vapour Metal Refining (CVMR) plant, as well as supporting electrical and water reticulations.

The proposed project would entail several so-called 'listed activities', which may not commence prior to obtaining an Environmental Authorisation in terms of section 24 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA]. An application for Environmental Authorisation in terms of NEMA, for activities listed in Government Notices R.544 and R.545 of 18 June 2010, was submitted to the Limpopo Department of Economic Development, Environment and Tourism (LEDET) on 11 March 2011, which this authority acknowledged on 30 March 2011 (Appendix 2). The reference number **12/1/9/2-W11** has been issued by LEDET for this project. Furthermore, LEDET reviewed the draft scoping report, accepted the content therein and requested a final version to be submitted to the department. A copy of their acceptance letter (dated 6 September 2011) can be found in Appendix 2 hereto.

The proposed activities that are identified in GN R.544 and R.545 and which require Environmental Authorisation in terms of NEMA are summarised below:

- The construction of facilities or infrastructure for
  - the bulk transportation of water, sewage or storm water;
  - the transmission and distribution of electricity
  - the generation of electricity
  - the storage and handling of dangerous goods;
- The construction of a road outside an urban area;
- The transformation of undeveloped, vacant or derelict land;
- The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre;

- Any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent; and
- Facilities for the off-stream storage of water.
- Physical alteration of undeveloped land for industrial use where the total area to be transformed is 20 hectares or more.
- Commencing of an activity, which requires an atmospheric emission licence in terms of section 21 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)

The focus of the scoping and EIA process will be to assess the impacts on bio-physical and socio-economic site elements resulting from the project and to assign suitable management measures, where possible, to abate the identified impacts to within acceptable levels. The scoping phase, as the name implies, has scoped/identified the more pertinent of the potential impacts on the environment as provided below and these will be taken to the EIA phase for more comprehensive assessment:

- Impacts on surface and groundwater resources through accidental leaks and spillages of wastes and hazardous materials during the operational lifetime of the mine, as well as the impact of required dewatering on the surface and ground water regimes of the area. This is due to the expected interconnection between ground and water resources in the area. Due to the intense public interest in the project, specifically with regard to groundwater (and after public review of the draft scoping report), the geohydrological study scope has been increased to address some of these concerns, within reasonable limits.
- Impacts on natural site flora and fauna due to vegetation clearance and topsoil stripping, as well as the proximity to the Nyl River, which has a high biodiversity and is considered a key birding area in the Province.
- Impacts on the visual and aesthetic character of the region due to the establishment of a new mine
- Impacts of mine wastes on human health and the groundwater environment.
- End use alternatives will also be included.

The above impacts, as well as many others, will be comprehensively interrogated in the EIA phase of the project and the impact significance assessment thereof supplemented with specialist inputs where necessary. No environmental or socio-economic fatal flaws have been identified for the proposed project to date.

Furthermore, the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) requires so-called listed 'waste management activities' to be licensed. Various waste management activities in terms of GN. R. 718 of 3 July 2009, promulgated under the NEMWA, will be "triggered" and a waste management licence has been applied for to National Department of Environmental Affairs (DEA). An application to this effect was submitted to the DEA on 23 March 2011 and acknowledgment of the application received on 30 March 2011 (Appendix 3). The reference number **12/9/11/L582/5** has been assigned by the DEA to this application for waste management licensing.

In terms of the Mineral and Petroleum Resources Development Act (MPRDA), (Act 28 of 2002), a comprehensive Environmental Management Programme Report (EMPR) will be compiled in support of the application for a mining licence. The EMPR will be compiled in terms of section 39 of the MPRDA and section 51 of Regulation 527 of 2004. The MPRDA also requires a scoping and EIA process to be undertaken that will inform the compilation of the

EMPR. The objectives and reporting format for the required MPRDA scoping process are mirrored by those required for the environmental authorisation and waste licensing procedures. A single scoping and EIA process and resulting reports are proposed to be compiled that conform to the regulatory requirements of NEMA, NEMWA and the MPRDA in relation to the identification of potential environmental impacts resultant from the proposed Volspruit Mine. An application for a mining right was submitted to the Limpopo DMR in early September 2011. This scoping report will be assessed by the DMR in terms of MPRDA requirements for a mining right application.

In addition, an Integrated Water Use Licence application in terms of section 21 of the National Water Act (NWA) (Act 36 of 1998) will be completed and submitted to the Limpopo Department of Water Affairs. In support of this water use licence application, a comprehensive Integrated Water and Waste Management Plan (IWWMP) for the proposed Mine will be compiled.

Due to the proposed addition of a smelter complex and CVMR plant at the Volspruit mine, certain air emissions will be generated, which are regulated and controlled in terms of emission standards set in Regulations promulgated under the National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004)[NEMAQA]. Accordingly, an Atmospheric Emission Licence (AEL), as contemplated in NEMAQA, will also be applied for, for the proposed establishment of the smelter complex and CVMR plant.

This scoping report is not intended to provide a comprehensive assessment, but a preliminary indication of the more pertinent impacts anticipated from the development. In addition, this scoping report is intended to provide Interested and Affected Parties (I&APs) and Key Commenting Authorities (e.g. Dept. Water Affairs, Local and District Municipalities, LEDET, etc.) with sufficient information and background on the project to participate meaningfully in the EIA process. Furthermore, the scoping report and Plan of Study for Environmental Impact Assessment (PoSEIA) are intended to provide the Competent Authorities [LEDET, DMR and the National Department of Environmental Affairs (DEA)] with sufficient information to make an informed decision on whether to allow the application for environmental authorisation for the Volspruit Mine to proceed to the EIA phase.

The draft scoping report (which was made available for public review during July and August 2011) was sent for independent specialist review. This final version of the scoping report has taken cognisance of the independent review and comments of interested and affected parties and has been slightly modified, formatted and enhanced, although the content of the report has remained unchanged. The independent review was commissioned by Sylvania and undertaken by Sean O'Beirne of Sustainable Environmental Solutions (SE Solutions). The review is contained in the Appendix 10 to this report.

It is the Environmental Assessment Practitioner's submission that the EIA process to date (i.e. the 'scoping' phase) has been undertaken correctly and within the bounds of the applicable regulatory environment, as well as with environmental best practise principles in mind. It is, therefore, recommended that the scoping report and PoSEIA be accepted by LEDET, DMR and the DEA and ESA be allowed to proceed with the EIA phase of the application to further determine and quantify what the various impacts that the proposed Volspruit mine will have on the receiving environment.

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ABBREVIATIONS

APPA:	Atmospheric Pollution Prevention Act, No. 45 of 1965
BAT:	Best Available Technique
BEP:	Best Environmental Practice
BFD:	Bag Filter Dust
BPEO:	Best Practicable Environmental Option
CDM	Cleaner Development Mechanism
CER	Certified Emission Reduction
CO:	Carbon monoxide
CO_2:	Carbon dioxide
CVMR:	Chemical Vapour Metal Refining
DEA:	Department of Environmental Affairs
DMR	Department of Mineral Resources
MDL:	Minimum Detection Limit
DWA:	Department of Water Affairs
EIA:	Environmental Impact Assessment
IAPs:	Interested and Affected Parties
IPWM:	Integrated Pollution and Waste Management
IWWMP	Integrated Water and Waste Management Plan
LEDET:	Limpopo Department of Economic Development, Environment & Tourism
NEMA:	National Environmental Management Act, No. 107 of 1998
NEMA EIA Regulations:	Regulations GN R.543, R.544, 545 and R.546 (18 June 2010), as amended. Promulgated in terms of section 24(5) read with section 44, and sections 24 and 24D of the National Environmental Management Act, 1998
NEMAQA:	National Environment Management: Air Quality Act, No. 39 of 2004
NEMWA:	National Environment Management: Waste Act, No. 59 of 2008
NO_X:	Nitrogen oxides (NO & NO_2)
O_2:	Oxygen
PM:	Particulate matter
POSEIA:	Plan of Study for EIA
SO_2:	Sulphur dioxide
SO_3:	Sulphur trioxide
SO_X:	Sulphuric oxides
SR:	Scoping Report
TCLP:	Toxicity Characteristic Leaching Procedure
TOC:	Total Organic Carbon
UNESCO	United Nations Educational, Scientific and Cultural Organization

UNITS OF MEASURE

ºC: (Degree) Celsius
g: Gram
J: Joules
ºK: (Degree) Kelvin
kg: Kilogram (1 kg = 1000 g)
kJ: Kilojoules (1 kJ = 0.24 kcal)
kPa: Kilo Pascal (= one thousand Pascal)
l: Litre
m^3: Cubic metre (typically under operating conditions without normalisation)
MJ: Mega joule (l MJ= 1000 kJ)
mg/kg: Milligrams per kilogram
m/s: Metres per second
ng: Nanogram (1 ng = 10^{-9} gram)
Nm_3: Normal cubic metre (101.3 kPa, 273 ºK, 11% O^2)
pg: Picogram (1 pg = 10^{-12} gram)
ppb: Parts per billion
ppm: Parts per million
ppmv: Parts per million (volume basis)
t: Tonne (metric)
tpa: Tonnes per annum (year)
y: Year
µg: Microgram
µg/m^3: Micrograms per cubic metre

2. INTRODUCTION AND PURPOSE

2.1 BACKGROUND

Sylvania Platinum Limited (Sylvania) as the primary holding company, with subsidiary company Pan Palladium South Africa (Pty) Ltd (Pan Palladium) has commissioned the services of EScience Associates (hereinafter referred to as 'ESA') to undertake a scoping and Environmental Impact Assessment (S&EIA) process to assess the environmental feasibility and impact of the possible establishment of a new open cast Platinum Group Metals (PGMs) mine near Mokopane in the Limpopo Province.

Sylvania Platinum is a fast-growing PGMs producer located in South Africa's PGM-rich Bushveld Igneous Complex with a medium-term focus on low-cost tailings retreatment operations that are already contributing revenues and, in the longer term, a focus on shallow mining exploration interests. (From www.sylvaniaplatinum.com)

Pan Palladium (a subsidiary of Sylvania Platinum) proposes the mining of two (2) open cast ore bodies on the farm Volspruit 326 KP, as well as areas of the farm Zoetveld 294 KR being used for above ground infrastructure, near Mokopane in the Limpopo Province. The mining of these two ore bodies will result in two separate open cast pits to be established, the "North Pit" and the "South Pit". It was estimated that the ore reserves on site equal about 28 million tonnes, which suggests that the mine will be in operation for approximately 20 years. It is proposed that PGMs will be mined. The site is currently a 'Green-fields' site under intense agriculture and all relevant surface infrastructure and other infrastructural requirements for the project will need to be developed. The development is expected to include access roads, administration buildings, workshops, storage/lay-down yards, sewage treatment plants, open cast pits, a processing plant, conveyors, a slimes dam, return water dams, electricity substations, electrical and water reticulations.

The EIA is considered one of the early steps in evaluating the feasibility of a project of this scale. EScience Associates (ESA) has been appointed by Sylvania and Pan Palladium as independent Environmental Assessment Practitioners (EAP) to conduct the scientific investigations of the EIA and to facilitate the associated legal and administrative processes on their behalf. The main aim of the EIA is to assess the significance of potential environmental and socio-economic impacts and to provide this information to the public and relevant Government Authorities who are responsible for making decisions on the environmental approvals that the project would require before it may commence. The key Competent Authorities (CA) responsible are the Limpopo Department of Economic Development, Environment and Tourism (LEDET), the Limpopo Department of Mineral Resources (DMR) and the National Department of Environmental Affairs [DEA - previously the Department of Environmental Affairs and Tourism (DEAT)]. The National DEA will be responsible for assessing the waste licence application which will be submitted to this department, as hazardous waste will be produced/treated/recycled on the Volspruit mining property.

The proposed project would entail several so-called 'listed activities' which may not commence prior to obtaining an Environmental Authorisation in terms of section 24 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)[NEMA]. An application for Environmental Authorisation, in terms of NEMA, for activities listed in Government Notices R.544 and R.545 of 18 June 2010, was submitted to the CA (LEDET) on 11 March 2011, which this authority acknowledged on 30 March 2011(Appendix 2). The

reference number **12/1/9/2-W11** has been issued by LEDET for this project. Furthermore, LEDET reviewed the draft scoping report, accepted the content therein and requested a final version to be submitted to the department. A copy of their acceptance letter (dated 6 September 2011) can be found in Appendix 2 hereto.

Due to the nature and/or scale of some of the activities that would be associated with the proposed project, NEMA requires that the potential environmental impacts must be considered, investigated, assessed and reported on to the CA through a scoping and detailed EIA process, described in Regulations 26–35 of Government Notice R.543 (the so-called NEMA EIA 2010 amendment Regulations), promulgated in terms of section 24(5) of NEMA.

Furthermore, the regulations promulgated under the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) require certain waste management activities to be licensed. Various waste management activities in terms of Regulation 718 will be "triggered" and a waste management licence has been applied for from the National DEA. An application was submitted on 23 March 2011, and acknowledgment of the application was received from the DEA on 30 March 2011 (Appendix 3). The reference number **12/9/11/L582/5** has been assigned by DEA to this application for the waste management licence.

In terms of the Mineral and Petroleum Resources Development Act (MPRDA) (Act 28 of 2002), a comprehensive Environmental Management Programme Report (EMPR) will be compiled in support of the application for a mining licence. The EMPR will be compiled in term of section 39 of the MPRDA and section 51 of Regulation 527 of 2004. The MPRDA also requires a scoping and EIA process to be undertaken that will inform the compilation of the EMPR. The objectives and reporting format for the required MPRDA scoping process are mirrored by those required for the environmental authorisation and waste licensing procedures. A single scoping and EIA process and resulting reports are proposed to be compiled that conform to the regulatory requirements of NEMA, NEMWA and the MPRDA in relation to the identification of potential environmental impacts resultant from the proposed Volspruit Mine. An application for a mining right was submitted to the Limpopo DMR in early September 2011. This scoping report will be assessed by the DMR in terms of MPRDA requirements for a mining right application.

In addition, an Integrated Water Use Licence application in terms of section 21 of the National Water Act (NWA) (Act. 36 of 1998) will be completed and submitted to the Limpopo Department of Water Affairs. In support of this water use licence application, a comprehensive Integrated Water and Waste Management Plan (IWWMP) for the proposed Mine will be compiled.

The entire scoping and EIA process will also inform the compilation of an Environmental Management Programme Report (EMPR) in terms of Mineral and Petroleum Resources Development Act (MPRDA) (Act 28 of 2002. The EMPR will be submitted to the DMR as an addition, and in support of, the Mining Right Application. A detailed EMPR will be developed for the construction, operation and decommissioning of the proposed mine.

2.2 PURPOSE OF A SCOPING REPORT

The scoping and EIA process is divided into two main phases. These are the scoping phase and the EIA phase. Scoping is a critical stage of any EIA process and is an initial step in involving stakeholders in environmental considerations for all stages of planning and development processes.

The proposed Volspruit Mine EIA process is currently in the scoping phase. The ultimate purpose of the scoping phase is as follows:

- Scoping focuses the EIA to identify the key issues and potential impacts pertaining to the project, which will be further investigated in detail during the environmental impact assessment phase;
- Scoping results in the establishment of the technical terms of reference (TOR) (in the form of a Plan of Study for EIA) for the environmental assessment phase. It is, therefore, used as a tool to define the nature and extent of required investigations and specialist assessments during the EIA phase of the process; and
- Scoping is used to involve all interested and affected parties in the identification of key environmental issues that will be further investigated during the EIA phase.

After the scoping report has been reviewed by the various competent authorities, the competent authorities will give approval of the final scoping report and plan of study for EIA (provided the competent authority feels that the content of the scoping report is sufficient to make an informed decision on and approves it). If the report is accepted, this then allows the process to enter the EIA phase, where the TOR that were defined in the scoping report are taken forward and the actual assessment is undertaken on the ground.

The draft scoping report (which was made available for public review during July and August 2011) was sent for independent specialist review. This final version of the scoping report has taken cognisance of the independent review and interested and comments of affected parties and has been slightly modified, formatted and enhanced, although the content of the report has remained unchanged. The independent review was commissioned by Sylvania and undertaken by Sean O'Beirne of Sustainable Environmental Solutions (SE Solutions). The review is contained in the Appendix 10 to this report.

2.2.1 KEY OBJECTIVES OF SCOPING

The key objectives of scoping are to:

- Outline/define the baseline environment in which the project is proposed to take place
- Identify issues for investigation during the EIA
- Inform public of potentially significant impacts
- Identify stakeholders and their concerns
- Identify information necessary for decision-making
- Define alternatives (site and technology)
- Produce a plan of study for the EIA (TOR or methodology to undertake the EIA)

2.3 REGIONAL LOCATION

The study area is located in the Limpopo Province of South Africa, approximately 20km south of Mokopane. The farm is currently used for agriculture and is under intensive irrigation. A variety of commercial crops are grown on the property. The farm has river frontage on the Nyl River, which lies to the west of the property. The study property is the farm Volspruit 326 KT and The Farm Zoetveld 294KR, which lies to the south-east of the N1

national road, and west of the N11 road. For full locality plans and A3 maps, please refer to Appendix 1.

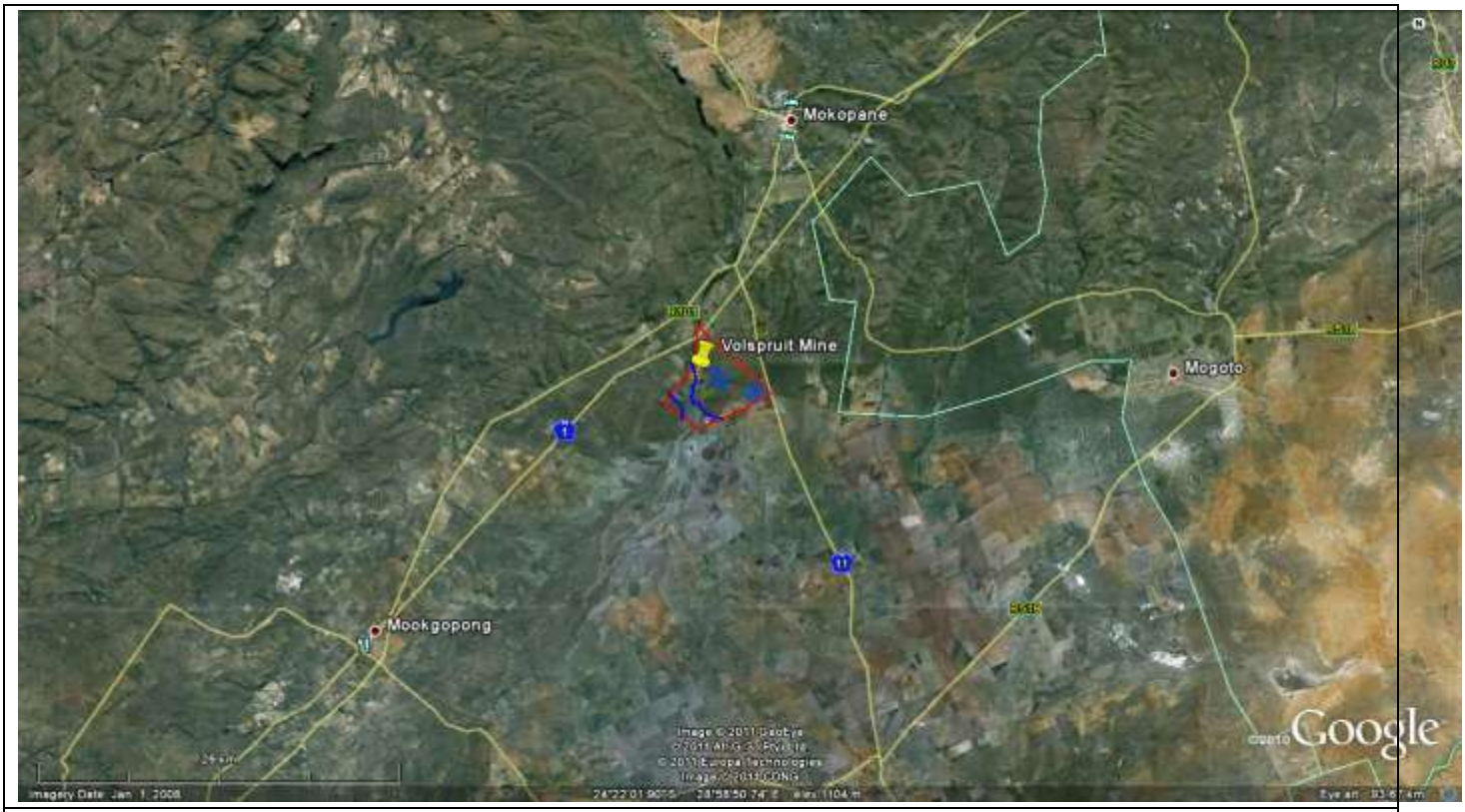


Figure 2-1: Regional orientation map for Volspruit Mine

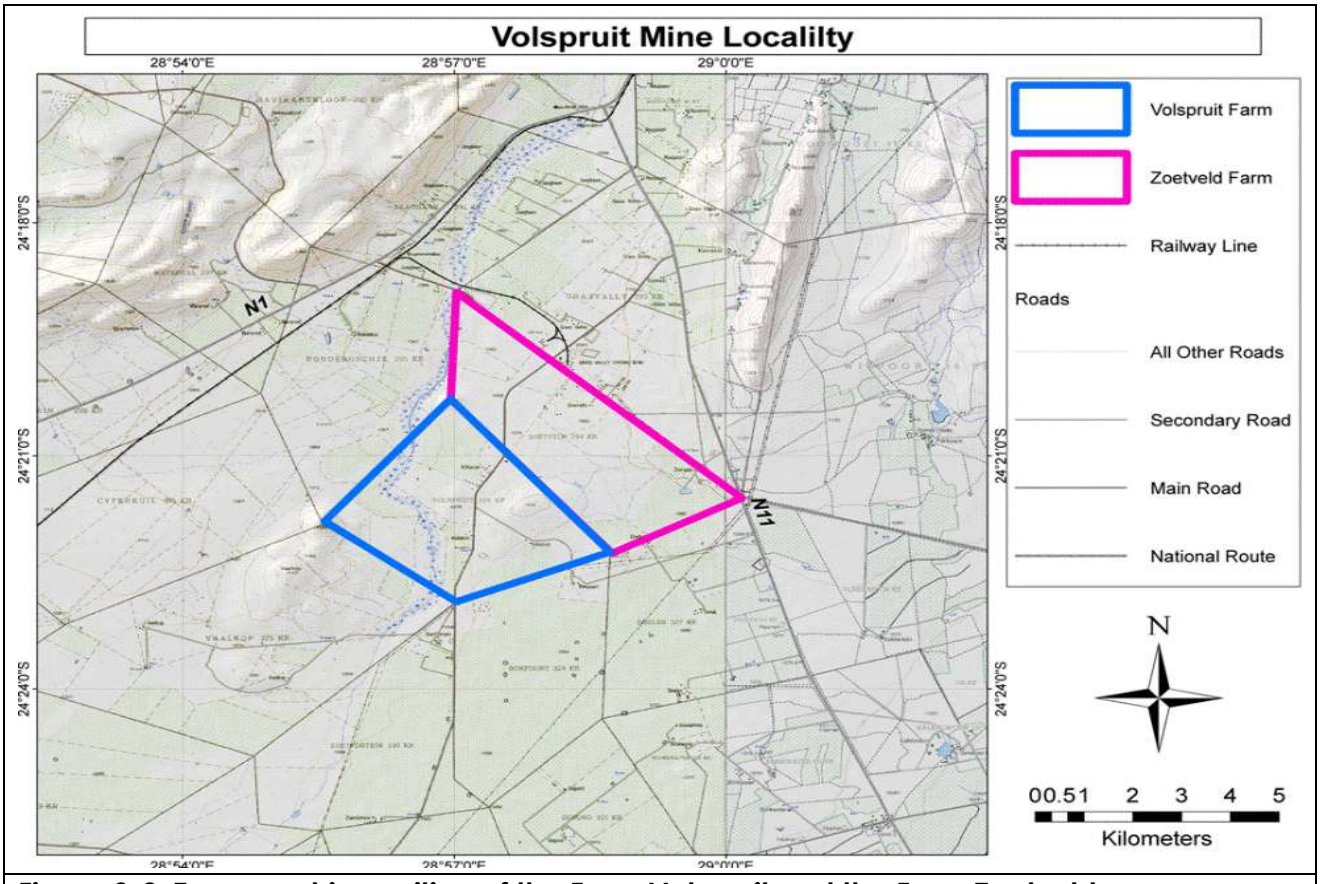


Figure 2-2: Topographic position of the Farm Volspruit and the Farm Zoetveld

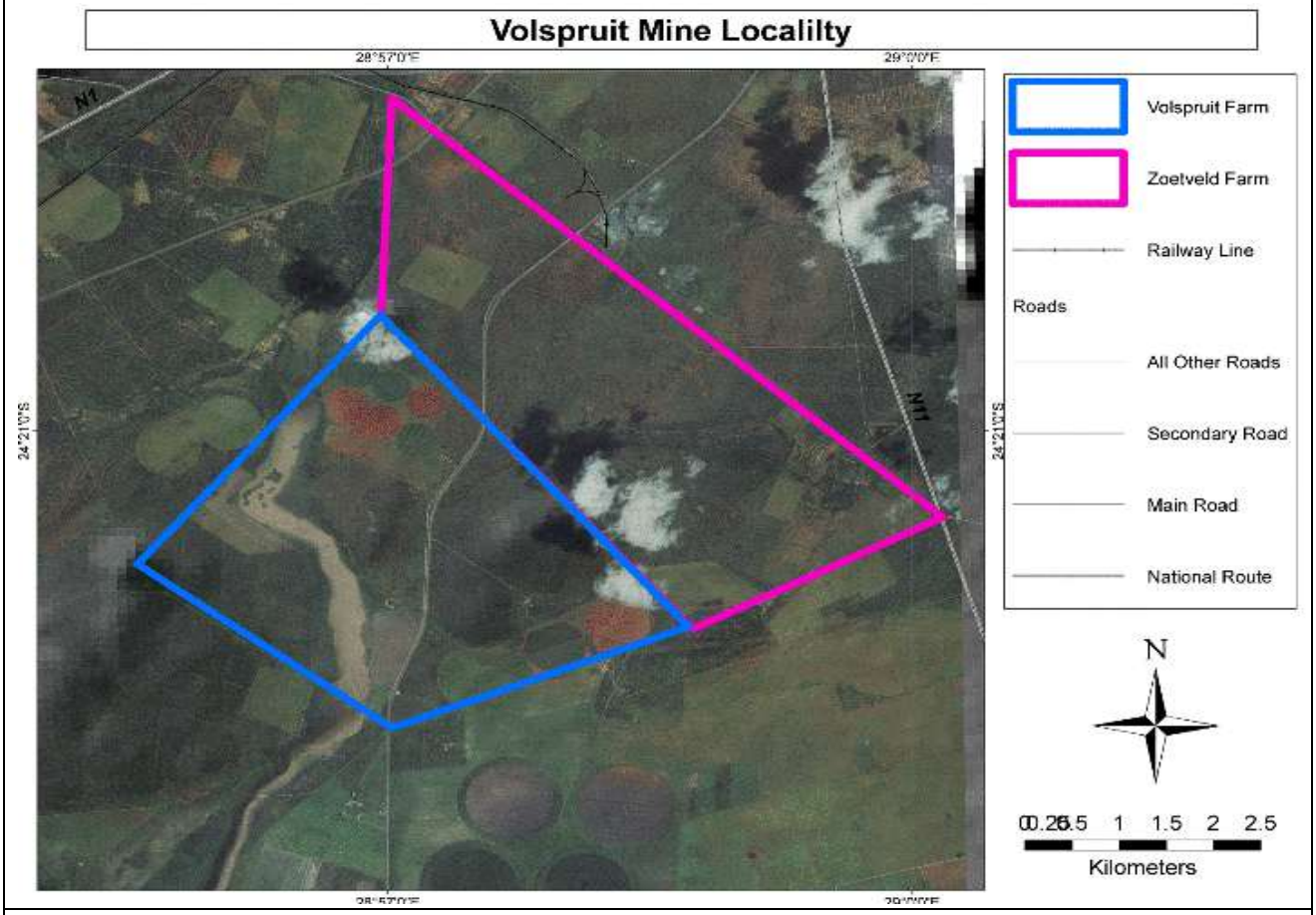


Figure 2-3: Aerial photograph of the Farm Volspruit and the Farm Zoetveld

Figure 2-4: Google Earth map of the Farms Volspruit and Zoetveld, with the positions of the north (yellow) and south (Green) open cast pits, as well as the 1:100 year flood line (blue line).

DETAILS OF ENVIRONMENTAL ASSESSMENT PRACTITIONERS (EAP)

The Scoping assessment for this application was undertaken by EScience Associates (Pty) Ltd. (ESA), as independent Environmental Assessment Practitioners (EAP) to Pan Palladium. The Environmental Impact Assessment study team was led by Mr Theo Fischer, senior environmental scientists with more than 10 years' experience in environmental management, with Brian Gardner, Roelof Letter and Bradley Thorpe in EIA project management roles (see Appendix 8 for relevant CVs).

2.4 LAND, LANDOWNER DETAILS AND SURFACE RIGHTS

Surveyor General 21 digit codes for 7 farms included in the EIA process:

T	O	K	R	0	0	0	0	0	0	0	0	0	3	2	6	0	0	0	1
T	O	K	R	0	0	0	0	0	0	0	0	0	3	2	6	0	0	0	2
T	O	K	R	0	0	0	0	0	0	0	0	0	3	2	6	0	0	0	5
T	O	K	R	0	0	0	0	0	0	0	0	0	3	2	6	0	0	0	7
T	O	K	R	0	0	0	0	0	0	0	0	0	3	2	6	0	0	0	8
T	O	K	R	0	0	0	0	0	0	0	0	0	2	9	4	0	0	0	2
T	O	K	R	0	0	0	0	0	0	0	0	0	2	9	4	0	0	0	R

Farm Portion	**Owner/contact person**
Portion 1 of the Farm Volspruit 326 KR	Faer Glen Properties (Pty) Ltd (Mr Phlippie de Klerk)
Portion 2 of the Farm Volspruit 326 KR)	Elizabeth de Beer (Contact Dewald de Beer)
Portion 5 & 7 of the Farm Volspruit 326 KR	Sylvania Platinum. Previously owned by Mazzaro Investments cc (Venizio Mazzaro)
Portion 8 of the Farm Volspruit 326 KR	Lukie and Carina Steenkamp
Portion 2 of the Farm Zoetveld 294 KR	H.C. Keet
The remainder of the Farm Zoetveld 294 KR (NOTE: Portion 1 of the farm Zoetveld 294 KR has been incorporated into the Remainder and records show the same owner)	Terra Nominees (Pty) Ltd (A subsidiary company of BHP Billiton) – Ms Elsa Wloschowsky

2.5 MUNICIPALITY AND REGIONAL DETAILS

District Municipality:	Waterberg District Municipality
Local Municipality (LM):	Mogalakwena Local Municipality

Nearest town/city:	Mokopane (previously known as Potgietersrus) is 20km to the north of the site. Polokwane, (formally Pietersburg) is approximately 60km north of Mokopane. The town of Roedtan is 30km to the south of the site.

2.6 THE PROPONENT (APPLICANT)

Sylvania Platinum is a fast-growing PGMs producer located in South Africa's PGM-rich Bushveld Igneous Complex with a medium-term focus on low-cost tailings retreatment operations that are already contributing revenues and, in the longer term, a focus on shallow mining exploration interests. (From www.sylvaniaplatinum.com)

These assets, coupled with well-resourced metallurgical and engineering expertise, position the company firmly as a low-cost, low-risk high-margin PGM producer when compared to conventional underground platinum mines. Their strategy is based on deploying revenues from the retreatment operations to fund the longer-term mining prospects. (From www.sylvaniaplatinum.com)

Sylvania is listed on the Australian Securities Exchange (ASX: SLV), is a member of the S&P/ASX 300 Index and is listed on London's AIM market (SLV). (From www.sylvaniaplatinum.com)

2.6.1 SYLVANIA'S VISION

Sylvania's vision is to become the pre-eminent, South African, mid-tier PGM producer as measured by its stakeholders, using its metallurgical and engineering expertise to acquire and develop low-risk tailings and shallow mining assets (From www.sylvaniaplatinum.com)

2.6.2 BEE FOR VOLSPRUIT PROJECT

To accommodate the required BEE participation in the project, it is proposed that PPD will transfer the prospecting right to a newly formed company, known as Volspruit Mining Company (Pty) Limited (VMC), a subsidiary company of PPD. The proposed shareholding in VMC will be 74% by PPD and 26% by BEE partners.

Figure 2-5 overleaf shows the current Sylvania company structure and operations.

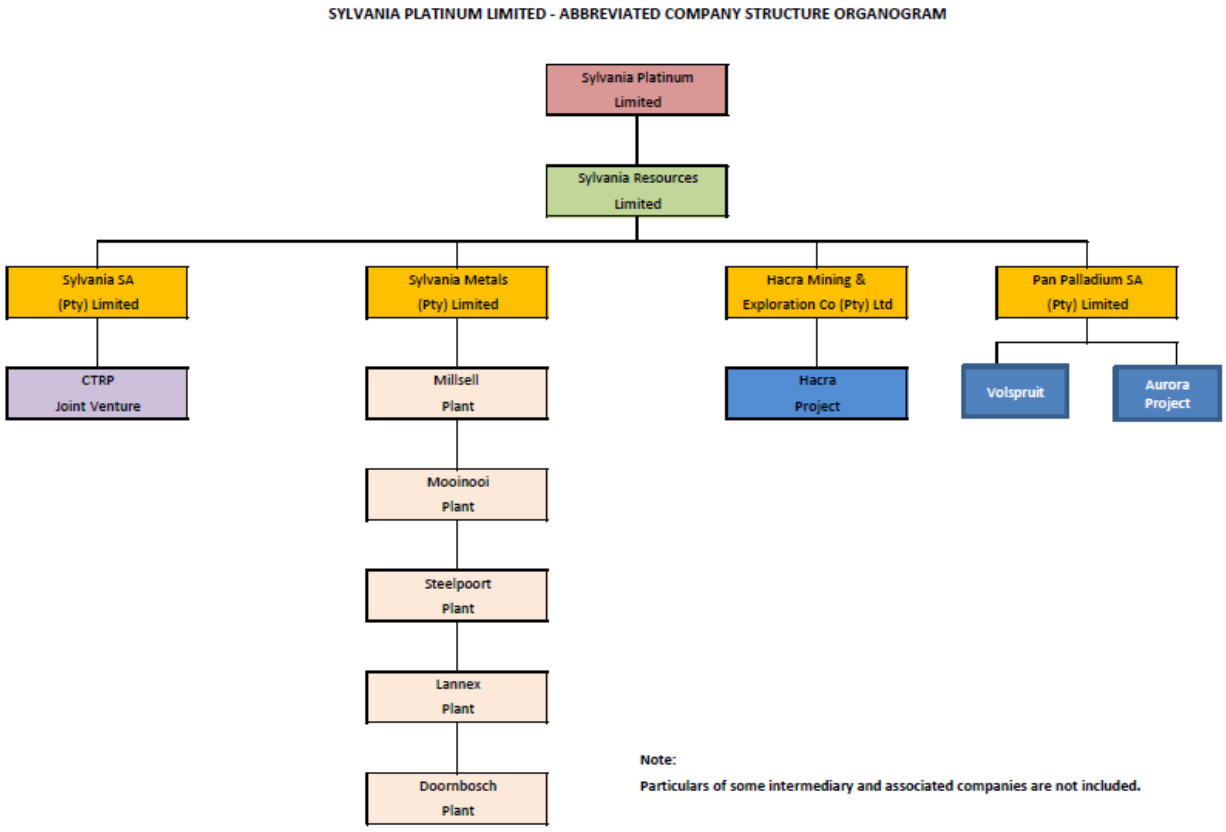


Figure 2-5: Sylvania Platinum Limited business structure

2.7 PROSPECTING RIGHTS ON THE FARM VOLSPRUIT

Currently, Pan Palladium is the holder of the prospecting right for the farm Volspruit and Portion 2 of the Farm Zoetveld, as indicated in Figure 2-6. It is required that the holder of the prospecting right also apply for the mining right. Pan Palladium South Africa (Pty) Limited (PPD is a subsidiary company of Sylvania Platinum Limited (Sylvania). The remainder of the farm Zoetveld is included in the scoping and EIA process as this property is proposed to be considered for alternative areas for the construction of the above ground infrastructure that is required for the project (i.e. tailings dams, admin buildings, waste rock dumps and a processing plant). Should this alternative be considered as feasible and realistic after all specialist studies have been undertaken, Pan Palladium will enter into discussions with the registered owner of the said property.

The landowners of the remainder of Zoetveld have been notified in writing that an EIA is in progress on their property.

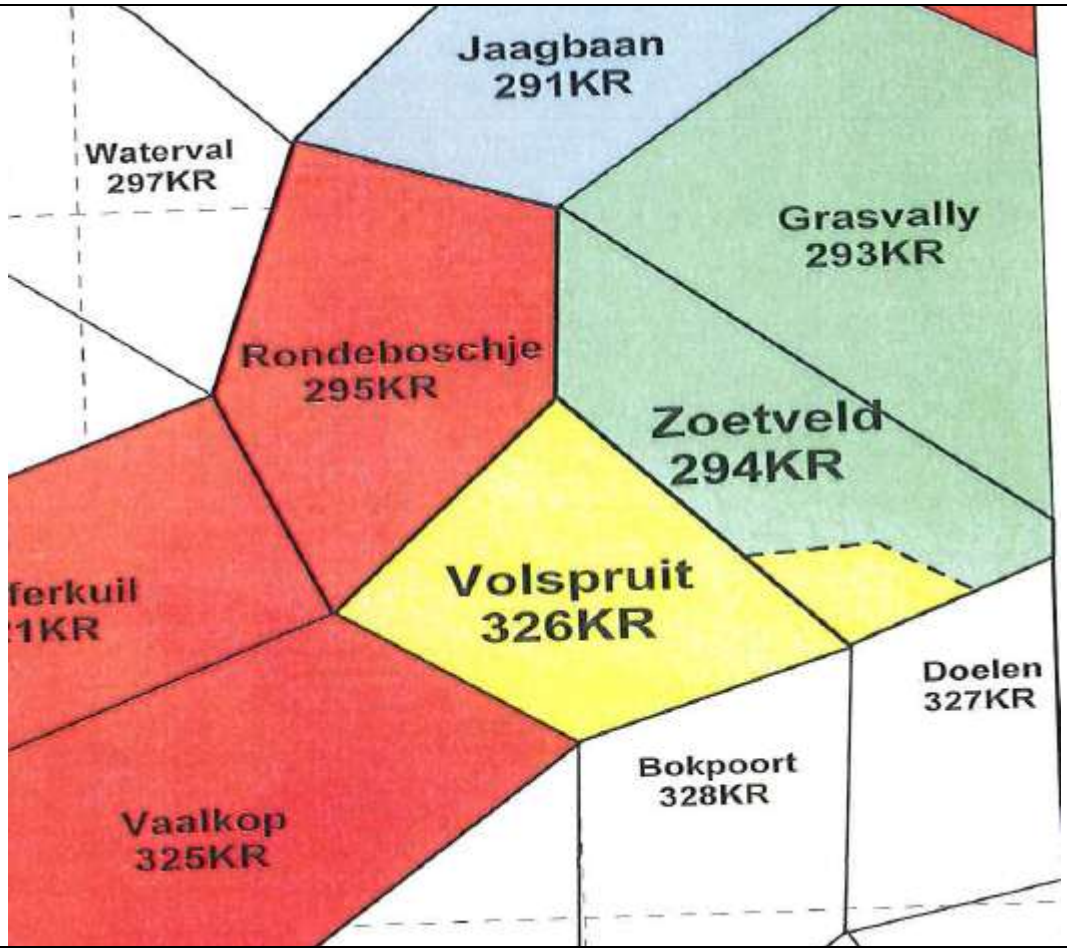


Figure 2-6: Map showing farm prospecting rights for Volspruit and surrounding farms. The prospecting right (yellow) is owned by Pan Palladium South Africa.

2.8 PROJECT MOTIVATION, NEEDS AND DESIRABILITY

Mining in South Africa is the single biggest economic driver and much of South Africa's wealth lies in precious metals. The Bushveld Igneous Complex has a wealth of precious metals and platinum group metals. The proposed Volspruit mine lies on the southern edge of the northern limb of the Bushveld Igneous Complex, with metals such as platinum, chromium, nickel and tin all being prevalent in economically recoverable quantities.

The Mokopane area already has one large PGM mine to the north of the town of Mokopane, which is a major contributor to the economic stability to the Mogalakwena Local Municipality and provides a number of jobs and stable incomes to families in the area.

The proposed Volspruit mine will further boost the economy of the Mogalakwena area, Limpopo Province and the overall South African economy. Platinum prices have been on the increase over the last 10 years, thus making the development of a PGM mine viable, which would contribute positively to economic growth.

The two figures which follow (Figure 2-7 and Figure 2-8) show clearly how the platinum and palladium prices have been steadily on the rise, worldwide, for the past few years. In the last 10 years platinum reached a high of over US$2100 in early 2008, but the world economic crisis of the latter half of 2008 devalued it by more than half its original value. Since December 2008 platinum prices have once again been on the increase and are now at around US$1700 per ounce.

Palladium prices have also been increasing steadily since the economic crash of 2008 and are currently at around US$700 per ounce.

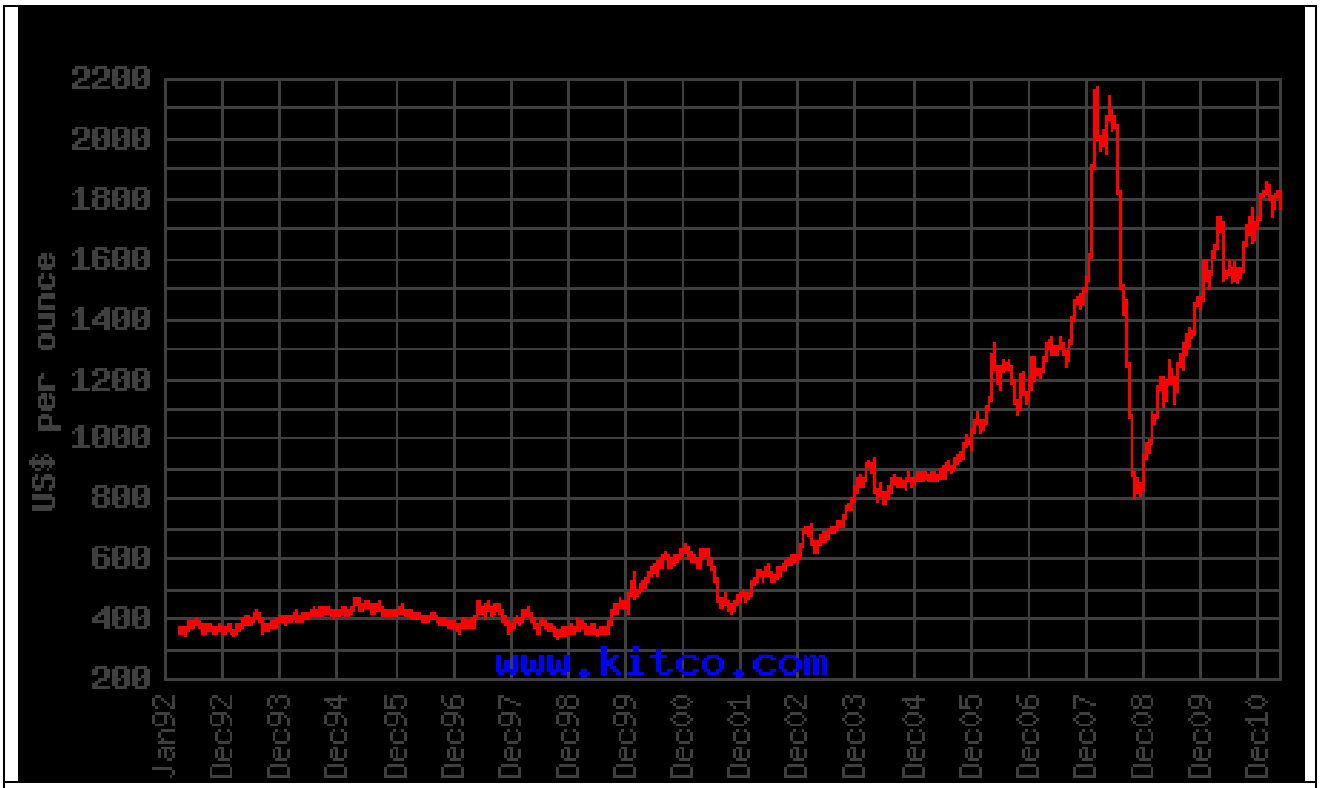


Figure 2-7: Graph showing the platinum price trend (in US$) from January 1992 to May 2011)

Figure 2-8: Graph showing the palladium price trend (in US$) from January 1992 to May 2011)

In addition to the above, the following section is adapted from Broughton. 2011: Urban-Econ Development Economists – Final scoping phase inputs (contained in Appendix 6 to this report), which has been compiled in order to better quantify the needs and desirability of the proposed Volspruit Mine project.

High unemployment rates and the need for increased injection into the national economy resulted in the change of the economic policy in the country in recent years. This creates a need to review the relevant policies and strategies with the purpose of identifying the alignment of the project with these policies and their implications on the proposed activity.

The proposed development is located in the Waterberg District. It involves extraction of PGMs and their beneficiation on site. For that purpose, the project includes the development of a smelter that will beneficiate the concentrate into platinum, nickel and copper, whereby the end result will be a chemically pure product of a relatively valuable grade. Given the intended processes and the output product targeted by the project, it can be determined that the level of beneficiation is represented by Stage 1 and Stage 2 operations (see Figure 2-9: Stages of beneficiation below).

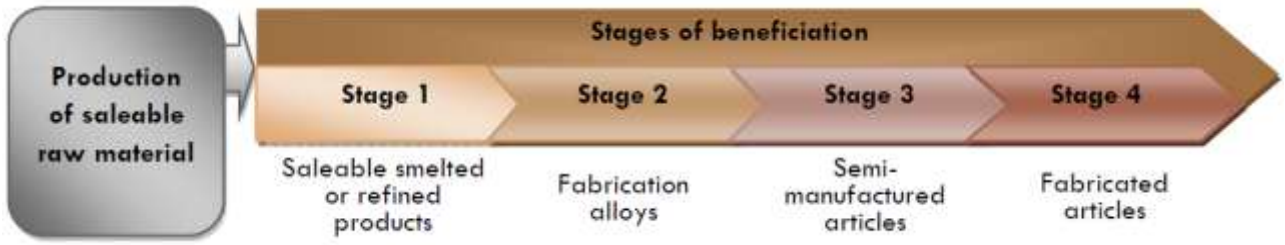


Figure 2-9: Stages of beneficiation

Given the above description of the proposed activity and the recent changes in the economic policy in the country, the following development growth plans, policies and strategies have been identified to potentially have a significant impact on the project's successful implementation:

- New Growth Path
- IPAP 2011/2012-2013/2014
- Industrial Development Corporation (IDC) and Development Bank of South Africa (DBSA) financing plans
- Draft Mineral Beneficiation Strategy for South Africa
- Limpopo Economic Development Plan
- Waterberg LED
- Waterberg Mining Strategy.

A brief synopsis of each policy and its relevance to the proposed development in terms of need and desirability follows.

2.8.1 NEW GROWTH PATH (2010)

The core focus of the New Growth Path is embedded in the objective to create decent employment, alleviate poverty and support sustainable long-term growth. Through the New Growth Path and the underlying policies and strategies, the government aims to create five million new jobs by 2020. The approach taken in the growth path is to identify areas in which employment creation is viable on a large scale and then to revisit policies

that hinder or promote specific industries. Priority has been given to the following sectors due to their ability to create employment opportunities whilst stimulating economic growth:

- Infrastructure
- Agricultural value chain
- Mining value chain
- Green economy
- Manufacturing sectors
- Tourism and high-level services

In terms of the mining sector, the Growth Path necessitates an effective review of mining policies, rights and regimes in order to stimulate private investment specifically aligned with beneficiation and greater utilisation of mineral resources in the country. Additionally, the New Growth Path gives preference to projects that engage Stage 3 and Stage 4 beneficiation (which entails semi-fabrication and fabrication of extracted minerals) as opposed to ending the value chain on smelting and refining. However, the Department of Mineral Resources (DMR) is currently conducting a value chain study to determine a strategic plan of action addressing Stage 4 beneficiation opportunities of certain minerals in the country. It is therefore worthy to note that although Stage 4 beneficiation is most advantageous, projects of lower levels of beneficiation remain highly desirable for the purpose of economic growth and provision of inputs for the downstream beneficiation.

The New Growth Path, based on the IDC's projections, set the employment target for the mining industry at 140 000 new jobs by 2020 and an additional 60 000 jobs by 2030. The majority of these employment opportunities are expected to be created from the enhanced PGMs, coal exports and final manufacturing using base metal products.

Since the proposed activity involves the extraction of PGMs and its beneficiation at Stage 1 and possibly Stage 2, it means that the project is in alignment with the New Growth Path framework and, if implemented, will make a direct contribution towards the achievement of the policy's targets set for the sector. Although it does not include Stage 4 beneficiation activities, it would provide valuable upstream support to expanding these types of activities if the project's outputs are used further in the local downstream activities instead of being exported.

2.8.2 NEW INDUSTRIAL POLICY ACTION PLAN 2 (IPAP) 2011/2012-2013/2014

The policy reflects collaborative objectives in economic growth and employment opportunities with regard to industrialisation in the country. The updated IPAP constitutes a central tool in the implementation of the New Growth Path job creation strategy. The Action Plan spans three years and is meant to be updated on an annual basis to assist the New Growth Path in achieving its target of five million jobs to be created by 2020. The interventions for the current IPAP2 2011/2012-2013/2014, though, target the creation of 129 000 jobs, of which 46 000 are expected to be created through direct impacts.

IPAP 2 2011/2012-2013/2014 desegregates targeted sectors into various clusters. The proposed project is mostly aligned with Cluster 2 interventions that aim at scaling up and breeding the existing IPAP sectors. The cluster targets existing sectors with high potential to positively impact industrialisation in the country through expansion in the relative industry and innovative ways to unleash the potential of the sector.

With respect to mineral beneficiation, IPAP 2 2011/0212-2013/2014 states that opportunities in this sector have already been operationalized, including the use of PGMs in

manufacturing of catalytic converters for application in emission control in the auto industry. The immediate actions set up for the active three-year period include, inter alia:

- setting minimum beneficiation levels for the key value chain through up-scaling the relevant strategy and programme, and
- the development of a gold-loan scheme to promote jewellery production.

Based on the above, the proposed project does not form part of any immediate actions set up for implementation within the mineral beneficiation industry. Nevertheless, it falls within the PGMs value chain that has been prioritised for development.

2.8.3 SUPPORT OF JOB CREATION BY IDC AND DBSA

The achievement of the New Growth Path targets and implementation of IPAP's interventions requires commitment from both public and private organisations. Some of the main vehicles that are charged with the objective to assist government in contributing to the achievement of the job creation target include the Industrial Development Corporation and the Development Bank of South Africa.

- The IDC has been identified as one of the key instruments in the successful implementation of the government's target of creating five million jobs over a decade. It is anticipated that about R102 billion will be lent to support government policies over the next five years and particularly for the implementation of initiatives set out in the current and later IPAPs. Mining and beneficiation will be allocated R22 billion of the above-mentioned amount, whilst the rest will be spent as follows:

    - Green industries – R22.4 billion
    - Manufacturing – R20.8 billion
    - Agricultural value chain – R7.7 billion
    - Tourism and creative industries - R14.8 billion
    - Funding to distressed companies - R2.5 billion
    - Strategic high-impact projects - R11 billion, and
    - Venture capital - R500 million.

    As part of its effort to support employment, the IDC has also launched a R10 billion scheme that would offer funding to developers of high-employment effect projects at prime less 3%.

    The specific areas that the IDC has identified for funding and technical assistance (where applicable) in accordance with the New Growth Path and the IPAP are as follows:

    - Mining, beneficiation and metal projects domestically and in the rest of the continent;
    - Facilitating acquisition of assets by historically disadvantaged people;
    - Developing the local jewellery manufacturing industry and other value-added beneficiation projects.

The role of the IDC in mining and mining beneficiation lies primarily the funding of capital investment for mining-related activities at all levels, i.e. funding is available for (emerging) mining houses and enterprises focusing on mining beneficiation. This means that the proposed project could potentially also apply for funding from the IDC.

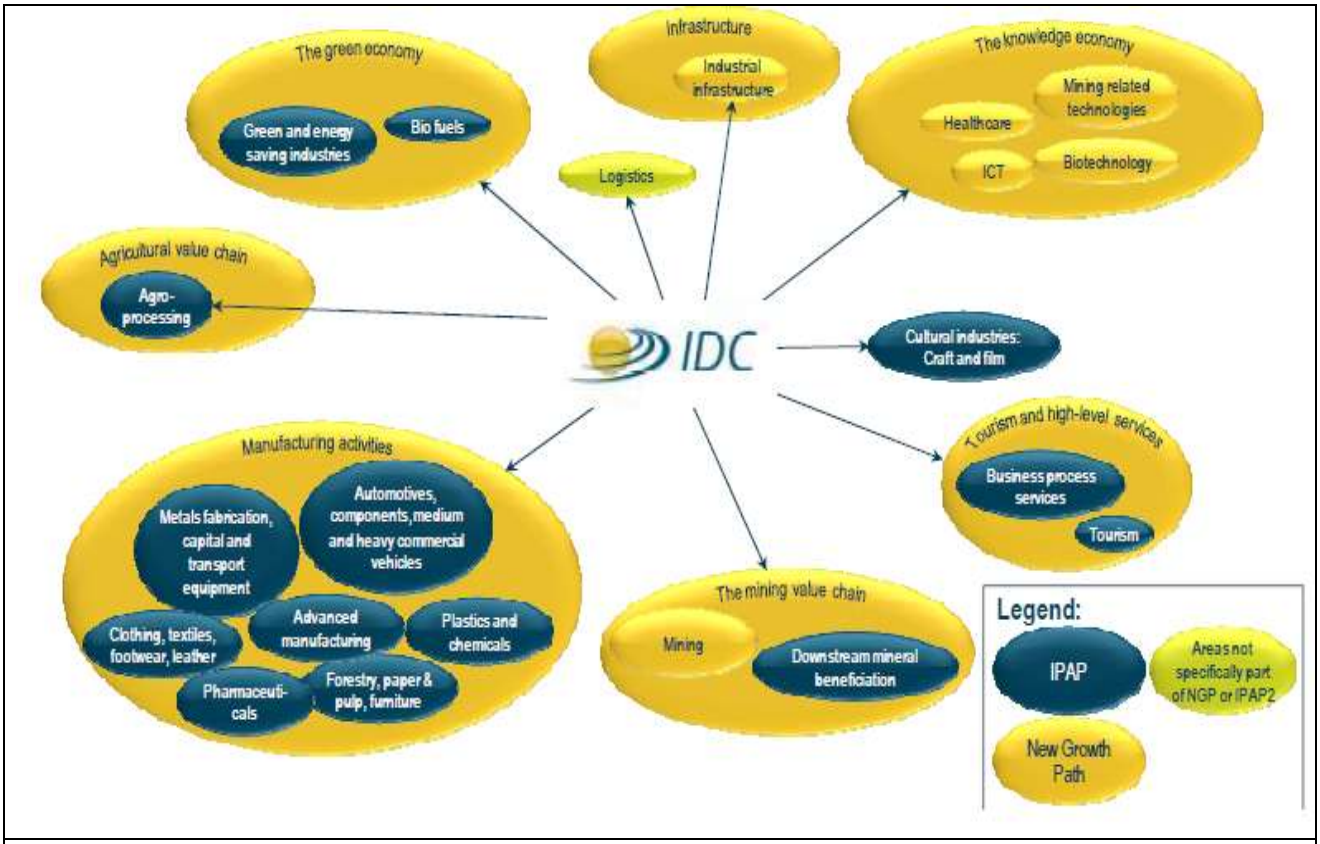


Figure 2-10: IDC target sectors – sectorial focus

- Another initiative by government aimed at supporting employment creation and economic growth is the allocation of R9 billion towards grants through a Jobs Fund, which is overseen by the Development Bank of South Africa (DBSA). The funding is available to both public and private sector agents which stimulate long-term job creation and have the potential to boost other local industries, i.e. high indirect and induced effects. The following sectors have been identified as key focus areas when selecting potential beneficiaries:
    - Enterprise development, which includes assistance to local procurement, marketing support, equipment upgrading or enterprise franchising
    - Infrastructural development, which includes the funding of light manufacturing zones and communication links to market goods
    - Support to job seekers, which includes setting up networks and projects that can provide training and career guidance
    - Institutional capacity building, which includes funding, internships and mentorship programmes

The mining industry has not been given a specific preference by the Job Fund; however, innovation, competitiveness and sustainability are the core criteria for the selection of projects. Therefore, eligibility of the proposed development for the Job Fund is a possibility provided that the key criteria are satisfied and the project shows that it will, for example, contribute to the support of job seekers.

2.8.4 DRAFT MINERAL BENEFICIATION STRATEGY FOR SOUTH AFRICA (2009)

The government has developed a Draft Mineral Beneficiation Strategy for South Africa in 2009/2010. In June 2011 government approved mineral beneficiation as an official policy. The document will be released later in 2011 after amendments have been made.

Although it is not known what changes will be made to the draft strategy, its review can already provide insight into the potential future developments in this sector.

The beneficiation strategy aims at promoting employment, poverty alleviation and improving the overall welfare of South Africans through mining and more specifically through the enhancement of mining beneficiation to the extent that mineral beneficiation is done up to the last stages of the value chain. Given the level of expertise and industry strength in the country, the strategy proposes the development of technological excellence and domestic know-how in beneficiation, in order for higher stages of beneficiation to be actively targeted.

The vision behind the beneficiation strategy is to identify innovative usage of mineral resources to enable the optimisation of the mineral resource base for the longer term benefit of the nation. The strategic goals in support of beneficiation are implemented through infrastructural development, investment promotion and facilitation, skills development, enabling a regulatory environment and research and development.

The strategy focuses on commodities such as gold, PGMs, diamonds, iron ore, chromium, manganese, vanadium, nickel, titanium, coal and uranium. It promotes the creation of five key value chains on the bases of the above-mentioned commodities, such as energy, steel/stainless steel, pigment production, auto-catalyst and diesel particulates, diamond processing and jewellery. These value chains have been chosen due to their potential to develop to the last stages of downstream beneficiation, such as fabricated articles as outlined in Figure 2 1. The use of PGMs is meant for the development of auto-catalysts and easel particulates, as well as jewellery production.

The draft strategy emphasised that the success of development of the PGMs-based value chain is based on, amongst others, commitment of the PGM mining sector to supply saleable raw materials for the local downstream beneficiation processes versus exporting them as has largely been done in the past. Given the composition of the proposed project, it can thus be stated that it would play an important role in ensuring the supply of necessary materials for the establishment of Stage 3 and Stage 4 beneficiation activities in the country.

2.8.5 LIMPOPO EMPLOYMENT GROWTH AND DEVELOPMENT PLAN (LEGDP) FOR 2009-2014

The Growth and Development Plan for Limpopo is a five-year plan that targets achievement of accelerated growth in terms of increasing sustainable jobs and increased levels of income sources in the Province through structural change in critical areas. The key challenges faced in Limpopo at present include persistent poverty due to a lack of productive capacities, limited fixed capital formation and low levels of skills and education of the population.

The LEGDP recognises the importance of mining in developing the provincial economy and creating new employment opportunities. In this respect, it identified the Dilokong Corridor (in Sekhukhune) and Mokopane (where the proposed mining site is based) as areas in the Province with potential for growth within the mining sector, which shows the optimal selection of a location for the proposed mining activity. The aforementioned high potential areas are likely to realise great benefit from the optimal location of the site varying from positive government assistance and intervention to higher than expected mineral resources.

The combination of the significance and potential of mining in the context of the provincial economy has led to the development of the primary goal to shift the local mining industry from a purely resource-based industry to a knowledge-based industry by 2030. The strategic challenges that need to be overcome and interventions aimed to be implemented to achieve the developmental vision for the mining sector and related beneficiation activities include, inter alia:

1. Challenges:
    - Development of Limpopo Mining and Minerals Beneficiation (LMMBI) aimed at acquiring the necessary skilled workforce (more specifically for the tooling and foundry industry) and establishing the Industrial Development Zones which will provide tax incentives, low tariff regimes and relaxed labour laws.
    - Formation and prioritisation of downstream beneficiation clusters with the primary goal of attracting Foreign Direct Investment (FDI).

2. Interventions:
    - Development of Limpopo Mining Input Suppliers Parks Beneficiation Hubs and a Supplier Development Programme that would focus on the supply of goods and services to the local mining activities.
    - Development of specialised mining skills programmes and schools.
    - Reviewing policy measures that allow the creation of industrial incentives unique to Limpopo mining beneficiation initiatives.

2.8.6 WATERBERG LOCAL ECONOMIC DEVELOPMENT (LED, 2007)

The main objective of the Waterberg LED is to stimulate economic growth in the district municipality via maximising competitive and comparative advantages, as well as optimal usage of local resources. The main aim of the LED is to target poverty alleviation whilst creating sustainable employment for the local people therefore improving the quality of life for all. Although the LED document is somewhat outdated, it still directs the development of the local economy and indicates the priorities for investments in the area.

The Waterberg LED recognises mining as a key sector in the district municipality followed by agriculture. A mining development strategy focusing on the improvement of the mining value chain has been established in support of the local mining industry. The LED focuses on clusters which have been formed in order to facilitate the specialisation of certain resources, namely PGMs and coal. With the assistance of the public sector, the cluster development aims to maximise the benefits of mineral resources through upstream and downstream activity in the local area.

The Waterberg District Municipality (DM) plays a two-tier role in the mining sector's development, i.e. firstly its role is to facilitate high-impact mining projects and secondly it is to promote small-scale mining among local cooperatives (Waterberg LED 2007). The proposed project could be classified as a high impact project as it does not only include the extraction of PGMs, but also involved their refinement and smelting. Although these stages of beneficiation are not usually assisted with labour-intensive activities and are rather capital-intensive exercises, the project will without doubt stimulate the growth of the local economy, thus making a direct contribution toward achieving a 6% economic growth rate target set by the LED. In addition, it will also provide new employment opportunities for local residents and ultimately improve the local employment situation and skills profiles, which is again in line with the objectives set by the LED.

2.8.7 WATERBERG MINING STRATEGY (2006)

The district economy is highly reliant on agriculture, mining and tourism due to the natural resources inherent to it. The recognition of comparative advantages associated with these sectors have led to the development of sectorial strategies for the district, including one for the mining sector. The Waterberg Mining Strategy aims to achieve a number of significant goals in order to advance economic growth through mining and minerals beneficiation. These goals include achieving increased competitiveness on a sustainable basis, attracting investment resulting in job creation, improving standards of living for communities and regional integration. Overall, the Waterberg mining strategy has set the following objectives:

- Create an environment conducive for mining expansion and new mining developments through, amongst others improved infrastructure (e.g. water, roads, electricity, and rail), skills promotion and small scale mining development.
- Promoting the capacity of BBBEE companies with regard to the supply for local mines.
- Enhance the capacity of local municipalities and local authorities as well as communities, to maximise the benefit from mining activity in and around their areas.

The Waterberg Mining Strategy highlighted the potential of the Waterberg District to become the major producer of platinum group metals in the world. It further stated that in 2006 no smelting or refining activities were taking place in the District and limited local procumbent was done in 2006. Given these gaps, the strategy calls for the development of downstream beneficiation and increased local procurement practices. The above are suggested to be achieved through a partnership between the local mines and government, whereby government should assist with the development of necessary infrastructure and removing land-use constraints. This suggests that potentially mining households and investors could approach local government to negotiate their involvement and assistance in the successful initiation of the project that would stimulate local economic growth and provide new employment opportunities for the residents.

3. PROJECT DESCRIPTION

3.1 PROCESS DESCRIPTION AND PROPOSED ONSITE INFRASTRUCTURE

Volspruit Mine is proposed to include two opencast pits, which are otherwise referred to as the "North pit" and the "South pit", due to their geographical location on the farm Volspruit. Mining of these opencast pits will entail initial topsoil stripping and stockpiling, with subsequent rock blasting and ore handling with large front-end loaders and trucks at the rock face thereafter. Waste rock (i.e. all material with no resource value that needs to be removed in order to access the targeted ore bodies) from the operations will be stockpiled above ground as waste rock dumps. Areas for waste rock dumps have yet to be determined. This waste rock will be transferred to ground level *via* haul trucks. The target ore will also be transferred to surface by haul trucks, but will be stockpiled separately as a ROM (Run of Mine) stockpile. This stockpiled ROM will then be transferred *via* conveyor and/or truck to a processing plant. Once at the processing plant, ore is washed, crushed, screened and sorted into different grades. Graded ore will then be transported to the smelter complex, for smelting *via* the Conroast process.

3.1.1 WHAT IS OPENCAST MINING?

Opencast mining (or open-pit mining) refers to a method of extracting rock or minerals from the earth by their removal from an open pit, or borrow pit.

The term is used to differentiate this form of mining from extractive methods that require tunnelling into the earth. Open-pit mines are used when deposits of commercially useful minerals or rock are found near the surface; that is, where the overburden (surface material covering the valuable deposit) is relatively thin or the material of interest is structurally unsuitable for tunnelling (as would be the case for sand, cinder, and gravel). For minerals that occur deep below the surface—where the overburden is thick or the mineral occurs as veins in hard rock—underground mining methods extract the valued material (Wikipedia, 2011).

Open-pit mines are typically enlarged until either the mineral resource is exhausted, or an increasing ratio of overburden to ore makes further mining uneconomical.

3.1.2 BENCH AND TERRACE OPENCAST MINING

This is the traditional cone-shaped excavation (although it can be any shape, depending on the size and shape of the ore body) that is used when the ore body is typically pipe-shaped, vein-type, steeply dipping stratified or irregular. Although it is most often associated with metallic ore bodies, e.g. Palabora copper mine, Mamatwan and Sishen iron-ore, it can be used for any deposit that suits the geometry (i.e. the Volspruit deposit).

The excavation is normally by rope- or hydraulic shovels with trucks carrying both ore and waste. Drill and blast is most often used, which makes the process cyclic. Waste is dumped outside the mined-out area since no room is available within the pit. Waste is placed as close to the edge of the pit as possible, to minimise transport costs. Figure 3-1 illustrates the terminology used in the pit design (Bullivant, 1987).

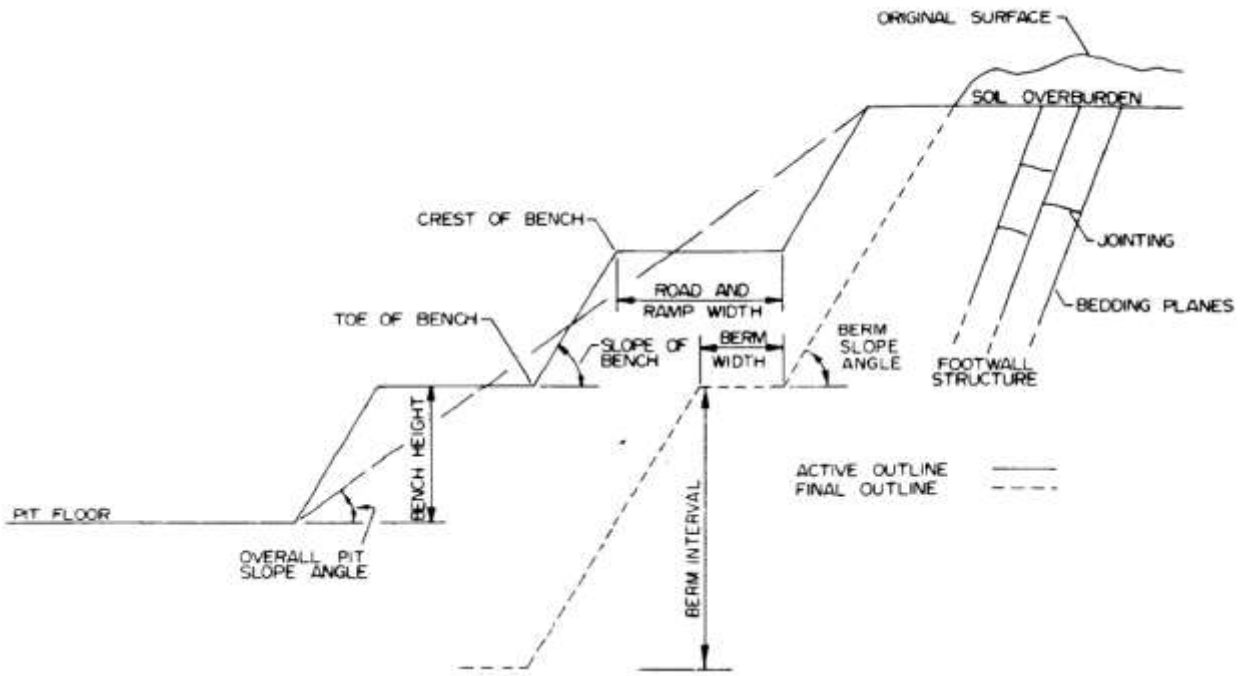


Figure 3-1: Typical open-pit bench terminology

Benches are normally excavated from 2-15m in height in stacks of 3 to 4, in between which is a crest on which the haul road is placed. When the number of benches in the stack increases, the road gradient also increases (Bullivant, 1987).

Benches in the stack have a steep face angle whilst the stack and overall slope angles are flatter, thereby helping to prevent slope failures. From an analysis of overall slope geometry, it is clear that as steep a slope as possible should be mined, to reduce the overall stripping ratio. However, this rule is limited by the maximum gradient of the haul road – typically 8-10% which requires frequent wider crests and the need to have flatter slope angles in places to provide slope stability. Note that each pit slope can have a different angle according to the requirements of the design – with or without haul roads, geology and depth of pit (Bullivant, 1987).

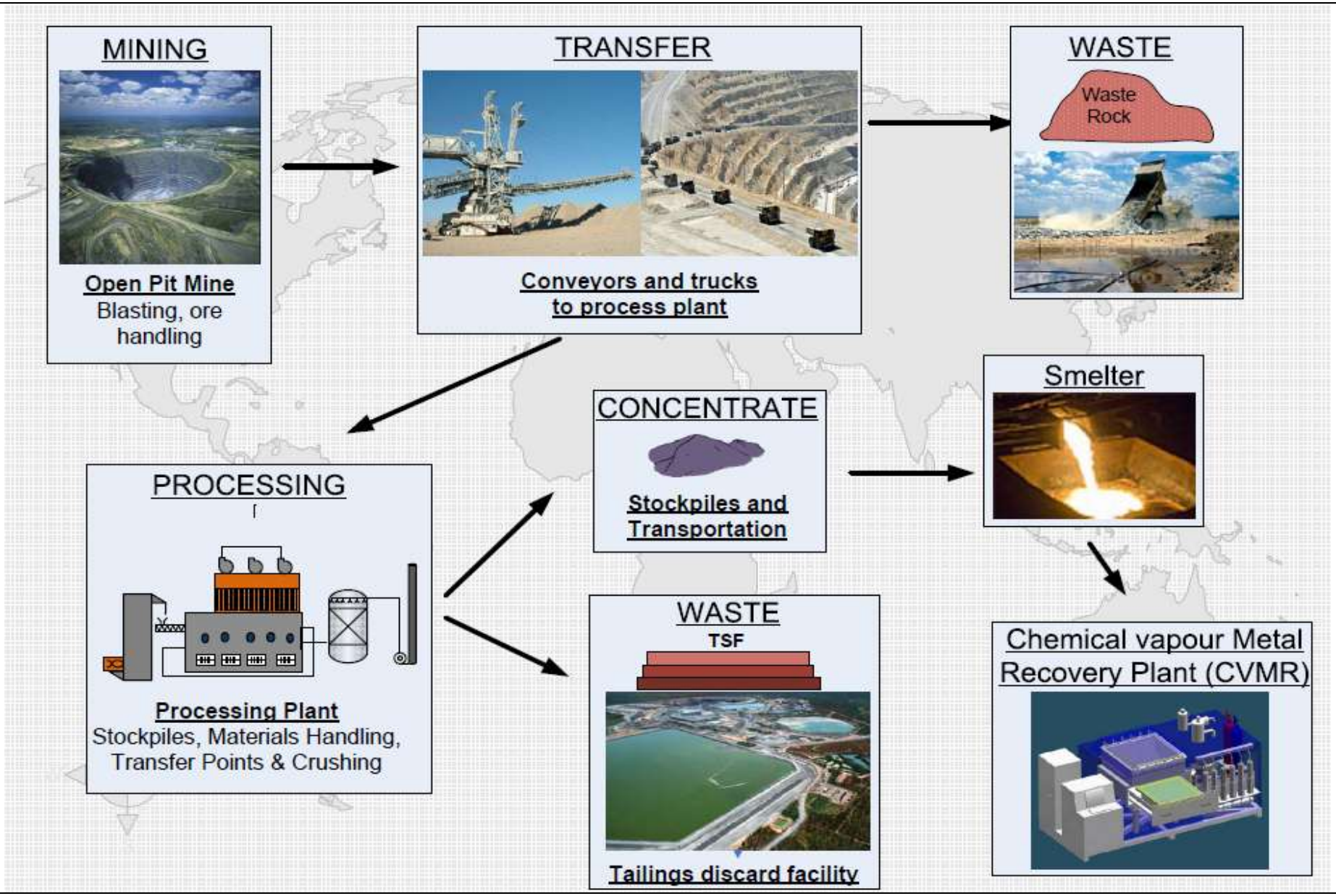


Figure 3-2: Generic diagram showing the mine process flow.

3.1.3 PROPOSED PIT DEPTHS AND DIMENSIONS

Definitions of phrases used in this section (from Wikipedia, 2011):

Inferred resource is an estimate, inferred from geo-scientific evidence, drill holes, underground openings or other sampling procedures and before testing and sampling information is sufficient to allow a more reliable and systematic estimate.

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

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

Stripping ratio or strip ratio refers to the amount of waste rock or overburden removed to recover ore. For example, a stripping ratio of 3:1 means to recover one ton of ore you must remove three tons of waste rock.

3.1.3.1 NORTH PIT

The proposed North Pit dimensions as shown in Figure 3-3 below are as follows:

Red line: 1 000 metres
Green Line: 1 002 metres
Blue line: 665 metres
Area covered: Approximately 62 hectares

Northern Pit statistics:
Total *in situ* resource: 50.94 million tonnes
In Measured Category: 28.4 million tonnes
In Indicated Category: 16.6 Million tonnes
In Inferred Category: 0.76 Million tonnes

- Mining from the Northern Ore Body will yield 46.18 million tonnes ore.
- Total Waste Rock Mined from Northern Ore Body: 84.71 million tonnes
- Strip ratio: 1.83 : 1
- Northern Pit depth: 180 metres

The final cut on north bench is at elevation 900 metres above sea level (masl). Starting elevation is 1 080 masl; therefore proposed pit depth is 180m. This depth assumes a stripping ratio of 1.83:1

Figure 3-3: Dimensions of the proposed North Pit

3.1.3.2 SOUTH PIT

The proposed South Pit dimensions as shown in Figure 3-4 below are as follows:

Red line: 826 metres
Blue line: 432 metres
Area covered: Approximately 30 hectares

Southern Pit statistics:

Total *in situ* Resource: 47.8 million tonnes
In Indicated Category: 28.4 million tonnes
In Inferred Category: 19.3 million tonnes

- Mining from the Southern Ore Body will yield 10.22 million tonnes ore.
- Total Waste Mined from Southern Ore Body: 40.30 million tonnes
- Strip ratio: 3.94 : 1
- South Pit depth: 180m

The final cut on South Bench is at elevation 910 masl. Starting elevation is 1 090 masl; therefore proposed pit depth is 180m. This depth assumes a stripping ratio of 3.94:1.

Figure 3-4: Dimensions of the proposed South Pit

3.1.4 PROCESSING PLANT

The processing plant will involve eight (8) distinct stages, which are described below.

1. **Crushing**

Run of mine (ROM) ore is received from the pit and transferred to either a temporary stockpile, or directly to the crushing plant.

ROM ore is reclaimed from the stockpile or fed by a feeder directly into a primary jaw crusher. The product is then conveyed to a bin and fed via a vibrating feeder onto a single deck screen. The oversize product is fed into a cone crusher. The screen undersize and cone crusher product is conveyed to a bin where it is fed via a feeder to a triple deck dry screen. The oversize is recycled through a cone crusher and the undersize fed to the mill feed bin.

2. **Mill feed**

Crushed ore is withdrawn at a controlled rate from the mill feed bin by a combination of two variable speed vibrating feeders delivering onto the mill feed conveyor. The mill feed conveyor is fitted with a mass meter for measurement of tonnage treated and control of the mill feed rate. An atomised fog dust suppression system is included. Steel balls are automatically loaded onto the mill feed conveyor by a ball charger.

Milling

Crushed ore is milled in the ball mill. The mill discharges slurry via a trommel screen, the oversize scats discharge into the scats bunker for reclaim by front end loader.

The mill trommel undersize slurry flows into the mill pump tank and is pumped to the mill cyclone cluster for size classification. The mill pump tank level is measured and controlled by adjusting cyclone feed pump speed. Cyclone feed pulp density is maintained at a constant level by addition of dilution water.

Cyclone underflow gravitates to the mill for further grinding, whilst the cyclone overflow gravitates to the rougher floatation. The primary mill is thus in closed circuit with the primary cyclone cluster. Vertical spindle pumps are provided in the milling area for spillage handling.

3. Rougher floatation

Primary rougher feed reports to the first of two conditioner tanks and then flows into the rougher float cells, finally gravitating into the rougher tailings tank.

Promoter, collector and depressant are added to the first conditioner. Frother and collector are added to the first rougher cell and depressant to the third rougher cell. Frother plays a critical role in the flotation of precious and base metal sulphide ores. Its main function is to stabilize the bubbles that transport the hydrophobic value minerals to the surface froth zone where they can be easily collected.

4. Cleaning

Primary rougher concentrate reports to the cleaner flotation cells for upgrading of the concentrate.

Low pressure air is supplied to each of the rougher cells as is spray water to the concentrate launders for each cell. Cleaner concentrate is pumped to re-cleaning, and spillage in this area is diverted to the primary rougher spillage pump.

5. Re-cleaning

Cleaner concentrates report to the re-cleaner flotation cells after which a depressant is added. Concentrate from the re-cleaner cells is pumped as final concentrate to concentrate dewatering.

Tailings from the primary re-cleaner cells is pumped to cleaning and low pressure air is supplied to each of the cells as is spray water to the concentrate launders for each cell.

6. Concentrate dewatering

Final concentrate is received in the concentrate feed tank where it is dosed with flocculent and flows to the concentrate thickener. The thickener underflow pump alternates between feeding the concentrate stock tank or re-circulating slurry to the thickener feed. Thickener overflow gravitates to the spray water tank from where it is pumped to the flotation circuit sprays.

Underflow density is controlled. Concentrate slurry is pumped from an agitated stock tank to the concentrate filter press at the smelter concentrate receiving area.

7. Tailing (pre-holding facility)

Flotation tailings report to the tailings feed tank. The tailings slurry is stored in an agitated tank before pumping to the tailings storage facility.

From the tailing feed tank, a waste "tailings slurry" is pumped to a "Tailings Dam" or "Tailings Storage Facility" (TSF). The actual location of the tailings dam on either the farm Volspruit or Zoetveld is at this juncture not known. This will become known after specialist studies have been undertaken, which will inform the placement of the TSF.

3.1.5 SMELTER COMPLEX AND CVMR PLANT

In addition to the opencast mining operations on site, it is proposed that a smelter complex be established. The smelter will be based on the Conroast process with the key

process items being Concentrate Roasting and Direct Current (DC) smelting. The alloy will be atomised and sent to the refinery operating on the Chemical Vapour Metal Refining (CVMR) carbonyl process. Taken from Wikipedia, 2011, "Smelting" is a form of extractive metallurgy; its main use is to produce a metal from its ore. This includes iron extraction from iron ore and copper extraction and other base metals from their ores. Smelting uses heat and a chemical reducing agent to change the oxidation state of the metal ore; the reducing agent is commonly a source of carbon such as coke, or in earlier time's charcoal. The carbon or carbon monoxide derived from it removes oxygen from the ore to leave the metal. The carbon is thus oxidized in two stages, producing first carbon monoxide and then carbon dioxide. As most ores are impure, it is often necessary to use flux, such as limestone, to remove the accompanying rock gangue as slag.

The smelter capacity is calculated to achieve a nominal electrical power delivery of 5 Mega-Watts (MW) to the Direct Current (DC) furnace.

3.1.5.1 SMETLER PROCESS DESCRIPTION

Adapted from the Volspruit Smelting and Refining Scoping Study report (compiled by Vardar 2011), the smelter complex is proposed to have the following six (6) distinct phases:

1. Concentrate receiving and blending. The slurry will be delivered via a slurry pipeline from the Volspruit concentrator to the smelter. The concentrate slurry will be stored in agitated holding tanks. The slurry from the holding tanks will be pumped to an agitated filter feed tank. The filter will be fed at a constant slurry density and flow rate to the slurry filter. The filter filtrate will be pumped to the process water thickener. The filter cake will be discharged onto a conveyor, transferring the cake to the concentrate storage shed. Provision will be made to receive concentrate cake.

2. Concentrate drying. The dryer feed conveyor will transfer the concentrate cake to the dryer feed inlet chute. A coal-fired hot gas generator will deliver the required energy to the flash dryer. The cake will pass through a disintegrator to separate the cake into fine particles to enhance the drying process. The concentrate will travel up along the flash tube and enter a cyclone. The cyclone underflow will be collected in the dry concentrate storage silo. The cyclone overflow will feed a baghouse. The baghouse dust will be fed to the dry concentrate storage silo. The clean air passing through the baghouse will be released via a stack into the atmosphere. The concentrate storage silo will discharge into a pneumatic transfer system feed tank. The dry concentrate will be transferred pneumatically to the roaster feed hopper. The pneumatic transfer air will be supplied with compressor and air receivers.

3. Roasting. The dry concentrate will be transferred pneumatically from the dry concentrate storage bin to the roaster feed hopper. Sand will be fed for start-up and fluidisation. The energy for roasting will predominantly be supplied by the exothermic oxidation of sulphur in the concentrate. Coal will be used as an additional heat source to maintain the roasting temperature. LPG will be used as start-up fuel and nitrogen will be used to flush the combustion chamber. The Ni, Cu, Co, Fe sulphides will be converted to oxides.

   The roasted concentrate will be blown/ sucked from the fluidised bed to the off-gas ducting. Air will be introduced to cool the off-gas temperature to just above the dew point of the acid. A cyclone and baghouse combination will collect the

roasted concentrate. The roasted concentrate will be stored in a bin and pneumatically transferred to the furnace feed bins.

4. Sulphur fixation plant. The roaster off-gas exiting the baghouse will contain high amounts of SO_2(g) and acid mist, which will be captured in a S-fixation plant, producing gypsum. Limestone will be slurried with water and injected into the scrubber. Oxygen will be blown into the scrubber basin to produce a stable product of gypsum. The produced gypsum will be dewatered in a belt filter and stored. (It should be noted that it is possible that an H_2SO_4 plant will be considered as an alternative to the sulphur fixation plant. This has not been finally determined as detailed engineering needs to be undertaken.)

5. Furnace. The primary feed to the furnace is roasted concentrate. The roasted concentrate will be pneumatically transferred to the furnace feed bins. Level indicators on the feed bins will ensure that the desired concentrate levels in the bins are maintained.

   Anthracite will be used as a reductant and transferred in bulk bags with the overhead crane to the furnace anthracite feed bin(s). The anthracite bin levels will be controlled. Rotary feeders with variable speed drives control the feed rate of anthracite to the dosing conveyor. Reverts are collected and returned to the furnace reverts feed bin.

   The alloy fall in the furnace is controlled by the flow rate of anthracite to the furnace. Sufficient iron oxide from the feed is reduced to iron in order to ensure good recovery and collection of valuable base metals and PGMs. Care is taken to ensure that the alloy quantity is kept close to the minimum required (in order to keep the concentration of PGMs as high as possible).

   One slag and one alloy water-cooled copper taphole block will be provided. One mudgun/drill system will be installed that can operate at either taphole. Oxygen lancing facilities will be provided. Molten slag will be tapped into cascading ladles and naturally cooled. Alloy will be tapped into ladles and transferred with an overhead crane to the holding and atomisation section of the plant.

   The furnace off-gas contains significant amounts of CO(g). The CO(g) is combusted in the ducting by air suction through a slip gap between the roof and water cooled ducting. The hot combusted gas will be diluted with air to reach a temperature just above the dew point of SO_2(g) before being cleaned with bag filters. The collected dust in the filters will be discharged into a hopper located under the bag house and transferred pneumatically or in bags to the concentrate feed bins.

6. Hot holding and Atomisation plant - The furnace alloy will be tapped into ladles and transferred with an overhead crane to the hot holding and atomisation plant section. The alloy will be poured from the ladle to an induction furnace. The induction furnace will superheat and maintain the alloy temperature optimal for atomisation. The induction furnace will be equipped with a tilting mechanism. The induction furnace will pour the alloy to the atomising unit turn-dish, which will ensure a constant flow into the atomiser. The alloy will be atomised with highly pressurised water into the atomiser basin. The slurry containing the atomised alloy will be pumped to a buffer tank. The buffer tank will be able to contain one tap of atomised alloy slurry. The atomised alloy will be dewatered first with a magnetic separator followed by a LPG fired dryer. The dry atomised alloy will be bagged and transferred to the CVMR plant.

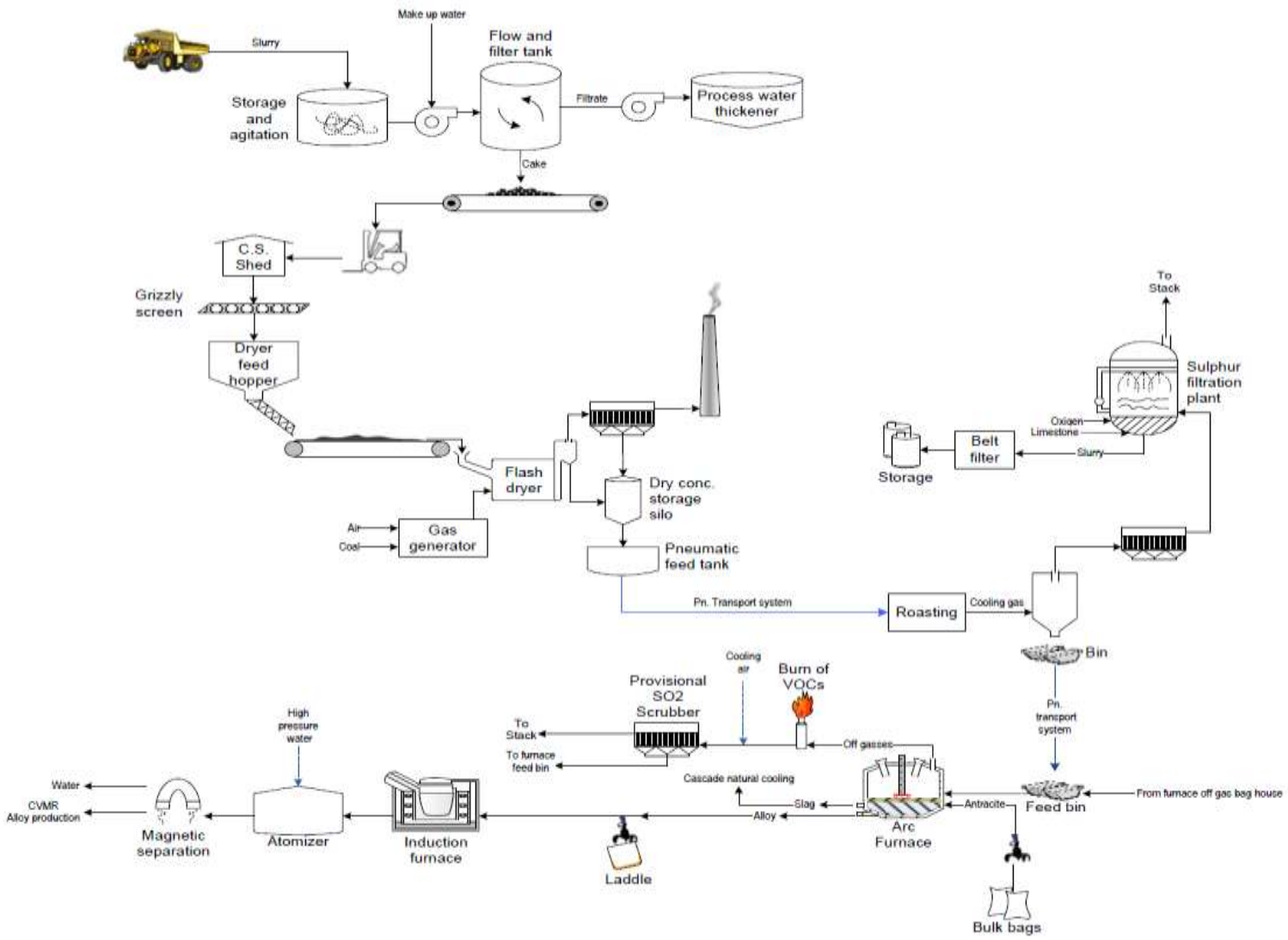


Figure 3-5: Process flow diagram of smelter complex

3.1.5.2 CVMR PROCESS DESCRIPTION

The following section is taken from www.cvmr.ca. As sourced from the CVMR website in April 2011, Chemical Vapour Metal Refining (CVMR®) is a process of extraction and refining of metals from ore, ore concentrates or recycling materials. The CVMR® process was developed, in its basic form, at the beginning of the 20th century. At present, more than 20% of worldwide annual nickel production is refined using carbonyl technology, a variety of CVMR® process. Carbonyl technology (the Mond process) is a vapour metallurgical refining method based on the ability of nickel, iron, cobalt, etc. to form volatile metal carbonyl compounds.

The current extraction method of the Platinum Group of Metals (PGM) from an ore concentrate and the subsequent separation of one PGM metal from another is a time-consuming complicated multi-step process. The use of the Chemical Vapour Metal Refining (CVMR®) process for the extraction and separation of PGMs is a simple and economical alternative.

In the case of PGMs, CVMR® does not use CO, and hence, the process is quite different from the carbonyl process previously attempted by a number of organizations and test facilities. CVMR® extracts PGMs via synthesis of trifluorophosphine complexes at low pressures and low temperatures (80 to 100°C). These two facts alone make the process highly economical, compared to other methods available (Kovtun, *et al.,* 2002).

CVMR® processes and technologies have many applications that serve a variety of industries, in addition to the refining industry. By varying the process parameters at the end of the refining, a wide range of metal forms are created, such as:

- The production of pure metal powders and metal foams, used for batteries, catalysts, capacitors, or for alloys which require ultra-pure metals.
- The application of pure metal coatings on a wide range of substrates, including non-metallic materials such as powders, fibres, resins, composites, polymers, ceramics, and metallic coatings inside porous substrates.
- The production of solid metal net shapes and mould inserts directly on the master with perfect replication. These tool inserts require no polishing.
- The manufacture of seamless net shapes, such as uniformly deformable cans ("HIP cans") used for isostatic pressing.
- The production of nickel moulds made for the manufacture of plastic light-wave guides, for hand-held computer touch screens. These use etched silicon wafers as the master forms.
- The manufacture of thin nickel parts as fuel cell focusing devices for NASA's deep space programme.

CVMR®'s metallic vapour infiltrates into cavities and pores of various substrates to coat their inner surface completely. This can provide strength, conductivity, mass and protective layers for the substrates.

The CVMR® process can decompose the metalorganic gases in layers of metals with different characteristics, simply by varying the gas compositions, in order to produce layered metals, or alloys, with varying metal mixes as part of one continuous piece. For example, hardness, ductility, and the percentages of various metals used in an alloy, can be varied from one end of the metal alloy, to the other.

The growth of the pure metals by thermal decomposition ensures that every feature of a master form is replicated perfectly atom by atom. The CVMR® process is, therefore, excellent for optical parts by reproducing mirror finishes exactly.

Telecommunication devices are moulded precisely with the assistance of mould tool inserts made by the CVMR® process. This enables plastic parts manufacturers to produce accurate parts with significantly high tolerances.

In the bio-technology industry, medical instruments such as tipping tools, are made with CVMR® mould inserts.

The CVMR® process applies well to the metal coating of a wide range of materials. Any substrate can be metal-coated by this gaseous process, provided that the material is stable at a temperature of 175°C and does not off-gas. This enables CVMR® to apply coatings to metal and non-metal powders, such as ceramics, polyamide, silicon, resins, fibres, carbon whiskers and porous materials.

CVMR®'s processes produce a range of metal powders in varied forms and morphologies. They can also produce solid metals with a nano-crystal structure and can manufacture metal foams and ultra-pure powders as dense products, or as filamentary products, to meet various specifications.

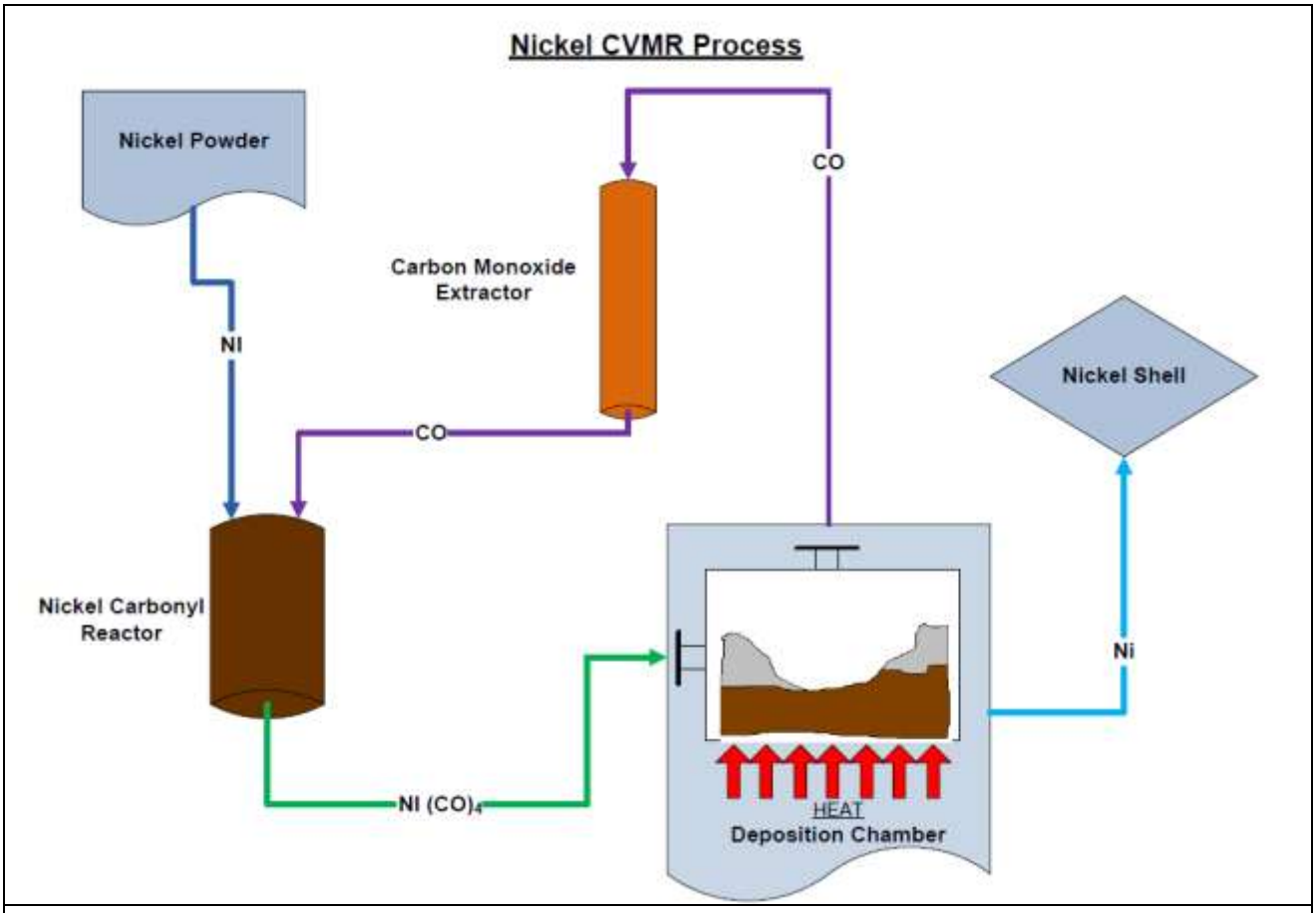


Figure 3-6: Process flow of a nickel CVMR process

3.1.6 INVENTORY OF PROPOSED ABOVE GROUND INFRASTRUCTURE

As with all mines and mining operations, there are numerous onsite supporting surface structures and infrastructure that are proposed. The exact locations of all the required

structures and infrastructure are not known at this time, but will become known as the EIA process follows its due procedural course. The following is a list of proposed supporting structures and infrastructure:

- Entrance road (will make use of existing gravel road, with upgrades proposed);
- Plant roads and other gravel roads outside of plant area;
- Mining haul roads;
- Storm water drainage channels and silt traps;
- Storm water effluent dams;
- Sewage reticulation and piping (draining to sewage treatment plant);
- Sewage treatment works;
- Water reticulation and piping;
- Water treatment works;
- Water holding tanks and reservoirs;
- Flood barrier between Nyl River and "North pit";
- Processing plant complex;
- Smelter complex;
- CVMR plant;
- Open cast pits (two open cast pits);
- Plant offices;
- Mine administration offices;
- Medical clinic;
- Change houses and ablution facilities;
- Canteen;
- Workshops (electrical, mechanical, boiler maker etc…);
- Lay-down yards;
- Salvage yards;
- Storage areas;
- Metallurgical laboratory;
- Main gatehouse;
- Weighbridges;
- Tailing storage facility;
- Waste rock dumps;
- Slag dump
- Topsoil and overburden stockpiles
- Conveyors;
- Product stockpiles;
- Return water dams;
- Car park areas;
- Truck load-out facilities;
- General waste disposal site; and
- Power generation plant.

3.1.7 CONCENTRATE ANALYSIS AND ESTIMATED CONCENTRATE MINERALOGY

In late 2010, Sylvania commissioned Mintek to undertake an analysis of the concentrate that would emanate from the processing plant. Mintek was provided with an ore sample which would be obtained from the opencast mining operations. Mintek then put this ore through its pilot processing plant to obtain the exact concentrate one would get form the actual onsite processing thereof.

A concentrate analysis was undertaken and the following results were obtained:

Table 3-1: Mintek Grassvalley (Volspruit Mine) report (9 Nov 2010) – concentrate analysis

Element	%
Ni	4.87
Cu	1.65
Fe	15.0
Co	0.17
S	12
PGM, 4E, ppm	50
Cr	0.29
Si	20.00
Mg	11.50
Ca	1.20
Al	1.13

From the above given concentrate elemental composition, the mineralogy composition was estimated assuming that all Ni (Nickel) forms pentlandite $Ni_9Fe_8S_{15}$, all Cu forms chalcopyrite $CuFeS_2$, all Co forms CoS, the remaining S forms phyrotite Fe_7S_8 and the remaining Fe forms FeO.

From the above results shown, the estimated concentrate mineralogy could be determined:

Table 3-2: Estimated concentrate mineralogy	
Volspruit concentrate	**Wt%**
$CuFeS_2$	4.74
$Ni_9Fe_8S_{15}$	13.37
CoS	0.26
Fe_7S_8	14.81
FeO	0.62
Cr_2O_3	0.42
CaO	1.68
MgO	19.15
SiO_2	42.82
Al_2O_3	2.13
PGM's ppm	0.0050
Total	100.00

3.2 PRE-FEASIBILITY STUDIES UNDERTAKEN ON THE FARM VOLSPRUIT

In 2010, Sylvania Platinum commissioned three (3) pre-feasibility studies to be undertaken for the Farm Volspruit, to concentrate on the following three key aspects:

1. Flood line determination of the Nyl River
2. Biodiversity impact assessment for the North and South Pit areas
3. Hydrogeological modelling and groundwater analysis of the North ore body/ North Pit area.

From the findings of the three (3) specialist studies undertaken, the following overall conclusions can be drawn:

- The underground geology is very fractured and faulted and there is a substantial amount of underground water which will need to be dewatered from the North Pit if mining is to be sustainable and economically viable.
- The borehole yields in the area are high and there it can be said that there is a substantial amount of groundwater on Volspruit farm.
- The estimated dewatering is predicted to be in the region of 12000m^3 per day by the 15th year of mine operation.
- The cone of groundwater depression will gradually expand from the mining area in all directions. It is predicted that this depression will reach the river in about three to five years.
- The area has very high biodiversity sensitivity as it is located in the Nyl River wetland area, downstream of the Nylsvley RAMSAR wetland site.
- More detailed wetland and biodiversity study will confirm the present of potential red data fauna and flora (this study was subsequently undertaken in February/March 2011).
- Mining of the northern ore body should only commence if all impacts on fauna, flora, wetlands and aquatics can be successfully mitigated (WCS, 2010).
- The N1 road bridge is the overriding feature that has an impact on the flood lines in the area.
- Both the 50- and 100-year floodlines encroach heavily on the western extent of the northern ore body (and subsequent western extent of proposed north open cast pit).
- Predicted deterioration in water quality as water will be pumped from the mine, partially or fully contaminated and discharged back in to the Nyl River. It is recommended that a clarifier and full reverse osmosis plant be installed if the mine is to commence.

A full summary of the above-mentioned studies are contained in Appendix 5 to this report. These pre-feasibility studies were undertaken to inform the EIA process and identify potential fatal flaws in the process.

3.3 ALTERNATIVES

Alternatives were introduced into South Africa's 'environmental' legislation to encourage developers, 'industry' and 'mining' to consider different ways of doing things that would have different environmental impacts, whilst still achieving the development goal. Going through the process of identifying and comparing alternatives, through cost-benefit analysis, will likely yield improvements to the original draft proposal. The ultimate goal of the consideration of alternatives is to both reduce negative environmental impacts and to increase or introduce positive environmental impacts.

3.3.1 MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT (MPRDA) REGULATIONS (GN. R. 527 OF 2004)

The MPRDA Regulations (GN. R. 527 of 2004), for example, refer to alternatives as follows:

For scoping reports in s49(1)(d): *"identify and describe reasonable land use or development alternatives to the proposed operation, alternative means of carrying out the proposed operation and the consequences of not proceeding with the proposed operation;"*

and for EIA reports in s50(d*): "a comparative assessment of the identified land use and development alternatives and their potential environmental, social and cultural impacts;"*.

Typical factors assessed for each alternative include:

- financial feasibility
- environmental impact
- socio-economic impact
- land use planning
- future expansion of the operations
- logistical constraints – power, water, raw materials, labour, market, etc.

Alternatives can take the form of relatively small adjustments to an operation, in which case they blur into mitigation, or totally different activities, depending on how widely the development goal has been stated. Generally, whatever the scale of the alternative, they are grouped into various types, including the following main groups (after DEAT, 2004):

- activity or process alternatives
- location or routing alternatives
- layout, design or scale alternatives
- operational or scheduling alternatives
- the no-go alternative.

The role of assessing alternatives in the EIA process is to reach the most desirable outcome for all parties involved in and affected by the proposed project. Having alternatives allows the comparison and selection of the best option, considering the pros, cons and costs of each of those alternatives. Ultimately, the alternative that minimises negative impacts and maximises benefits should be the chosen one (provided that the chosen alternative is economically feasible). The EIA process must contain a range of alternatives developed to fulfil the purpose and goal(s) of the proposed project. All feasible alternatives should be carried through from the scoping phase and subjected to a process of detailed impact analysis during the EIA phase of the project.

3.3.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA), 1998 (ACT 107 OF 1998) - ALTERNATIVES

The consideration of alternatives is also described in NEMA.

Section 24 "**Implementation**" of NEMA states the following:
Implementation.— (1)In order to give effect to the general objectives of integrated environmental management laid down in this Chapter, the potential impact on—

a. the environment;
b. socioeconomic conditions; and
c. the cultural heritage,

of activities that require authorisation or permission by law and which may significantly affect the environment, must be considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorising, permitting, or otherwise allowing the implementation of an activity.

…

(7)Procedures for the investigation, assessment and communication of the potential impact of activities must, as a minimum, ensure the following:

(a) Investigation of the environment likely to be significantly affected by the proposed activity and alternatives thereto;

*(b) Investigation of the potential impact, including cumulative effects, of the activity and its **alternatives** on the environment, socioeconomic conditions and cultural heritage, and assessment of the significance of that potential impact;*

3.3.3 SITE ALTERNATIVES

The determination of site alternatives for the mining area is difficult and one which will be explored in greater detail during the EIA phase of the project. The difficulty lies in the fact that the position of underground ore bodies constrains open cast mining activities to a very specific area, due to the location of the ore rock underground. Figure 3-7: Google Earth image indicating the farm boundaries/portions (orange), with the positions of the North (yellow) and South (green) open-cast pits. The thin green, blue and red lines indicate the 1:10, 1:50 and 1:1000 year floodlines respectively. The position of the ore underground will not change and the position of the open cast pits will fall more-or-less over these areas. The open cast pit designs have not yet been finalised and once finalised, will be incorporated into the EIA report.

However, the location of above ground infrastructure, tailing dams, offices, workshops, etc. can be evaluated as "alternatives" and the preferred option found. The areas used for above ground infrastructure can be altered to a greater extent in relation to receiving environment sensitivities. There are areas which have been determined to be the "preferred alternatives" and those areas that can be considered "secondary alternatives". These areas have been determined from a preliminary evaluation of how they are most optimally configured between the open-pits, outside of the 1:100 floodline, and away from potentially sensitive areas such as koppies or "virgin" bushveld, in favour of proposed positioning on previously disturbed farming and agricultural land. However, consideration will also have to be given to high agricultural potential soils and the potential impacts of sterilizing these agricultural lands through the establishment of mining related land uses.

With the above in mind, three (3) areas, as indicated in blue in Figure 3-8, are the preferred and secondary alternative areas for the tailings dam. Some of these areas have been previously disturbed by agricultural practices, whilst other areas (such as the large blue area in the centre of the site), fall on "virgin" bushveld areas. Exact areas for tailings storage facilities and other above ground infrastructure have not yet been determined; only potential areas where these could be placed. The large blue areas to the south and south-east of the site are potentially earmarked for the tailings facilities, as it is the largest disturbed area of the Volspruit and Zoetveld farm and the geology consists of quartzite and slate outcrops which may be less sensitive from a geological and environment perspective, than other areas of the site. This will be further determined during the EIA phase.

Furthermore, two (2) alternative areas have been identified for the admin/process plant/smelter, and these areas are indicated and red shading in Figure 3-8 below.

During the alternative analysis in the EIA phase, a detailed assessment will be done of all these areas, to determine which of the areas would be most suitable for above-ground infrastructure, taking into consideration environmental conditions, topography, financial feasibility, the linkage between pit and surface infrastructure, access to various parts of the site and existing infrastructure such as irrigation pivots and farm homesteads.

3.3.4 PROCESS ALTERNATIVES

Apart from the site alternatives that will be considered, there will also be a consideration as to the process of sulphur removal in the smelter plant process. The current preferred proposal is to have a sulphur fixation plant. The roaster off-gas exiting the baghouse will contain high amounts of SO_2(gas) and acid mist, which will be captured in a S-fixation plant, producing gypsum. Limestone will be slurried with water and injected into the scrubber. Oxygen will be blown into the scrubber basin to produce a stable product of gypsum. The produced gypsum will be dewatered in a belt filter and stored.

However, as an alternative to the sulphur fixation plant, an H_2SO_4 plant will be considered. The H_2SO_4 plant will achieve the same outcomes as a S-fixation plant, but via a slightly different process. The final design alternative for the plant will be informed by the Air Quality Impact Assessment, as well as financial and engineering models to determine feasibility.

3.3.5 ADVANTAGES AND DISADVANTAGES OF PROPOSED SITE ALTERNATIVES

The advantages and disadvantages of the sites listed below can be referenced in Figure 3-8 below.

Tailing dam sites:

	Advantage	**Disadvantage**
Tailings site 1	1. Close to open cast pits 2. Close to plant and smelter area	1. Large area of virgin bush would need to be cleared 2. Partly falls over medium-high sensitive biodiversity area 3. Considered more of "green-fields" site
Tailings site 2	1. Falls over low sensitive biodiversity area 2. Virgin vegetation already disturbed	1. Close to Zebediela fault 2. Distance from process plant
Tailings site 3	1. Falls over low sensitive biodiversity area 2. Virgin vegetation already disturbed	1. Close to Zebediela fault 2. Distance from process plant

Waste rock sites:

	Advantage	**Disadvantage**
Waste rock site 1	1. Close to open pits 2. Close to road for truck access 3. Partly falls over low sensitivity	1. Close to floodline 2. Party falls over medium sensitive biodiversity

	biodiversity area 4. Some of the area could be considered a "brown-fields" site	area 3. Some of the area could be considered as a "green-fields" site
Waste rock site 2	1. Right next to North Pit operations 2. Could form part of current topography (koppie on site)	1. Close to floodlines 2. Small area for disposal 3. Falls over medium biodiversity area
Waste rock site 3	1. Use of waste rock in flood berm construction 2. Economical use of waste rock 3. Provides barrier between pit and wetland/Nyl River	1. Inside floodlines 2. Close to wetland

Plant and admin building areas:

	Advantage	**Disadvantage**
Plant and admin area1	1. Over low/medium sensitive biodiversity area 2. Will make use of some current onsite infrastructure (farm house etc.) 3. Equidistant between both pits 4. Ready road access 5. Area (virgin habitat) generally already disturbed by farming 6. Considered more of a "brown-fields site"	1. Sterilize current crop agricultural land (1 pivot) 2. Closer to floodline and river
Plant and admin area 2	1. Close to tailings site 1 2. Further away from river 3. No crop agriculture sterilization	1. Party falls over medium/high sensitive biodiversity area 2. Lots of virgin bush will need to be cleared 3. Further from North Pit 4. Considered more of "green-fields" site

The actual listing of process alternatives for the smelter complex has as yet not been evaluated. A detailed listing of advantages and disadvantages will be tabled once more feasibility work has been done on the options.

3.3.6 GROUNDWATER MITIGATION ALTERNATIVES

As part of the EIA, a number of groundwater mitigation alternatives will be addressed, to minimise the impact on the groundwater in the Volspruit area and neighbouring Nyl River floodplain, and how these potential impacts can be optimally managed by the proposed mining operations.

Various grid and curtain grouting techniques and alternatives will be investigated by obtaining information from South African and international case studies on grouting as an

aid to opencast mining as well as deep excavations in civil engineering projects . A desktop assessment will be undertaken to determine the various alternative techniques for grouting opencast pits, as well as addressing the environmental impacts of the various grouting techniques, and the various substances used for grouting (viz Gels, Cement, wood chips etc…)

Furthermore, other groundwater impact mitigation alternatives (and in combination with grouting) such as dewatering, aquifer reinjection and potential discharge to surface water will be properly addressed.

From this exercise, various "preferred alternatives" and potential secondary alternatives will be assessed and evaluated for groundwater management. A plan of study for grouting techniques and alternatives is contained in section 9.1.8 of this scoping report.

3.3.1 NO-GO ALTERNATIVE

The no-go option refers to the alternative of the proposed development not going ahead at all. This alternative will avoid potentially positive and negative impacts on the environment and the *status quo* of the area would remain intact. The implications of the no-go option will be evaluated as part of the EIA, focussing on comparing potential impacts from the proposed project with the *status quo* and will be particularly relevant should it be found that detrimental impacts cannot be managed to an acceptable level.

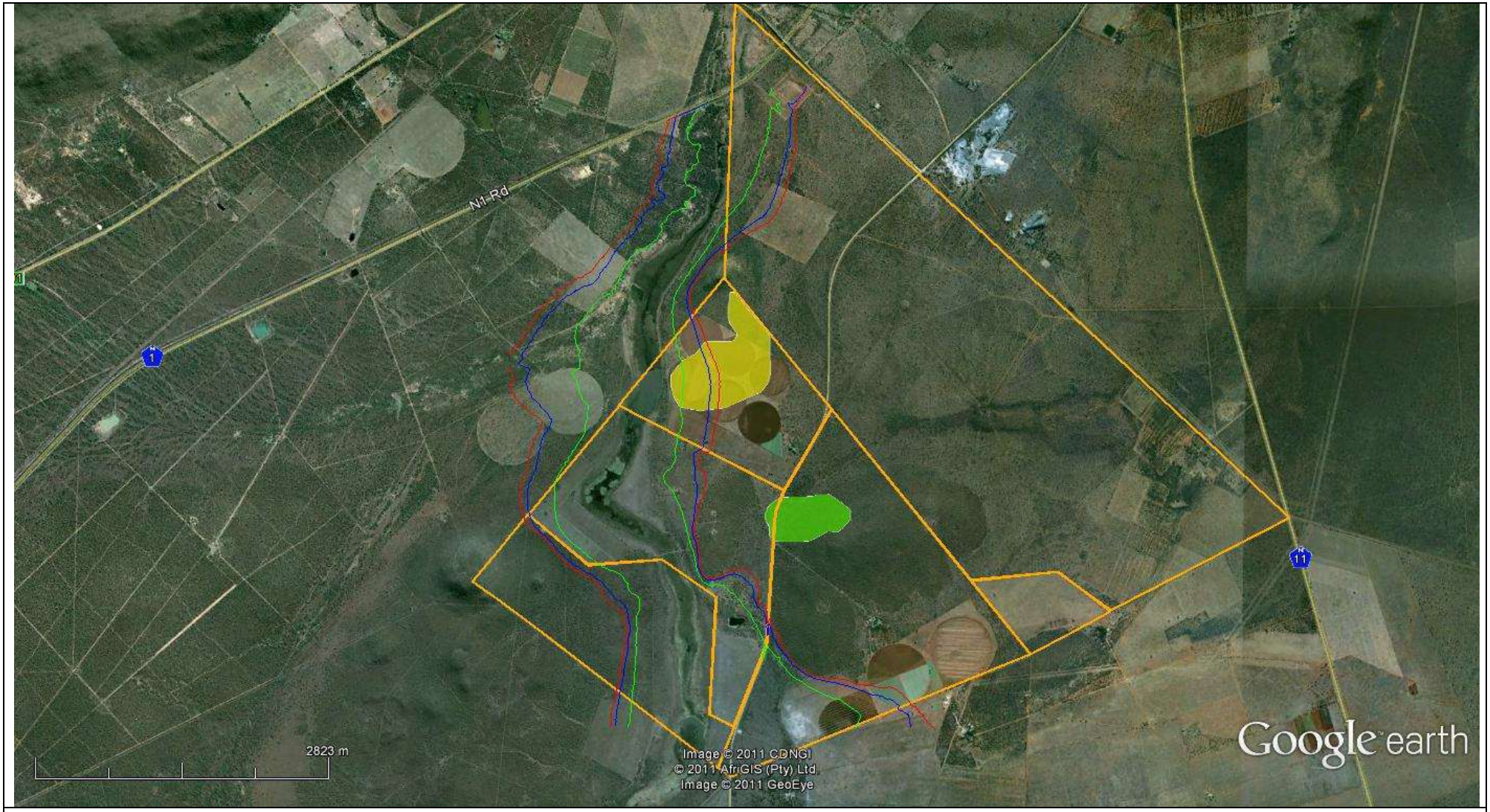


Figure 3-7: Google Earth image indicating the farm boundaries/portions (orange), with the positions of the North (yellow) and South (green) open-cast pits. The thin green, blue and red lines indicate the 1:10, 1:50 and 1:1000 year floodlines respectively.

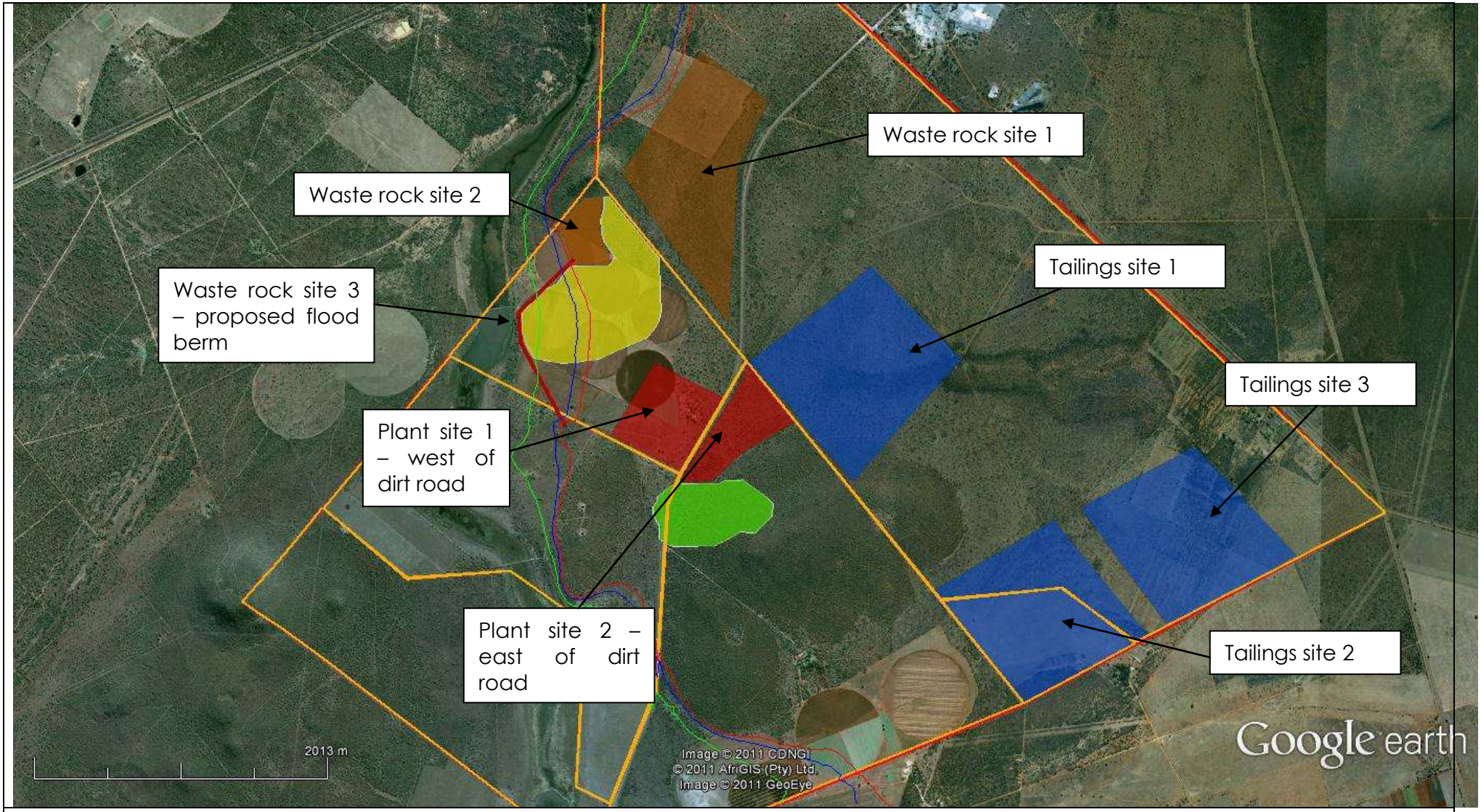


Figure 3-8: Google Earth image indicating the farm boundaries/portions (orange), with the positions of the North (yellow) and South (green) open-cast pits. The light red line indicates the 1:100 year floodline of the Nyl River. The blue areas indicate the preferred alternative areas for tailings dams, whilst the brown areas indicate preferred waste rock dump areas. Red areas indicate the proposed admin buildings, smelter and processing plant and associated above ground infrastructure.

4. LEGAL REQUIREMENTS

4.1 EIA AND ENVIRONMENTAL AUTHORISATION

4.1.1 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA), 1998 (ACT 107 OF 1998)

NEMA is South Africa's overarching environmental legislation, and contains a comprehensive legal framework to give effect to the environmental rights contained in section 24 of The Constitution. Section 2 of NEMA contains environmental principles that form the legal foundation for sustainable environmental management in South Africa. NEMA introduces the principle of integrated environmental management that is achieved through the environmental assessment process in section 24, which stipulates that certain identified activities may not commence without an Environmental Authorisation from the competent authority, in this case LEDET, DMR and DEA. Section 24(1) of NEMA requires applicants to consider, investigate, assess and report the potential environmental impact of these activities. The requirements for the investigation, assessment and communication of potential environmental impacts are contained in the so-called 2010 amendment EIA Regulations (GN R.543, R.544, R.545 and R.546; 18 June 2010).

Based on the potential significance of impacts, the Regulations identify specific activities that are either subject to a Basic Assessment process, or more comprehensive scoping and EIA process. The proposed Volspruit mine project includes several activities that require a scoping and EIA, but some others only require a Basic Assessment. All activities are however included in the scoping and EIA assessments, i.e. a single application procedure. The activities that would be (or are likely to be) associated with the proposed Volspruit mine are listed below. It should be noted that the two lists below are comprehensive, but some of the activities may eventually not proceed. The activities ultimately undertaken by Pan Palladium will be based on the findings and recommendations of the future detailed EIA investigation and final project infrastructure design, including certain capacity thresholds and the feasibility of identified alternatives.

Table 4-1: Listed activities applied for in terms of the NEMA 2010 EIA regulations

Listing	Activity number	Description of each listed activity
GN R.544 of 18 June 2010 - Listing Notice 1	1	The construction of facilities or infrastructure for the generation of electricity where: i. the electricity output is more than 10 megawatts but less than 20 megawatts; or ii. the output is 10 megawatts or less but the total extent of the facility covers an area in excess of 1 hectare. REASON: Electricity is proposed to be generated at the mine. Actual electrical output at this point has not been determined, but is proposed to be less than 20 MW
GN R.544 of 18 June 2010 - Listing Notice 1	9	The construction of facilities or infrastructure exceeding 1 000 metres in length for the bulk transportation of water, sewage or storm water - (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more, excluding where:

		a). such facilities or infrastructure are for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or b). where such construction will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse. REASON: Some infrastructure may be required in excess of 1km for transport of process/waste water to and from the mine area, or within the mine area. This listing has been included so that if infrastructure is needed in excess of 1km in length, that it has been applied for. This will be finalised during the EIA.
GN R.544 of 18 June 2010 - Listing Notice 1	10	The construction of facilities or infrastructure for the transmission and distribution of electricity - (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or (ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more. REASON: Electricity of between 33 and 275 KV will be transmitted within the mining area and is applied for.
GN R.544 of 18 June 2010 - Listing Notice 1	11	The construction of: (i) canals; (ii) channels; (iii) bridges; (iv) dams; (v) weirs; (vi) bulk storm water outlet structures; (vii) marinas; (viii) jetties exceeding 50 square metres in size; (ix) slipways exceeding 50 square metres in size; (x) buildings exceeding 50 square metres in size; or (xi) infrastructure or structures covering 50 square metres or more Where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line. REASON: Canals, channels, bridge, dams and/or weirs will need to be built on the mine site (locations at this time not yet known, but will be finalised during EIA and mine design).
GN R.544 of 18 June 2010 - Listing Notice 1	12	The construction of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50000 cubic metres or more, unless such storage falls within the ambit of activity

		19 of Notice 545 of 2010; REASON: Dams and reservoirs will need to be constructed; however, total capacity at this stage is unknown. Capacity and locations will be assessed at the EIA stage.
GN R.544 of 18 June 2010 - Listing Notice 1	13	The construction of facilities or infrastructure for the storage, or for the storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic metres. REASON: Facilities for the storage and handling of a dangerous good (heavy fuel oil – HFO) will be constructed with a capacity of greater than 50 but less than 500 cubic metres.
GN R.544 of 18 June 2010 - Listing Notice 1	18	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from (i) a watercourse; (ii) the sea; (iii) the seashore; (iv) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater- but excluding where such infilling, depositing, dredging, excavation, removal or moving (i) is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; or (ii) occurs behind the development setback line. REASON: More than 5 cubic metres of soil and/or sand may have to be deposited or excavated in or very close to a watercourse and this activity would be triggered.
GN R.544 of 18 June 2010 - Listing Notice 1	20	Any activity requiring a mining permit in terms of section 27 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) or renewal thereof. REASON: A mining license will need to be applied for with the Limpopo DMR. It must be noted that all mining activities fall under the authority of the DMR, therefore this specific activity has not yet been enacted under the NEMA regulations and according to the regulations, the enactment date of this activity will be communicated in due course. Therefore, in order to cover the proposed enactment, this activity has been included.

GN R.544 of 18 June 2010 - Listing Notice 1	22	The construction of a road, outside urban areas, (i) with a reserve wider than 13,5 metres or, (ii) where no reserve exists where the road is wider than 8 metres, or (iii) for which an environmental authorization was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Notice 545 of 2010. REASON: The mine will require new roads for access, delivery and distribution, as well as internal roads. Locations of these roads are at this time unknown, and will be finalised during EIA phase, after sensitive areas have been assessed and the best routing determined.
GN R.544 of 18 June 2010 - Listing Notice 1	23	The transformation of undeveloped, vacant or derelict land to – (i) residential, retail, commercial, recreational, industrial or institutional use, inside an urban area, and where the total area to be transformed is 5 hectares or more, but less than 20 hectares, or (ii) residential, retail, commercial, recreational, industrial or institutional use, outside an urban area and where the total area to be transformed is bigger than 1 hectare but less than 20 hectares; - except where such transformation takes place, (i) for linear activities; or (ii) for the purposes of agriculture or afforestation, in which case Activity 16 of Notice No. R 545 applies. REASON: The mine will cause transformation of undeveloped land, to full-scale mining operations of greater than 20 Ha in extent.
GN R.544 of 18 June 2010 - Listing Notice 1	24	The transformation of land bigger than 1 000 square metres in size, to residential, retail, commercial, industrial or institutional use, where, at the time of the coming into effect of this Schedule such land was zoned open space, conservation or had an equivalent zoning. REASON: It is unknown at this point if any land which will need to be rezoned is in fact currently zoned open space or conservation. This will be further investigated, however, in order to pre-empt the possible, it has been included in the application.
GN R.544 of 18 June 2010 - Listing Notice 1	47	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre - (i) where the existing reserve is wider than 13,5 metres; or (ii) where no reserve exists, where the existing road is wider than 8 metres, excluding widening or lengthening occurring inside urban areas.

		REASON: The final siting of the surface infrastructure of the mine may require link roads with existing road network, thus this activity is triggered.
GN R.545 of 18 June 2010. Listing Notice 2.	3	The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres. REASON: Facilities for the storage and handling of a dangerous good (heavy fuel oil – HFO) will be constructed with a capacity of potentially greater than 500 cubic metres.
GN R.545 of 18 June 2010. Listing Notice 2.	5	The construction of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent and which is not identified in Notice No. 544 of 2010 or included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case that Act will apply. REASON: This activity will be triggered, as a smelter complex (which requires an air emission licence) is proposed and permits may need to be applied for.
GN R.545 of 18 June 2010. Listing Notice 2.	6	The construction of facilities or infrastructure for the bulk transportation of dangerous goods - (i) in gas form, outside an industrial complex, using pipelines, exceeding 1 000 metres in length, with a throughput capacity of more than 700 tons per day; (ii) in liquid form, outside an industrial complex, using pipelines, exceeding 1 000 metres in length, with a throughput capacity more than 50 cubic metres per day; or (iii) in solid form, outside an industrial complex, using funiculars or conveyors with a throughput capacity of more than 50 tons day. REASON: It is likely that this activity may be triggered, but the EIA process will further inform this decision.
GN R.545 of 18 June 2010. Listing Notice 2.	8	The construction of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex. REASON: Electricity with a capacity of greater than 275Kv will be transmitted and this activity is triggered.

GN R.545 of 18 June 2010. Listing Notice 2.	10	The construction of facilities or infrastructure for the transfer of 50 000 cubic metres or more water per day, from and to or between any combination of the following: (i) water catchments, (ii) water treatment works; or (iii) impoundments, excluding treatment works where water is to be treated for drinking purposes. REASON: It is highly likely that facilities will be needed for the transfer of water in and around the mine area. There will be a substantial amount of dewatering occurring, and this water will need to be moved or transferred. It is not clear at this time whether the amount of water will be more or less than 50 000 cubic metres per day.
GN R.545 of 18 June 2010. Listing Notice 2.	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; except where such physical alteration takes place for: (i) linear development activities; or (ii) agriculture or afforestation where activity 16 in this Schedule will apply. REASON: The entire new mine area will transform an area greater than 20 hectares.
GN R.545 of 18 June 2010. Listing Notice 2.	19	The construction of a dam, where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 metres or higher or where the high-water mark of the dam covers an area of 10 hectares or more. REASON: Dams will be built for the mining operations, and it is likely that the dam wall will be greater than 5 metres high. Locations of these dams are not yet known, and will be further informed by the EIA phase.
GN R.545 of 18 June 2010. Listing Notice 2.	20	Any activity which requires a mining right or renewal thereof as contemplated in sections 22 and 24 respectively of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002). REASON: A mining right is being applied for and this activity will be triggered. It must be noted that all mining activities fall under the authority of the DMR, therefore this specific activity has not yet been enacted under the NEMA regulations and according to the regulations, the enactment date of this activity will be communicated in due course. Therefore, in order to cover the proposed

		enactment, this activity has been included.
GN R.545 of 18 June 2010. Listing Notice 2.	22	Any activity which requires a production right or renewal thereof as contemplated in sections 83 and 85 respectively of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002). REASON: A production right may or may not be applied for, and if it is applied for, this activity will be triggered. It must be noted that all mining activities fall under the authority of the DRM, therefore this specific activity has not yet been enacted under the NEMA regulations and according to the regulations, the enactment date of this activity will be communicated in due course. Therefore, in order to cover the proposed enactment, this activity has been included.
GN R.545 of 18 June 2010. Listing Notice 2	26	Commencing of an activity, which requires an atmospheric emission licence in terms of section 21 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004), except where Activity 28 in Notice No. R. 544 of 2010 applies. REASON: An Air Emissions Licence will need to be applied for, for the operation on of the proposed smelter and CVMR plant.

The process of applying for Environmental Authorisation includes a requirement to conduct an initial scoping phase, followed by a detailed EIA as part of the application process. The assessment process (Figure 4-1) is comprehensive and detailed where appropriate, aimed at identifying potential positive and negative impacts on the environment (biophysical, socio-economic and cultural), in order to:

- Examine alternatives/management measures to minimise negative and optimise positive consequences;
- Prevent substantial detrimental impact to the environment;
- Improve the environmental design of the proposal;
- Ensure that resources are used efficiently; and
- Identify appropriate management measures for mitigation and the monitoring thereof.

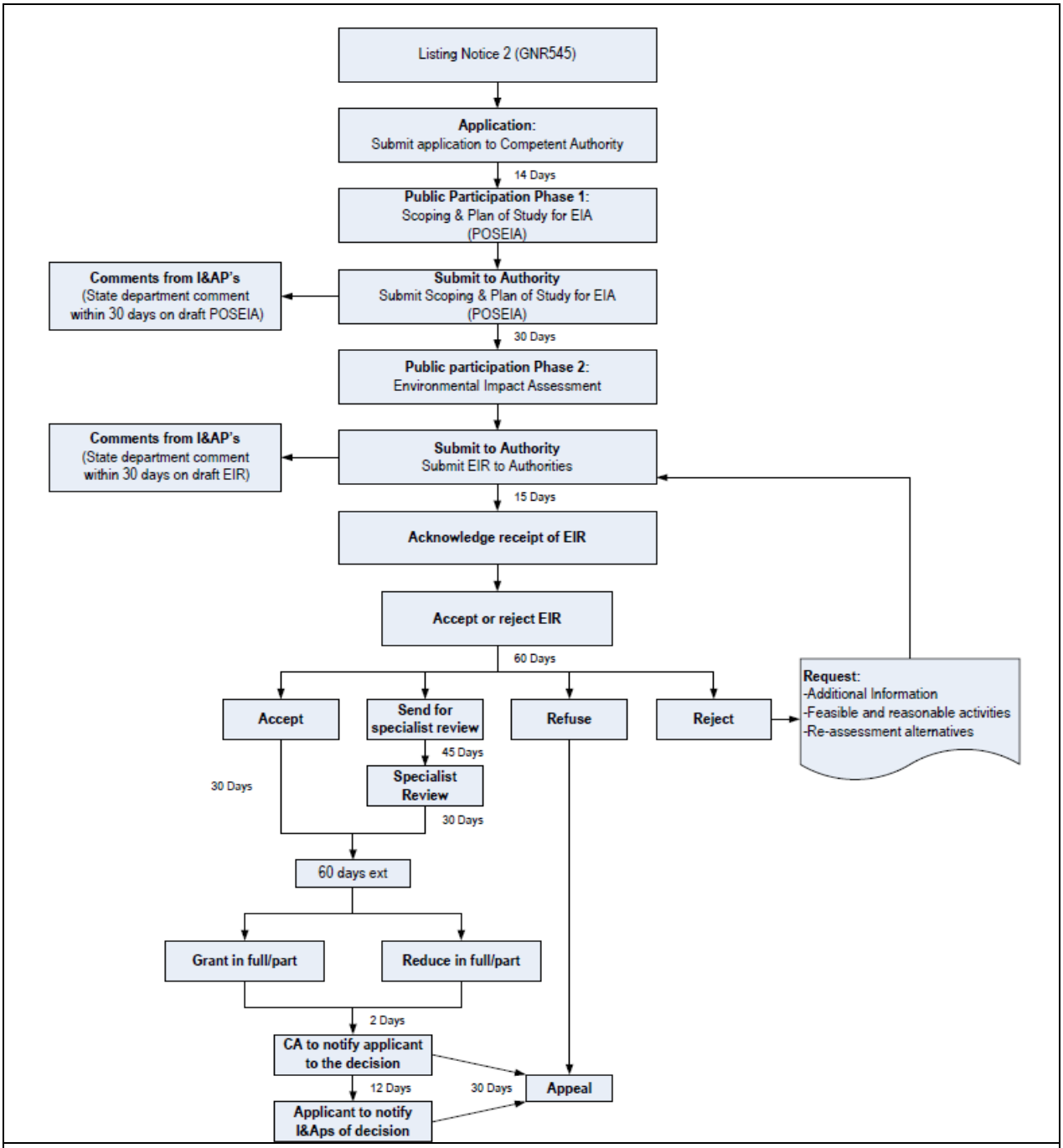


Figure 4-1: Scoping and EIA process as prescribed by the NEMA 2010 EIA regulations

4.1.1.1 DUTY OF CARE – SECTION 28 OF NEMA

The National Environmental Management Act, Act 107 of 1998, (NEMA) places a duty to care on all persons who may cause significant pollution or degradation of the environment. Specifically, section 28 of the Act states:

"28 (1) Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

(2) Without limiting the generality of the duty in subsection (1), the persons on whom subsection (1) imposes an obligation to take reasonable measures, include an owner of land or premises, a person in control of land or premises or a person who has a right to use the land or premises on which or in which-

(a) any activity or process is or was performed or undertaken; or

(b) any other situation exists, which causes, has caused or is likely to cause significant pollution or degradation of the environment.

(3) The measures required in terms of subsection (1) may include measures to-

(a) investigate, assess and evaluate the impact on the environment;

(b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;

(c) cease, modify or control any act, activity or process causing the pollution or degradation;

(d) contain or prevent the movement of pollutants or the causant of degradation;

(e) eliminate any source of the pollution or degradation; or

(f) remedy the effects of the pollution or degradation."

In the context of a mining operation (including Volspruit mine), it is generally expected that there will be a potentially significant impact on ground and surface water. The significance of such impacts is dependent on:

- the nature, duration, extent and frequency of the source and its physical and chemical characteristics;
- the topographical and climatological nature of the area in which the impact is situated; and
- the sensitivity of the receiving environment.

Consequently, in the context of this assessment, the owner/operator of the mine must take "reasonable steps" to prevent pollution or degradation of the environment which may result from the proposed mining and related activity. These reasonable steps include the investigation and evaluation of the potential impact and identification of means to prevent an unacceptable impact on the environment and to contain or minimise potential impacts where they cannot be eliminated.

4.1.2 LIMPOPO ENVIRONMENTAL MANAGEMENT ACT (ACT 7 OF 2004)

The aim of the Limpopo Environmental Management Act (LEMA) (Act 7 of 2004) is to: "*consolidate and amend the environmental management legislation of or assigned to the Province; and provide for matters incidental thereto*". Although NEMA still remains the overarching legislation governing environmental management in South Africa, there are certain provisos in LEMA which will be taken into consideration during the compilation of the EIA.

The Limpopo Environmental Management Act does not, however, define any specific issues that would potentially emerge as a result of the proposed mine development. The proposed mine will be more stringently regulated under national legislation (i.e. NEMA and the associated NEMA EIA regulation).

4.1.3 MINERALS AND PETROLEUM RESOURCES DEVELOPMENT ACT (MPRDA)

The MPRDA of 2002 replaces the Minerals Act and raises the bar on the management of finite resources in the context of a country with gross imbalances in skills, wealth and access to mineral resources. The most important concept in the MPRDA is that the mineral resources of the country belong to the people of South Africa and that the state aims to regulate all aspects of mining with that concept in mind.

The main aims and principles of the MPRDA include:
- recognition of the finite nature of mineral and petroleum resources;
- ownership of mineral and petroleum resources is by the nation;
- the government is the custodian of the mineral and petroleum resources;
- promotion of sustainable development and protection of the environment;
- social upliftment through Social Development and Labour Plans (SDLP);
- promotion of black economic empowerment (BEE);
- guaranteeing security of tenure, to enable long term planning and investment; and
- creation of an internationally competitive and efficient regulatory system.

Section 38 of the MPRDA outlines the following integrated environmental management (IEM) requirements:
- comply with the IEM requirements of NEMA, namely s23-24 dealing with EIA;
- integrate environmental management into day- to-day mine operations;
- comply with the polluter pays principle and take responsibility for any environmental damage or pollution; and
- rehabilitate impacted areas to natural or agreed standards, in line with sustainable development principles.

According to section 39 of the MPRDA, every applicant for a mining right must conduct an EIA that results in the submission of an environmental management programme (EMPR). This approval process requires an EIA process leading toward the compilation of a detailed EMPR. The Mineral and Petroleum Resources Development Regulations (GNR527) of 2004 outline further details of the EIA and EMPR:
- s49: contents of scoping reports;
- s50: contents of EIA reports;
- s51: EMPR;
- s52: EMP;
- s53: methods for calculating financial provision;
- s54: quantum of financial provision;
- s55: monitoring and performance of EMPs and EMPRs;
- s56: principles for mine closure;
- s57: application for closure certificate;
- s58: application to transfer environmental liabilities to competent person;
- s59: qualifications of person regarding transfer of environmental liabilities and responsibilities;
- s60: environmental risk report;
- s61: closure objectives; and
- s62: contents of closure plan.
- The MPRDA and NEMA processes for application the submission of reports and authority review timeframes are slightly different, and as such the two process need to be streamlined in order to not let one process fall behind the other.

- The interrelationship between the two processes is very important and the flow diagram in Figure 4-2 indicates this relationship and the links in the process.

4.1.3.1 MPRDA REQUIREMENTS FOR AN EMPR

The key requirements of an EMPR, according to provisions in the Act and the Regulations, are:

- baseline information for the affected environment;
- the environmental objectives, both for operation and closure;
- a quantification of environmental impacts;
- an implementation programme that includes:
  - technological options
  - management systems
  - action plans with time schedules
  - emergency response plans
  - monitoring and evaluation
  - an environmental awareness plan aimed at informing employees; and
  - pollution/waste prevention, reduction and remediation.

The compilation of a detailed EMPR would be required to at least fulfil the above requirements. The EIA process required for an addendum to the existing EMPR, in terms of the MPRDA, can be undertaken in parallel with the EIA process required for the Volspruit mine project in terms of NEMA. The parallel process does, however, need to fulfil the requirements of both Acts.

Financial Provision

The MPRDA has the following to say regarding financial provisions for mine closure:

- an applicant submitting an EMP/EMPR must make the prescribed financial provision prior to approval of the EMP/EMPR;
- the Minister may use the financial provision to undertake rehabilitation or management on behalf of the holder of an EMP/EMPR, should they fail to do so adequately themselves;
- the financial provision must be assessed and adjusted appropriately annually; and
- should urgent action be required, or the financial provision be inadequate, the Minister may recover costs.

The above provisions are certainly true for any proposed EMPR, whereby the proposed project's contribution to the mine closure quantum will need to be assessed in relation to the mine's existing closure liability and increased accordingly. The project would result in additional requirements for the environmental and socially sound closure and rehabilitation of the mine (whether at the end of life of the mine or premature/unforeseen mine closure), which by their nature would carry associated costs that need to be provided for.

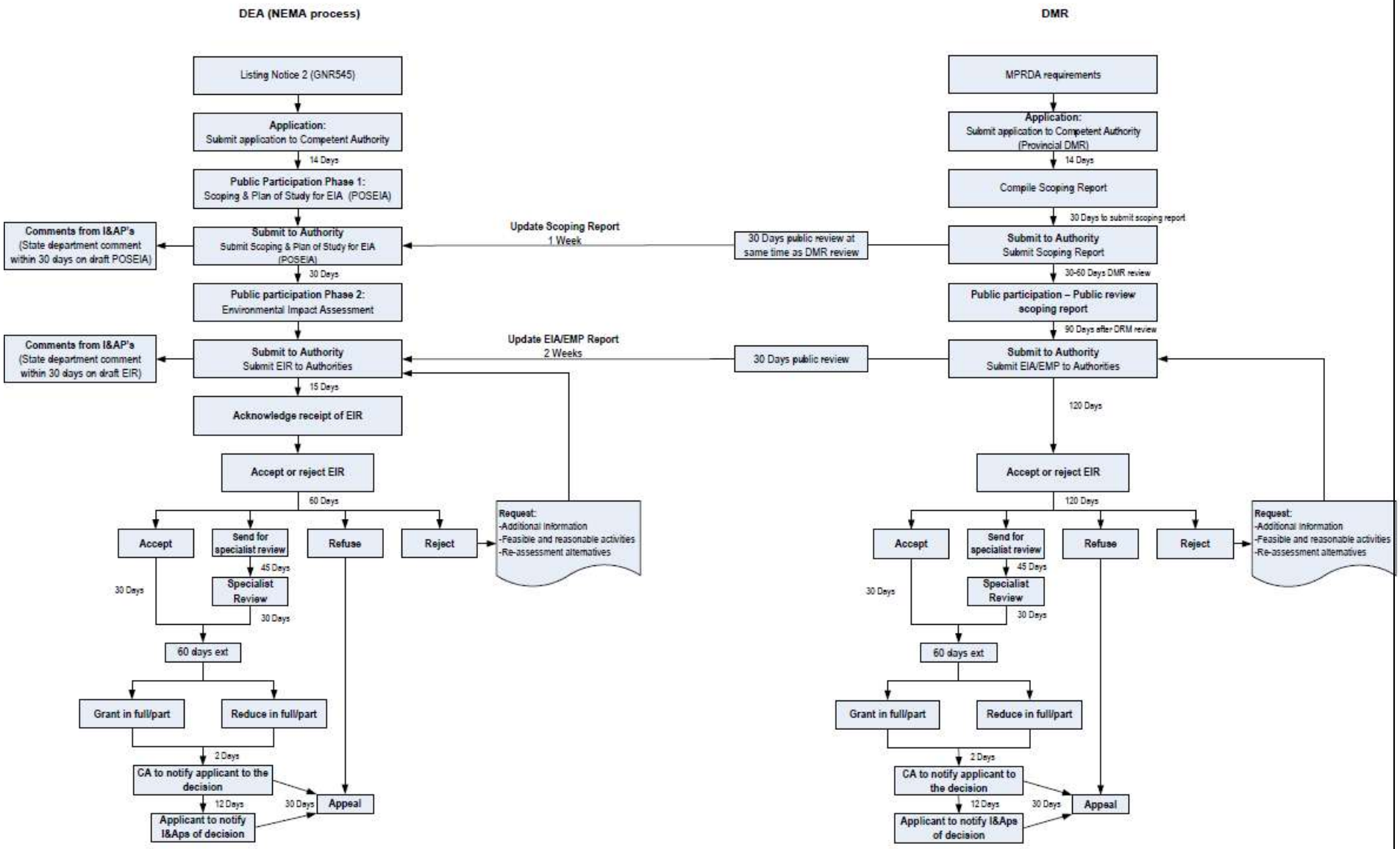


Figure 4-2: Relationship between the NEMA and MPRDA authorization process

The financial provision may take the form of one of the following:
- a trust fund;
- a financial guarantee from a registered South African bank; and
- a deposit into an account specified by the DME.

The value of the financial provision must be based on the commitments made in the EMP(R) and be valid for:
- early closure of the mine;
- rehabilitation of the mine surface area to as close to pre-mining conditions;
- prevention and management of air pollution;
- prevention and management of soil, water and groundwater pollution;
- prevention of migration of water and minerals from underground to the surface;
- decommissioning and final closure; and
- Post-closure management of residual and latent environmental impacts.

4.1.4 WATERBERG DISTRICT MUNICIPALITY ENVIRONMENTAL MANAGEMENT FRAMEWORK (EMF)

In 2010, DEA, LEDET and the Waterberg District Municipality (WDM) commissioned the compilation of an EMF for the WDM. The report was compiled by NRM Consulting, with inputs from various other consultancies.

As sourced from the EMF document, it describes the following:
*The Environmental Management Framework (EMF) is an initiative of the national Department of Environmental Affairs (DEA) in partnership with the Limpopo Department of Economic Development, Environment and Tourism (LEDET), and the Waterberg District Municipality (WDM). The EMF will support decision-making in the Waterberg District Municipality area in order to facilitate appropriate and sustainable development. The EMF integrates policies and frameworks and aligns government mandates to streamline decision-making and to improve cooperative governance. (*Waterberg EMF, 2010*)*

The overall compilation of an EMF involves three (3) reports, namely, a status quo report (which described the current status quo for the WDM), a desired state report (which outlines what the "desired" state of the WDM should be), and then the main report, the EMF, which essentially outlines and describes how to get from the "status quo" to the "desired state".

After the collation of all information, the EMF in effect described eleven (11) Environmental Management Zones (EMZ) – which are detailed in Figure 4-3 below. Initially the EMZ for the Waterberg District EMF were determined through the careful evaluation of the status quo inputs and especially the environmental sensitivity and other priority needs in the area as described in the previous section of the report *(*Waterberg EMF, 2010*)*.

There is a section of the main EMF document which provides a short description of each EMZ, a description of the desired state of each EMZ (taken from the Desired State Report) as well as an indication of preferred activities, compatible activities and undesired activities (as required in the EMF Regulations, 2010).

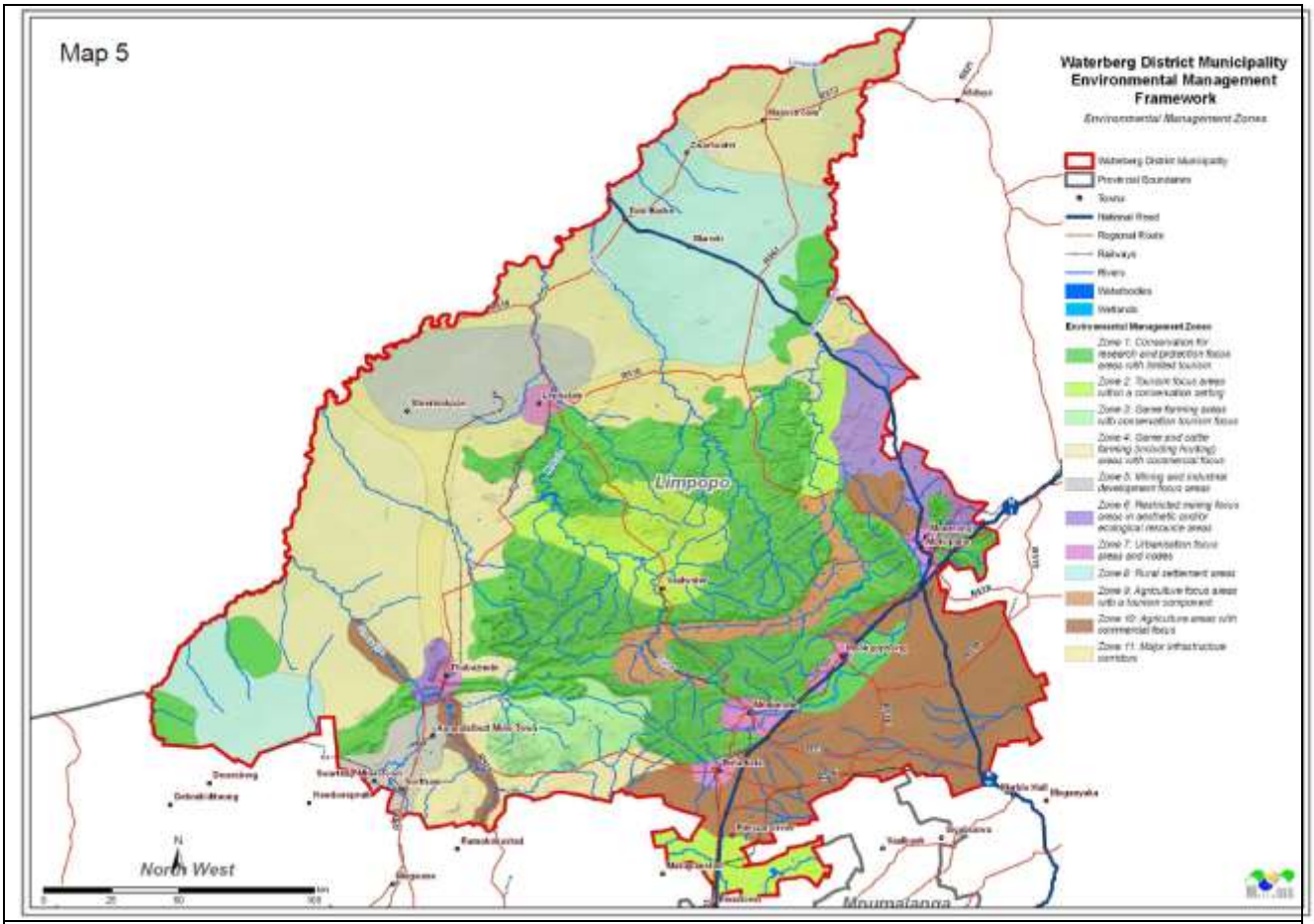


Figure 4-3: WDM Environmental Management Zones (Metro GIS, 2010)

The farms on which the proposed Volspruit Mine fall (i.e. the Farms Volspruit and Zoetveld) are located in Zones one (1) and 10. The EMF describes Zone 1 as an area where "*Protection of natural vegetation, scenic landscape and rock painting areas, with limited appropriate tourism*" should exist; and Zone 10 as: "*Agriculture areas with commercial focus*". The EMF goes further to list "undesirable activities" for each zone, as described above, where mining is listed as an "undesirable activity" in both Zone 1 and Zone 10. However, the EMF does describe the following, when discussing undesirable activities: "*It does not however mean that undesired activities for example will not be allowed under any circumstances but rather that such activities will have to meet very high standards and be considered very carefully by the relevant competent authorities before they are allowed*" (Chapter 5, page 75 of the EMF, 2010).

From the statement above, it is clear that by merely listing "undesirable activities" in a specific zone does not necessarily exclude those activities totally. It is therefore important that this proposed mine will need to meet "very high standards" and will have to be considered carefully by the relevant competent authority. In this respect, the EIA will aim to define and properly determine what these high standards would be and make management and mitigation suggestions accordingly.

EScience Associates have engaged constructively with the Limpopo Department of Economic Development, Environment and Tourism (LEDET) on this very aspect and decisions were made to continue with the EIA in order to make informed and defensible decisions based on the scientific studies undertaken. The outcome or decision of a particular process cannot be decided on one tool alone. The EMF is a guideline for decision-making and the EIA will take into account this guideline to ensure that the

authority is presented with the appropriate information to evaluate the proposed Volspruit mine development.

Further to the Environmental Management Zones as described above, the Waterberg Biosphere Reserve also needs to be considered. As can be seen in Figure 4-4 below, the EMZs have been overlain with the Biosphere Reserve Zones. The farms Volspruit and Zoetveld fall within "Transition Zone 2" of the Biosphere Reserve Zones.

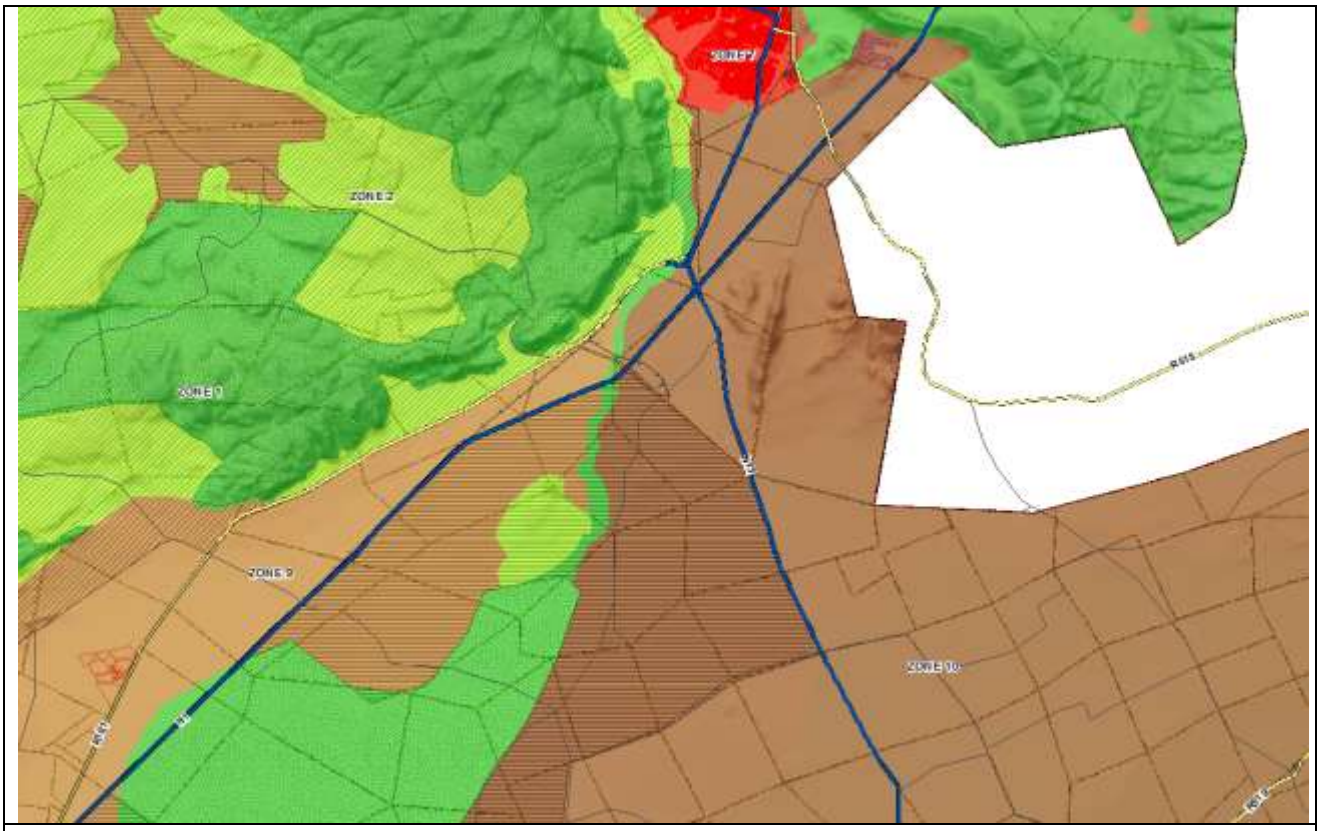


Figure 4-4: Environmental Management Zones overlain with Biosphere Reserve Zones (Adapted from MetroGIS, 2010).

Biosphere reserves are organised into 3 interrelated zones, namely: the core area; the buffer zone and the transition area. According to UNESCO only the core area requires legal protection, meaning that these areas usually correspond to existing protected areas such as nature reserves or national parks.

It must be further noted that the EMF mapping software (adapted from MetroGIS) also indicated "potential mining areas" (Figure 4-5). These areas that have been identified as "potential mining areas" are identified in maps only and are not discussed or addressed in the EMF document. The lack of discussion on the "potential mining areas" in the EMF text does not assist Environmental Assessment Practitioners and administrators (viz LEDET) in assessing the environmental, economic and social aspects of a proposed activity that is considered to be "undesirable".

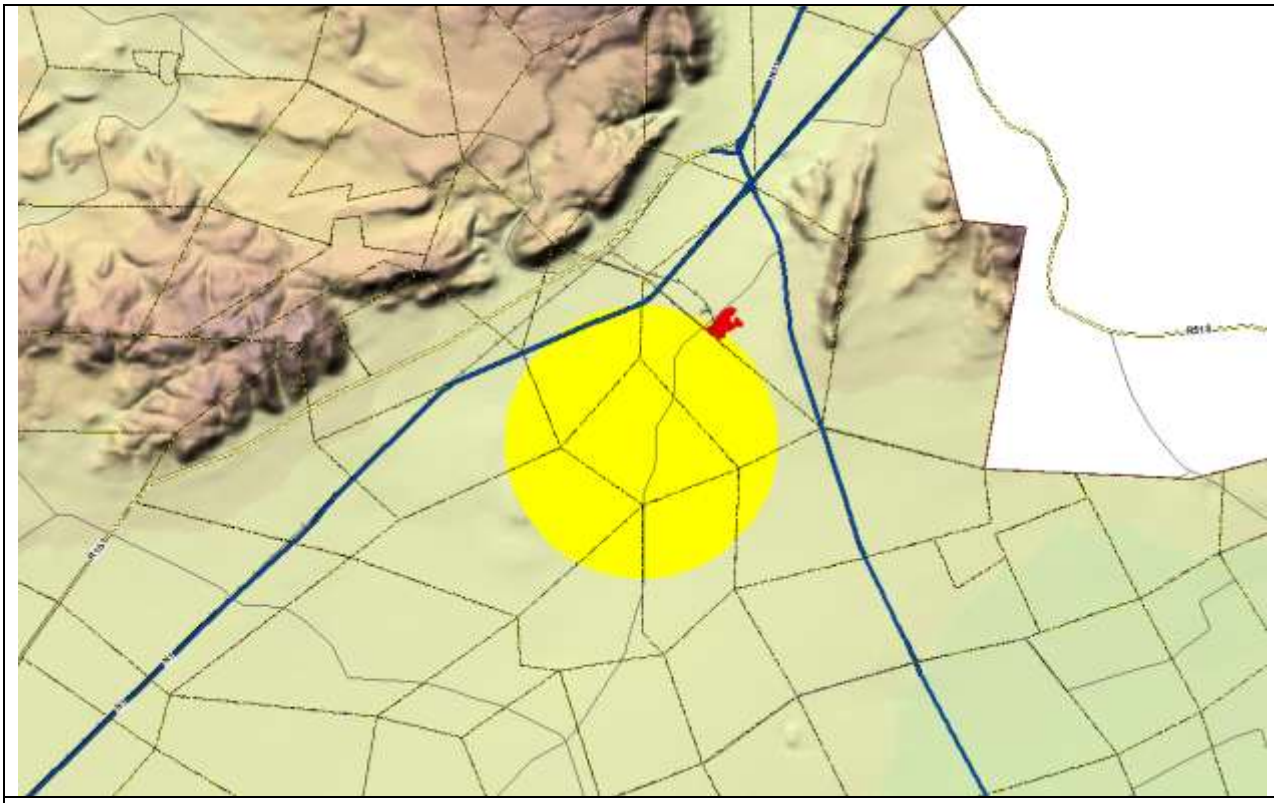


Figure 4-5: Potential mining areas as shown in a GIS layer provided by the EMF. (Adapted from MetroGIS, 2010)

4.2 PROTECTED AREAS

4.2.1 NATIONAL ENVIRONMENTAL MANAGEMENT: PROTECTED AREAS ACT (NEMPAA) (ACT 57 OF 2003)

The following section has been adapted from personal email and verbal communications with Mr Riaan Visagie of LEDET and from the actual text of the NEMPAA. Nature Reserves under the current legislation refers to any area which qualifies under the Act (NEMPAA) irrespective of the type of ownership.

Section 23(2) of NEMPAA specifies the basic qualification criteria for an area to be declared a Nature Reserves:

23. (1) The Minister or the MEC may by notice in the Gazette-
(a) declare an area specified in the notice-
(i) as a nature reserve; or
(ii) part of an existing nature reserve; and
(b) assign a name to the nature reserve.

(2) A declaration under subsection (l) (a) may only be issued-
*****
(b) to protect the area if the area-
(i) has significant natural features or biodiversity;
(ii) is of scientific, cultural, historical or archaeological interest; or
(iii) is in need of long-term protection for the maintenance of its biodiversity or for the provision of environmental goods and services;

(c) to provide for a sustainable flow of natural products and services to meet the needs of a local community;
(d) to enable the continuation of such traditional consumptive uses as are sustainable; or
(e) to provide for nature-based recreation and tourism opportunities.
…

The following requirements also apply to areas being declared as Nature Reserves under NEMPAA, which was not a requirement prior to NEMPAA of 2003.

- The owner or owners of the area must sign an agreement with the MEC or Minister when the area is proclaimed (Contract)
- The reserve must hand in a management plan not later than one year after proclamation
- The property declared gets an attachment to the deed of the specific property to indicate it is a Nature Reserve

Even though the current legislation recognises that "Nature Reserves" proclaimed pre-NEMPAA as still being Nature Reserves, it is however clear that pre-NEMPAA "Private Nature Reserves" do not comply with the requirements as mentioned above, even though the act recognizes them. These non-compliances are:

- No agreement with Minister or MEC
- No management plans
- No attachment to the deed

It is understood that mining activities prior to NEMPAA of 2003 were not prohibited in Nature Reserve as the previous legislation is silent on the matter, and the fact that the Grassvalley Chrome mine falls inside the Nyl Valley Nature Reserve indicates that this was acceptable. However, further to this, it is understood that all newly declared areas under the NEMMPAA will be protected against mining activities as mentioned in section 48 of the NEMPAA:

Prospecting and mining activities in protected area
48. (1) Despite other legislation, no person may conduct commercial prospecting or mining activities-

(a) in a special nature reserve or nature reserve;
(b) in a protected environment without the written permission of the Minister and the Cabinet member responsible for mineral and energy affairs; or
(c) in a protected area referred to in section 9(b) or (d).

(2) The Minister, after consultation with the Cabinet member responsible for mineral and energy affairs, must review all mining activities which were lawfully conducted in areas indicated in subsection (l) (a), (b) and (c) immediately before this section took effect.

(3) The Minister, after consultation with the Cabinet member responsible for mineral and energy affairs, may, in relation to the activities contemplated in subsection (2), as well as in relation to mining activities conducted in areas contemplated in that subsection which were declared as such after the commencement of this section, prescribe conditions under which those activities may continue in order to reduce or eliminate the impact of those activities on the environment or for the environmental protection of the area concerned.

(4) When applying this section, the Minister must take into account the interests of local communities and the environmental principles referred to in section 2 of the National Environmental Management Act, 1998.

Private Nature Reserves proclaimed up to 2003
As explained in the pre-2003 section of this document it is clear that these reserves are Nature Reserves under the previous provincial legislation.

The actual status of the "Nyl Valley Private Nature Reserve" still needs to be legally clarified and declared as such under NEMPAA, have an agreement with the Minister and MEC, as well as a formal management plan as stipulated in NEMPAA.

One can conclude that the Nyl Valley Private Nature Reserve is indeed a Nature Reserve, on paper, which was officially promulgated in 1960. However, it needs to be determined if it can still be considered a nature reserve under NEMPAA, due to mining and agricultural activities which have been allowed to take place within this area and due to the fact that the status is not supported by the new requirements of NEMPAA of 2003.

The National DEA is currently making recommendations to Provincial Departments (such as LEDET) as to what steps need to be followed to align these Private Nature Reserves to the NEMPAA requirements.

LEDET is undertaking the following steps in order to formalize the alignment of these Private Nature Reserves:

1. Collecting of the proclamation notices of all Private Nature Reserves for the province (This was finalized in 2010)
2. Digitizing of the diagrams into the GIS system (in progress, and target end date is July 2011)
3. Visits by the Provincial Department to each Private Nature Reserve for assessment and interaction with land owners (There are in the region of 300 Private Nature Reserves to be visited in Limpopo Province alone)
4. Determination of the future of each private reserve and the alignment with the objectives of NEMPAA.

As such, the formal promulgation of these Private Nature Reserves to align with the objectives of NEMPAA is on-going. This process will be borne in mind during the EIA phase of the project, and an update on status of these areas will be given during the EIA phase of the project.

4.2.2 PROCLAMATION OF ZOETVELD AS A PRIVATE NATURE RESERVE

On 27 January 1960 the remainder of the Farm Zoetveld (and other portions of the neighbouring Grassvalley farm) were gazetted as a "Private Nature Reserve". This nature reserve was proclaimed as the Nyl Valley Private Nature Reserve.

The details of this registration of this private nature reserve were received from stakeholders at a meeting in Mokopane on 19 April 2011. The extent of this nature reserve is outlined in Figure 4-6 below.

It is noted that the Farm Zoetveld may indeed be a Private Nature Reserve, promulgated in 1960. Very little is known about its current status under the new National Environmental Management: Protected Areas Act (Act 57 of 2003).

A report by Visagie, (2011) states that: "The Nyl Valley Private Nature Reserve overlaps the current proposed Volspruit Mine. This is specific for the remainder extend of the farm Zoetveld 294 KR. This property is protected under the National Environmental Management Protected Areas Act (NEMPAA) (Act 57 of 2003) and specifically under

section 48 of the Act". Section 48 of the Act is further detailed in section 4.2.1: National Environmental Management: Protected Areas Act (NEMPAA) (Act 57 OF 2003).

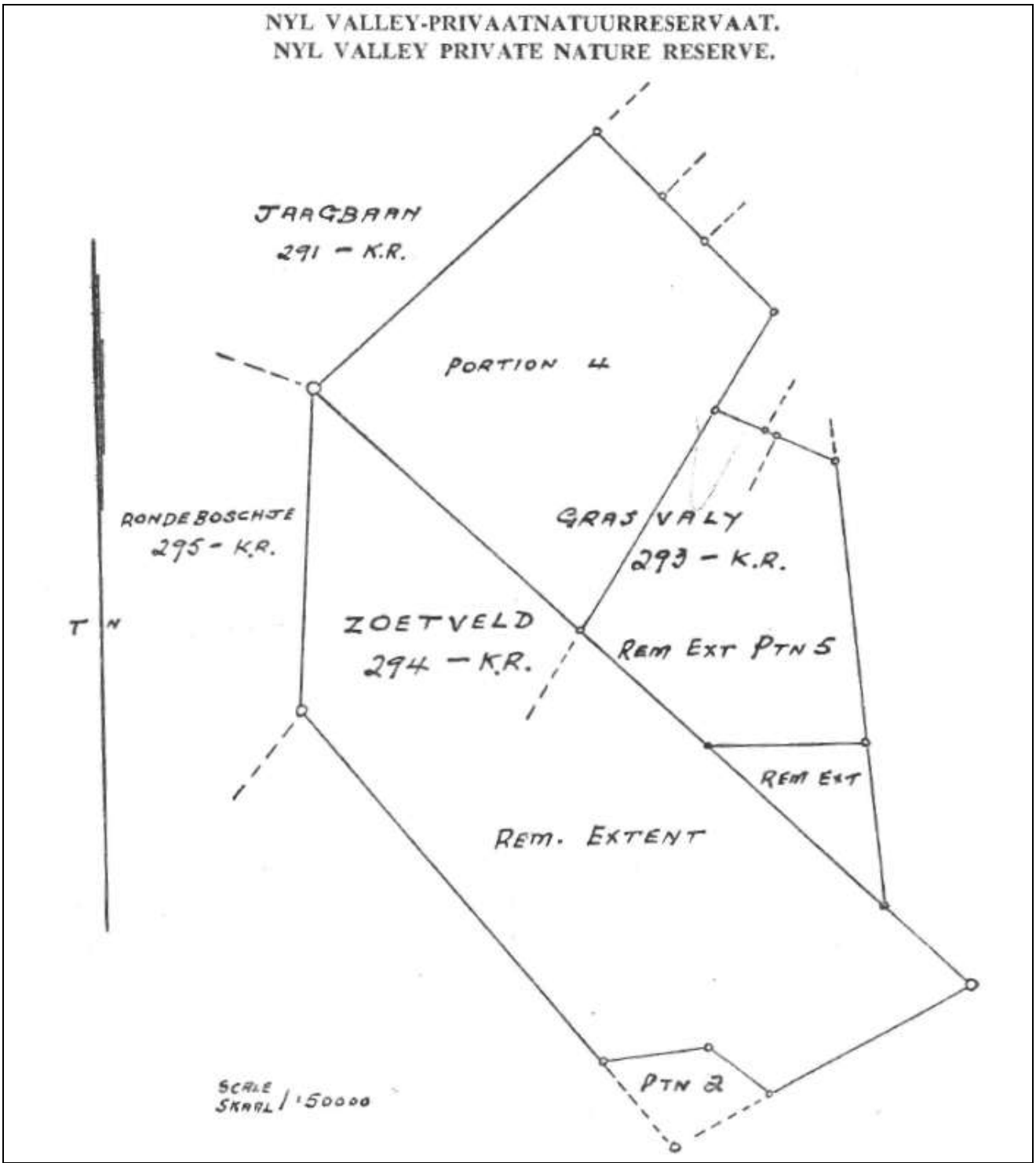


Figure 4-6: Extent of the Nyl Valley Private Nature Reserve proclamation (27 January 1960)

Furthermore, it must be noted that the now defunct Grassvalley Chrome mine was operational until the 1980s on the Remainder of Portion 5 of the Farm Grassvalley (inside this private nature reserve).

Notably, the Farm Zoetveld is not proposed to be mined for any mineral at this time, as the prospecting right is held exclusively on Volspruit and a small portion of Zoetveld. Zoetveld has, however, been identified as a possible area for the location of above ground surface

infrastructure such as tailings dams, waste rock dumps and workshops. The exact extent of and where some of this infrastructure may be placed on Zoetveld is not clear at this time and will be further investigated in the EIA phase and informed by specialist studies.

All Nature Reserves prior to the NEMPAA of 2003 had been proclaimed under numerous Provincial Legislation from 1950 up to 2003. In the "old Transvaal" reserves were declared under the ordinance of the Province.

When an area was proclaimed under that legislation the following applied:

- The owner of the property had to write a letter to the Director of Nature Conservation to motivate the proclamation of the specific farm or farms.
- Applications were then approved or denied from the director's office on his/her discretion.
- The only basic requirement was that the area had to be conservation orientated.
- The owner had the right also to name his reserve as he pleased and then the area was gazetted and proclaimed under that name.

Nature conservation officials visited these reserves yearly for inspection purposes. When perusing the legislation in place in the mentioned period (1950-2003) it will be noted that there are no references to the word Private Nature Reserve. It was discovered that legally all areas declared were classified as Nature Reserves. However, a trend developed in the naming of reserves to indicate the type of ownership. Owners of properties adopted the use of the word Private Nature Reserve which was not stipulated by legislation.

Thus, a Private Nature Reserve prior to NEMPAA of 2003 and a State Owned Nature Reserve had the same status in terms of the law, as both are Nature Reserves.

The Nyl Valley Private Nature Reserve came to existence through the process described above. The main reason for including the farm Zoetveld as a Nature Reserve may have been to obtain long standing permits for specific species on the property. At the moment, however, there seems to be no evidence that the use of the farm Zoetveld is in fact conservation orientated.

4.3 BIODIVERSITY

4.3.1 NATIONAL FORESTS ACT (ACT NO. 84 OF 1998)

There are a number of tree species that are protected according to Government Notice no. 1012 under section 12(I) (d) of the National Forests Act, 1998 (Act No. 84 of 1998). In terms of section1 5(1) of the National Forests Act, 1998 "*no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may be stipulated)*".

A number of species which have a geographic distribution that includes the study area appear on this list, including the following: *Acacia erioloba, Boscia albitrunca, Combretum imberbe, Curtisia dentata, Elaedendron transvaalensis, Pittosporum viridiflorum, Prunus africana, Sclerocarya birrea subsp. caffra* and *Securidaca longependunculata*. Protected tree species recorded in the study area were *Acacia erioloba, Sclerocarya birrea subsp. caffra* and *Boscia albitrunca*.

An application for a licence granted by the minister for the removal and/or relocation of these trees which may be disturbed or affected by the proposed Volspruit mine will be made with the Department of Agriculture, Forestry and Fisheries. However, these tree species will be identified, marked and their coordinates transferred to a location map. The applicant will aim to avoid the unnecessary destruction of protected species during the detail design phase of the project. Where such avoidance may be impractical, the Applicant will apply for the necessary permits to remove.

4.3.2 CONSERVATION OF AGRICULTURAL RESOURCES ACT (ACT 43 OF 1983)

As defined by the Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983), **Conservation** is defined as: "*in relation to the natural agricultural resources, includes the protection, recovery and reclamation of those resources*;"

The objectives of the CARA, as stated in section 2 of the Act, entitled "Objects of Act", are:
"*The objects of this Act are to provide for the conservation of the natural agricultural resources of the Republic by the maintenance of the production potential of land, by the combating and prevention of erosion and weakening or destruction of the water sources, and by the protection of the vegetation and the combating of weeds and invader plants*."

The objectives of CARA are noted and the proposed Volspruit mine will strive to meet these objectives as far as practicably possible. Mitigation and management measures relating specifically to the conservation of high agricultural potential soils that occur on the farm Volspruit will be outlined and discussed in the EIA phase and in the compilation of the EMPR.

The area where the mine is proposed to be placed (more specifically where the North Pit is to be located) is under intensive centre pivot irrigation agriculture, with high crop yields year round. From this and other tools used (including the Waterberg EMF) it can be determined that the soils in the area where the North Pit is proposed to be located has a high agricultural potential and needs to be managed accordingly.

Furthermore, Regulation 5 of CARA entitled: "Prohibition of spreading weeds", states:
No person shall-

(a) sell, agree to sell or offer, advertise, keep, exhibit, transmit, send, convey or deliver for sale, or exchange for anything or dispose of to any person in any manner for a consideration, any weed; or

(b) in any other manner whatsoever disperse or cause or permit the dispersal of any weed from any place in the Republic to any other place in the Republic.

Regulation 5 is noted and the Volspruit mine will strive to meet this requirement of CARA. The management and mitigation measure to achieve this will be defined in the EIA and EMPR.

Furthermore, Government Notice Regulation (GNR) 1048 of 25 May 1984 contains the regulations which have been promulgated under the Conservation of Agricultural Resources Act (CARA). Amongst others, GNR 1048 defines the following key aspects:

"flood area: *in relation to a water course, means the area which in the opinion of the executive officer is flooded by the flood water of that water course during a 1-in-10 years flood";*

Utilisation and protection of vlei, marshes, water sponges and water courses

7.(1) Subject to the provisions of the Water Act, 1956 (Act 54 of 1956), and subregulation (2) of this regulation, no land user shall utilise the vegetation in a vlei, marsh or water sponge or within the flood area of a water course or within 10 metres horizontally outside flood area in a manner that causes or may cause the deterioration of or damage to the natural agricultural resources.

(2) Every land user shall remove the vegetation in a water course on his farm unit to such an extent that it will not constitute an obstruction during a flood that could cause excessive soil loss as a result of erosion through the action of water.

(3) Except on authority of a written permission by the executive officer, no land user shall-

(a) drain or cultivate any vlei, marsh or water sponge or a portion thereof on his farm unit; or

(b) cultivate any land on his farm unit within the flood area of a water course or within 10 metres horizontally outside the flood area of a water course.

(4) The prohibition contained in subregulation (3) shall not apply in respect of-

(a) a vlei, marsh or water sponge or a portion thereof that has already been drained or is under cultivation on the date of commencement of these regulations provided it is not done at the expense of the conservation of the natural agricultural resources; and

(b) land within the flood area of a water course or within 10 metres horizontally outside the flood area of a water course that is under cultivation on the date of commencement of these regulations, provided it is already protected effectively in terms of regulation 4 against excessive soil loss due to erosion through the action of water.

(5) The provisions of regulation 2(2), (3) and (4) shall apply mutatis mutandis with regard to an application for a permission referred to in subregulation (3).

These regulations will be adhered to as far as possible and addressed accordingly in the EIA phase, where impacts and mitigation measures are tabled and discussed. The management of high potential agricultural soils (such as those currently under intensive centre pivot irrigation) will be discussed during the EIA phase.

4.3.3 NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT (ACT 10 OF 2004)

The National Environmental Management: Biodiversity Act (Act 10 Of 2004) (NEMBA) is the primary legislation governing biodiversity management in South Africa.

Section 2: "Objectives of the Act", states the following:

Objectives of Act
2. The objectives of this Act are-
a) within the framework of the National Environmental Management Act, to provide for-

(i) the management and conservation of biological diversity within the Republic and of the components of such biological diversity.
(ii) the use of indigenous biological resources in a sustainable manner; and
(iii) the fair and equitable sharing among stakeholders of benefits arising from bioprospecting involving indigenous biological resources;

b) to give effect to ratified international agreements relating to biodiversity which are binding on the Republic;
c) to provide for co-operative governance in biodiversity management and conservation; and
d) to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

The objectives of this Act will be upheld and promoted during the development of the EIR and EMP. The specialist who will be undertaking the biodiversity assessment will include this legislation in the development of their management and monitoring recommendations.

4.3.4 REQUIREMENTS FOR BIODIVERSITY ASSESSMENTS

It is acknowledged that there are no national guidelines for biodiversity assessments, however, in November 2009, the Department of Agriculture and Rural Development: Directorate of Nature Conservation published the "GDARD requirements for biodiversity assessments" (Version 2). Although these guidelines are specific for Gauteng Province, the essence of reporting on biodiversity issues and the minimum requirements for biodiversity studies can be adapted and used in any situation.

These guidelines will act as reference documentation for the reporting of biodiversity aspects on the Volspruit Project.

4.4 AIR QUALITY

4.4.1 NATIONAL ENVIRONMENTAL AIR QUALITY ACT (NEMAQA) (ACT 39 OF 2004)

Air Quality Management in South Africa has undergone significant changes with regard to amendments in Air Quality legislation. With the introduction of the new, there has been a shift in Air Quality Management from a sourced based and best practicable means (BPM) approach under the Air Pollution Prevention Act (APPA), Act 45 of 1965) to an ambient air quality management approach whereby responsibilities for AQM have been devolved down from the national level to the local authority level (including district and metropolitan municipalities). NEMAQA was brought into full force on 01 April 2010 and has superseded APPA.

Section 21 of the NEMAQA provides for the listing of activities resulting in atmospheric emissions. Specifically, the Minister must publish, by notice in the Government Gazette, a list of activities, which result in atmospheric emissions and which the Minister reasonably believes have or may have a significant detrimental effect on the environment.

Furthermore, such a notice must establish minimum emission standards for substances resulting from a listed activity, including the permissible amount or concentration of substances being emitted, as well as the manner in which measurements of such emissions must be carried out. The notice may also contain transitional and other special arrangements in respect of activities which are carried out at the time of their listing. The DEA has given effect to section 21 through the Listed Activities and Minimum Emission Standards (March 2010), which include air emission standards applicable to the proposed

smelter at the proposed Volspruit Mine and would accordingly require an Air Emission Licence.

The National Environmental Management: Air Quality Act, No 39 of 2004, (NEMAQA) has repealed APPA in total (in terms of section 60 of NEMAQA). However, at this point in time, due to the nature of the framework of the Act and that many local authorities are not adequately prepared for implementation of the legislation, it has only been partially devolved to the municipal and provincial administration level.

Further to the "duty of care" previously discussed in terms of NEMA, NEMAQA defines air pollution in the following terms:

""air pollution" means any change in the composition of the air caused by smoke, soot, dust (including fly ash), cinders, solid particles of any kind, gases, fumes, aerosols and odorous substances;"

This definition is particularly applicable to the generation or entrainment particulate matter (commonly referred to as dust), and gives context to the duty to prevent pollution in terms of atmospheric emissions. NEMAQA is effects-based legislation, with the result that activities that result in atmospheric emissions are to be managed through the setting of health-based ambient air quality standards. Each new development proposal with potential impacts on air quality must be assessed not only in terms of its individual contribution, but in terms of its additive contribution to baseline ambient air quality i.e. cumulative effects must be considered.

4.4.2 NEMAQA SECTION 21 EMISSIONS LIMITS FOR SMELTER COMPLEX

The NEMAQA requires all persons undertaking listed processes to obtain an atmospheric emissions licence. These listed processes were gazetted on 01 April 2010. The activities of the proposed mine (specifically the proposed smelter complex) do fall into these listings, as detailed below.

Table 4-2: Emission standards for smelting and converting of sulphide ores: NEMAQA 4.16			
Description	Processes in which sulphide ores are melted, roasted, calcined or converted.		
Application	All installations		
Substances or mixtures of substances		Plant status	mg/Nm^3 under normal conditions of 273 Kelvin and 101.3kPa
Common name	Chemical symbol		
Particulate Matter	N/A	New	50
		Existing	100
Oxides of Nitrogen	NO_x expressed as NO_2	New	350
		Existing	2000
Sulphur Dioxide (feed SO2 < 5% SO2)	SO_2	New	1200
		Existing	3500
Sulphur Dioxide (feed SO2 > 5% SO2)	SO_2	New	1200
		Existing	3500

Table 4-3: Emission standards for precious metal production and refining: NEMAQA 4.17			
Description	The production or processing of precious and associated base metals		
Application	All installations		
Substances or mixtures of substances		Plant status	mg/Nm^3 under normal conditions of 273 Kelvin and 101.3kPa
Common name	Chemical symbol		
Particulate Matter	N/A	New	50

		Existing	100
Chlorine	Cl_2	New	50
		Existing	50
Sulphur Dioxide	SO_2	New	400
		Existing	400
Hydrogen Chloride	HCl	New	30
		Existing	30
Hydrogen fluoride	HF	New	30
		Existing	30
Ammonia	NH_3	New	100
		Existing	100
Oxides of Nitrogen	No_x expressed as NO_2	New	300
		Existing	500

4.4.3 DRAFT NATIONAL DUST CONTROL REGULATIONS

Section 32 states that the Minister or MEC may prescribe measures relating to dust control. These have not been finalised and published yet, however, draft national dust control regulations have been gazetted for public comment for a period of 60 days. These draft regulations were gazetted on 27 May 2011.

The draft regulation states the following:
No person may conduct any activity in such a way as to give rise to dust in such quantities and concentrations that –

(1) The dust, or dust fall, has a detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage, or has contributed to the degradation of ambient air quality beyond the premises where it originates; or

(2) The dust remains visible in the ambient air beyond the premises where it originates: or

(3) The dust fall at the boundary or beyond the boundary of the premises where it originates exceeds -'
   (a) 600 mg/m2/day averaged over 30 days in residential and light commercial areas measured using reference method ASTM 01739; or
   (b) 1200 mg/m2/day averaged over 30 days in areas other than residential and light commercial areas measured using reference method ASTM 01739.

As noted, these are DRAFT regulations and may change once finalised. Regardless, these guidelines will be adhered to and implemented accordingly.

Furthermore, NEMAQA also makes provision for the establishment of national standards for ambient concentrations of specified substances or mixtures of substances in ambient air, which through ambient concentrations, bio-accumulation, deposition or in any other way, present a threat to health, well-being or the environment or which are reasonably believed to present such a threat. In December 2009 the Minister of Water and Environmental Affairs published national ambient air quality standards referring to various pollutants (e.g. Table 4-4). In addition, criteria and limits for dust deposition have also been drafted (Table 4-5 and Table 4-6).

Further to this, Figure 4-7 shows the interrelationship between the Air Emission Licence Application processes and the NEMA EIA process. As the smelter complex will require an

Air Emission Licence application, this interrelationship needs to be considered.

Table 4-4: National Ambient Air Quality Standards (24 December 2009)

Substance	10-minute maximum	1-hour maximum	8-hour maximum	24-hour maximum	Annual average
Sulphur Dioxide ((SO_2))	500 µg/m^3	350 µg/ m^3		125 µg/ m^3	50 µg/ m^3
Nitrogen Dioxide(NO_2)		200 µg/ m^3			40 µg/m3
Carbon Monoxide (CO)		30 mg/ m^3	10 mg/ m^3		
Particulate Matter (PM10)				75 µg/ m^3	40 µg/ m^3
Ozone (O_3)			120 µg/ m^3		
Lead(Pb)					0.5 µg/ m^3
Benzene(C_6H_6)					5 µg/ m^3

Table 4-5: Evaluation criteria for dust deposition (from SANS 1292, Ed. 2 Draft; 2009/11/17)

No.	*Description*	*Dustfall rate, D (mg/m²/day , 30 day average)*	*Comment*
1	Residential	D ≤ 600	Permissible for residential and light commercial
2	Industrial	600 < D ≤ 1 200	Permissible for heavy commercial and industrial
3	Action	1 200 < D≤ 2 400	Requires investigation and remediation if two sequential months lie in this band, or more than three occur in a year.
4	Alert	2 400 < D	Immediate action and remediation required following first incidence of dustfall rate being exceeded. Incident report to be submitted to relevant authority.

Table 4-6: Dust deposition target, action and alert thresholds (from SANS 1292, 2009/11/17)

Level	*Dustfall rate, D (mg/m²/day , 30 day average)*	*Averaging period*	*Permitted frequency of exceeding dustfall rate*
Target	300	Annual	
Action residential	600	30 days	Three within any year, no two sequential months.
Action industrial	1 200	30 days	Three within any year, not sequential months.
Alert threshold	2 400	30 days	None. First incidence of dustfall rate being exceeded requires remediation and compulsory report to the relevant authorities.

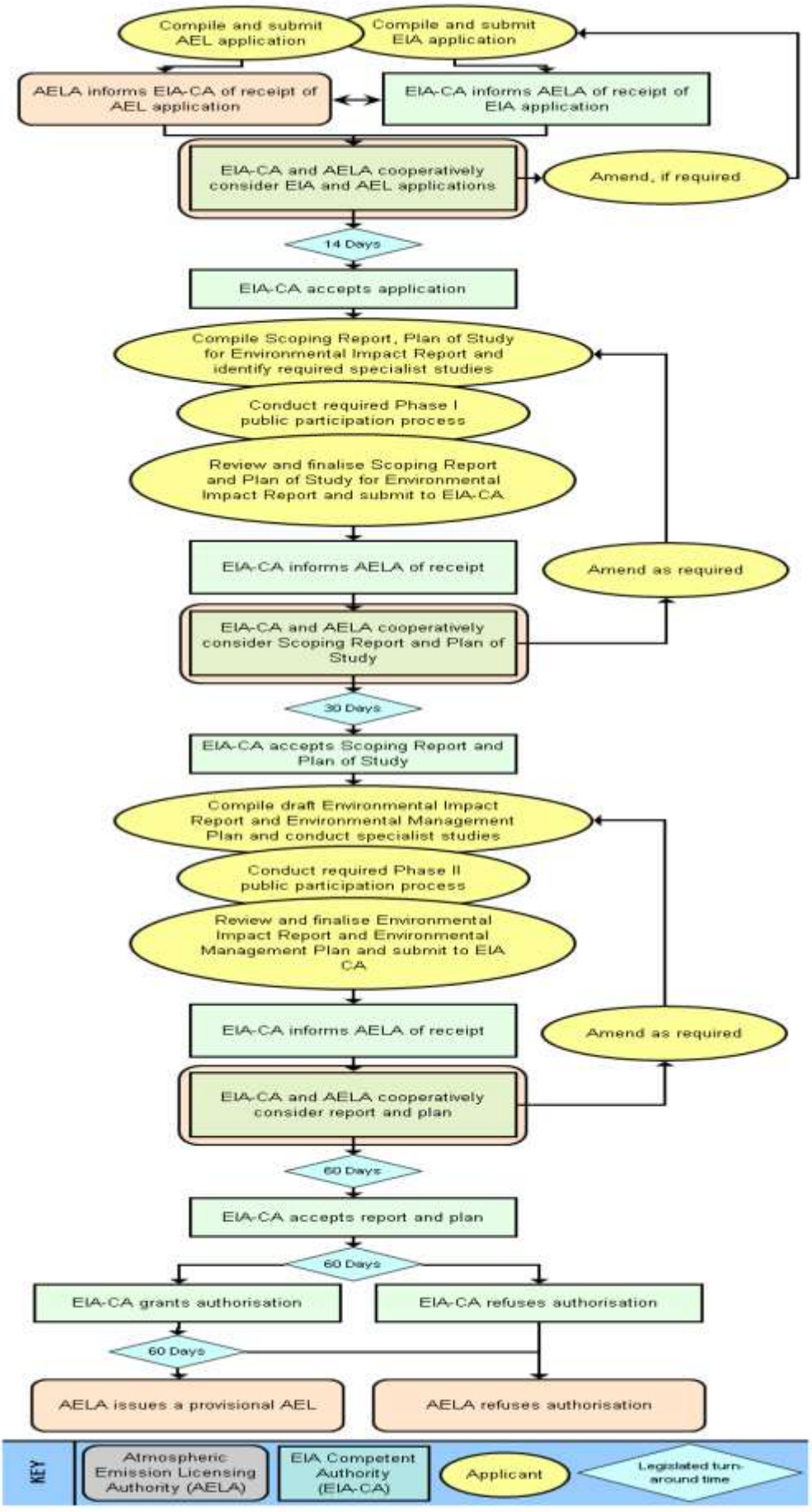


Figure 4-7: Interrelationship between the EIA and AEL processes

4.5 WASTE MANAGEMENT

4.5.1 NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT (ACT 59 OF 2008)

In the past, waste management activities were regulated under the Environment Conservation Act (ECA), 1989 (Act 73 of 1989), specifically section 20(1), which states that "no person shall establish, provide or operate any disposal site without a permit issued by the Minister of Water Affairs". Based on strict interpretation applied by authorities, any waste handling facility, including waste storage and treatment, also required permitting (or at least exemption) in terms of section 20(1). These requirements have, however, been replaced by the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA), which was enacted on 10 March 2009 and came into force on 01 July 2009.

The NEMWA defines 'waste' as "any substance, whether or not that substance can be reduced, re-used, recycled and recovered -
(a) that is surplus, unwanted, rejected, discarded, abandoned or disposed of;
(b) which the generator has no further use of, for the purposes of production;
(c) that must be treated or disposed of; or
(d) that is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector, but- (i) a by-product is not considered waste; and (ii) any portion of waste, once re-used, recycled and recovered, ceases to be waste".

Other key definitions in NEMWA are:

- Hazardous waste: Any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment;
- General waste: Waste that does not pose an immediate hazard or threat to health or to the environment, and includes (a) domestic waste; (b) building and demolition waste; (c) business waste; and (d) inert waste; and
- Inert waste: Waste that (a) does not undergo any significant physical, chemical or biological transformation after disposal; (b) does not burn, react physically or chemically biodegrade or otherwise adversely affect any other matter or environment with which it may come into contact; and (c) does not impact negatively on the environment, because of its pollutant content and because the toxicity of its leachate is insignificant.

While the waste streams resultant directly from the Volspruit mine and processing/ beneficiation plant will indeed fall within the definition of what is 'waste', as provided for in the NEMWA, the Waste Act is very clear in terms of the application thereof; where the Act does not apply to *inter alia* '*Residue deposits and residue stockpiles that are regulated under the Mineral and Petroleum Resources Development Act 2002 (Act No. 28 of 2002) [MPRDA]*'.

'Residue deposits and residue stockpiles' are defined in the MPRDA as follows:

- Residue deposit, means any residue stockpile remaining at the termination, cancellation or expiry of a prospecting right, mining right, mining permit, exploration right or production right; and
- Residue stockpile, means any debris, discard, tailings, slimes, screening, slurry, waste rock, foundry sand, beneficiation plant waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or

accumulated for potential re-use, or which is disposed of, by the holder of a mining right, mining permit or production right.

The Volspruit mine and processing plant/beneficiation plant wastes/tailings are deemed to be derived from or incidental to a mining operation and are stored for potential re-use by the mine on the mine property. The above definition is thus deemed to be triggered, thereby placing these waste streams outside the scope of application of the Waste Act.

According to section 19(1) and 19(3) of the Act, the Minister may publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment and must specify whether a waste management licence is required to conduct these activities. Under these provisions, a list of 'Category A' and 'Category B' waste management activities, which require a Waste Management Licence in terms of section 20(b) of NEMWA, were published via General Notice No: 718 on 3 July 2009 as Schedule 1 to NEMWA.

In terms of this notice, a person who wishes to commence, undertake or conduct any of these listed activities must, as part of the Waste Management Licence application, conduct either a Basic Assessment process (for Category A activities), or a scoping and EIA (for Category B) as stipulated in the EIA Regulations (GN R.543). The licensing process for waste management activities and the supporting information required is therefore the same as for activities listed in GN R.544, R.545 and R.546 that require an Environmental Authorisation (see Section 4.1). In order to avoid duplication by requiring two approvals for the same activity, waste activities listed in the EIA Regulations were removed by means of General Notice No: 719 on 3 July 2009, which means that currently, waste activities only require a Licence in terms of NEMWA and not an Environmental Authorisation in terms of NEMA too.

The implications of the preceding paragraphs are that the waste management activities to be undertaken on the site, that would at face value require a waste license from the competent authority in terms of section 20 of the NEMWA to proceed, actually do not. This does not, however, exempt the mine from having to ensure that these waste streams are managed in a manner that is environmentally and socio-economically acceptable to IAPs and all relevant spheres of Government; irrespective of whether the waste management activities to be undertaken require a waste license from the competent authority, or not.

Further to the above, it should be taken into consideration that salvage yards and sewage plants, for example, or storage of general and hazardous wastes (other than mining related residue stockpiles) will still require waste licensing if the applicable thresholds for such in GN. 718 of 3 July 2009 are exceeded. It is expected that these thresholds will be exceeded and a waste licence has been submitted to National DEA to cater to these licensing requirements.

4.5.2 MINING WASTE RESIDUE

Further to the above waste management and licensing activities, there are a number of considerations to be taken into account with regards to mining waste residue.

The following regulations and guidelines are taken from the DEA National Waste Management Strategy (NWMS), specifically section 4.4, which deals with mining waste:

4.4(1)

General, hazardous and industrial wastes from the mining industry fall within the scope of the Waste Act, and therefore are addressed by the NWMS. Section 4(1)(b) of the Waste Act specifically excludes residue deposits and stockpiles from the scope of the Act, in as much as these are regulated in terms of the Mineral and Petroleum Resources Development Act, 2002, (MPRDA) – which falls under the aegis of the Minister of Mineral and Energy Affairs.

4.4(2)
Residue stockpiles are defined in the MPRDA as:

"any debris, discard, tailings, slimes, screening, slurry, waste rock, foundry sand, beneficiation plant waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or accumulated for potential re-use, or which is disposed of, by the holder of a mining right, mining permit or production right;"

4.4(3)
A residue deposit is any residue stockpile that remains at the termination of a mining or prospecting activity.

4.4(4)
The MPRDA requires prospecting and mining operations to be conducted in accordance with the environmental principles set out in section 2 of NEMA, 1998 and provides further definition to this by establishing:

** Liability for environmental damage and the responsibility to rehabilitate the environment is assigned to permit holders, and the need for applicants for permits to make financial provision for environmental liability.*
** Permit holders are required to receive environmental authorisation in terms of NEMA, which includes the requirement to submit an Environmental Management Programme that contains a waste management plan, and to comply with any prescribed waste standards.*

4.4(5)
The 2008 Amendment to NEMA further defines the requirements for an Environmental Management Programme (EMPR). It further empowers the Minister of Mineral Resources to perform environmental functions in terms of NEMA that relate to mining activities (including prospecting, exploration and production). In respect to these activities, the Minister of Mineral Resources is empowered to:

** Stipulate mining activities that require EIAs and EMPRs.*
** Evaluate EIAs and EMPRs.*
** Issue Environmental Authorisations.*

4.4(6)
These parts of the amendment are scheduled to come into force 18 months after the proclamation of the NEMA amendment. Before they come into effect DEA will consult with DMR to determine whether the necessary capacity and administrative arrangements exist on the part of the DMR to fulfil the environmental functions that will be transferred.

4.4(7)
In relation to mining waste, the strategic focus in terms of the waste hierarchy is on ensuring the treatment and safe disposal of mining waste. However, opportunities for reuse of mining waste need to be fully exploited.
4.4(8)

It is in the interests of industry and good governance that norms and standards that apply to acceptable uses are developed for the storage, transport, disposal, re-use, treatment and processing of residue stockpiles and deposits. In relation to ash, for instance, it is necessary for standards for toxicity to be developed to ensure that potential re-use in brick-making or as cement extender does not pose a risk to health.

4.4(9)
"Residue stockpiles" constitute a heterogeneous category of actual or potential waste substances. DEA will engage with DMR to determine if a memorandum of understanding is possible to classify residue stockpiles with the framework of the WCMS.

4.4(10)
Appropriate waste management options for mining waste which falls outside of the Waste Act should be identified in an Industrial Waste Management Plan (IndWMP) for the mining sector. The central purpose of the plan will be to establish waste management guidelines and targets for the mining sector with which EMPRs must be aligned. In terms of the framework for IndWMPs described in section 3.4 of this strategy, the waste management plan in an EMPR corresponds to a site-level IndWMP.

4.4(11)
Institutional responsibility for the drafting of the mining sector plan will lie with the Chamber of Mines, who will be required to undertake a public consultation process in drawing up the plan. In approving or amending the Mining Sector IndWMP, the Minister for Environment Affairs will consult with the Minister of Mineral Resources.

4.5.3 WASTE CLASSIFICATION

Waste classification and management in South Africa has since the late 1990s been informed by a series of documents called the Minimum Requirements 2nd Edition, which was published by the Department of Water Affairs and Forestry in 1998 (Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste; Minimum Requirements for Waste Disposal by Landfill; and Minimum Requirements for the Monitoring of Water Quality at Waste Management Facilities). The Minimum Requirements were aimed at providing a norm by means of which authorities, waste generators, permit holders and other interested and affected parties can differentiate acceptable waste handling and disposable practices from unacceptable practices. The existing classification and management provisions in the Minimum Requirements Series have no legal standing in itself, although certain provisions have historically been formalised and enforced in varying degrees through inclusion into the conditions of waste permits issued in terms section 20 of the Environment Conservation Act, 1989 (Act 73 of 1989).

Through the implementation of the Minimum Requirements waste classification system over the past 12 years, a number of shortcomings have been identified by regulatory authorities, industry and waste managers alike. In an attempt to address these issues, a draft 3rd Edition of the Minimum Requirements was published in 2005, but the revised system was never finalised and implemented.

The Department of Environmental Affairs (DEA) therefore initiated a project in 2009 to develop a revised waste classification system, which would support the move away from landfill towards waste management options which favour waste recovery and re-use, and address some of the concerns that have been raised with respect to implementing the current Minimum Requirements 2nd Edition. It is the intention that this new National Waste Classification and Management System would be formalised into Regulations under

NEMWA, with associated schedules and/or norms and standards in terms of the Act as appropriate.

In terms of the latest draft framework (**Figure 4-8**), the revised system would include provisions under three main sections (or Components A, B and C):

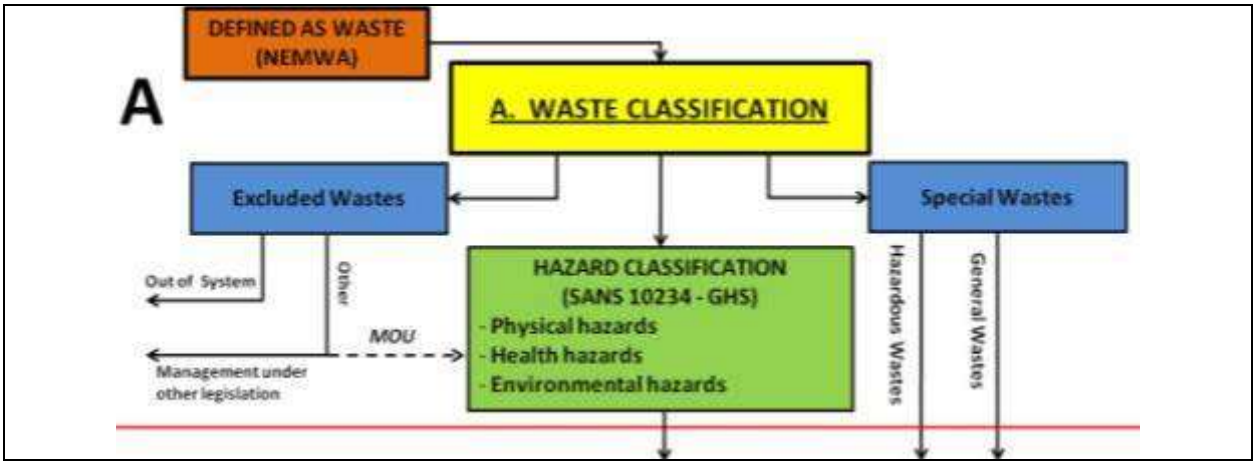
A. Waste Classification: Identifying the specific hazardous properties, characteristics and components of waste in terms of SANS 10234, and assigning a corresponding hazard class and category to the waste as appropriate.

B. Waste Management: Prescribing procedures, requirements and guidelines for the evaluation and implementation of appropriate waste management options.

C. Waste Categorisation and Reporting: Setting specific parameters for reporting on waste generation and management to the Department of Environmental Affairs' (DEA) Waste Information System (WIS).

The revised classification system currently in draft proposes several significant changes to the Minimum Requirements applied to date, with the result that the wastes from the proposed Volspruit mine complex would be subject to different classification and management requirements than currently in force. As the DEA project is still on going, the EIA will consider the provisions (even in draft form) of the system, particularly as it relates to classifying waste as hazardous or general, as well as revised landfill disposal requirements, in order to ensure alignment and ultimate compliance with the new system.

The potential applicability of the revised classification system to the project is also questionable, given that the respective waste streams are considered to be 'residue stockpiles', in terms of the MPRDA definition and thus exempt from the provisions of the Waste Act.



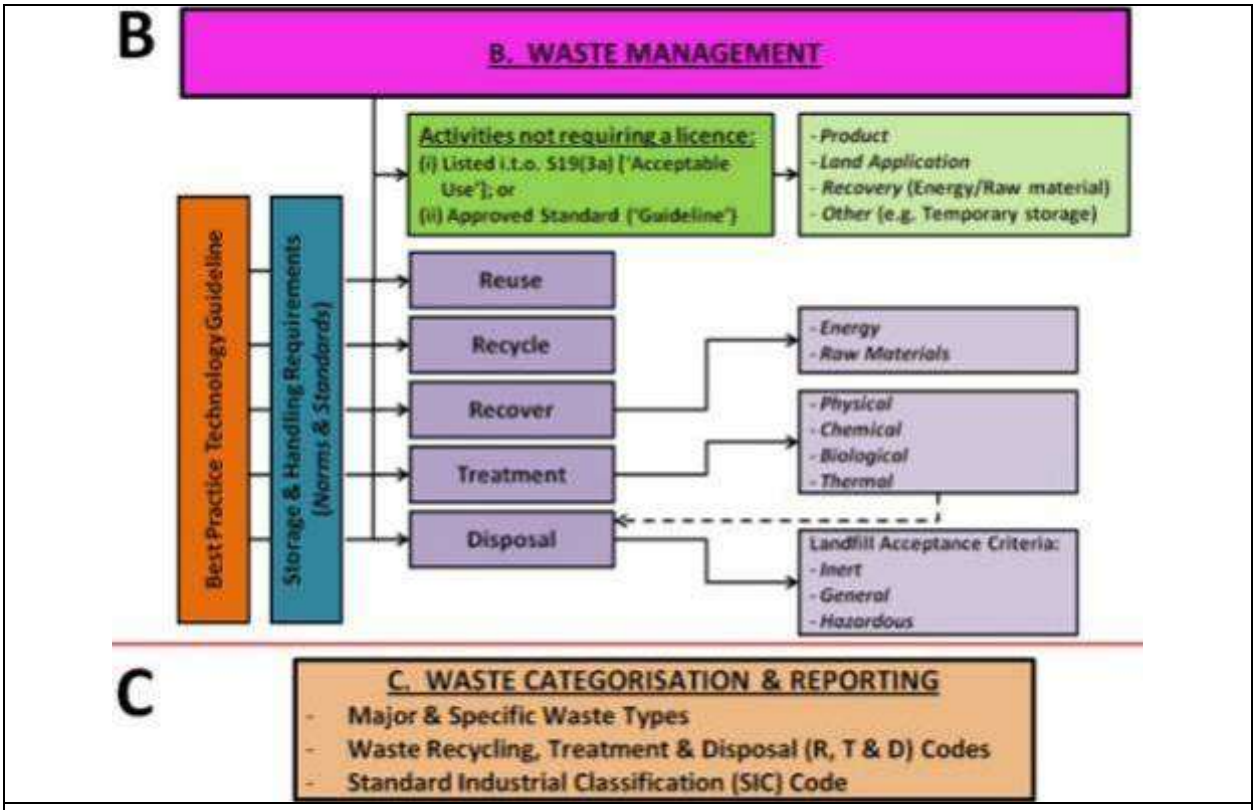


Figure 4-8: Waste Classification & Management System Framework (DEA, 11/12/2009)

4.6 WATER

4.6.1 NATIONAL WATER ACT (NWA), 1998 (ACT 36 OF 1998)

The National Water Act (NWA), 1998 (Act 36 of 1998), aims to manage national water resources in order to achieve sustainable use of water for the benefit of all water users. This requires that the quality of water resources is protected and integrated management of water resources takes place.

In terms of the National Water Act, Act No. 36 of 1998 (NWA) a water use licence is required for:

(a) taking water from a water resource;
(b) storing water;
(c) impeding or diverting the flow of water in a watercourse;
(d) engaging in a stream flow reduction activity contemplated in section 36;
(e) engaging in a controlled activity identified as such in section 37 (1) or declared under section 38 (1);
(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
(g) disposing of waste in a manner which may detrimentally impact on a water resource;
(h) disposing in any manner of water which contains waste from, or which has been heated in any industrial or power generation process;
(i) altering the bed, banks, course or characteristics of a watercourse;
(j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
(k) using water for recreational purposes.

Other provisions of the NWA have been taken into account, specifically relating to Part 4 (section 19), which deals with pollution prevention, in particular situations where pollution of a water resource occurs or might occur as a result of activities on land. A person who owns controls, occupies or uses the land in question is responsible for taking measures to prevent pollution of water resources. If these measures are not taken, the catchment management agency concerned may itself do whatever is necessary to prevent the pollution or to remedy its effects and to recover all reasonable costs from the persons responsible for the pollution.

4.6.2 SECTION 21 WATER USE AND LICENSING

The establishment of a mine will require obtaining a Water Use Licence (WUL), where any of the listings in terms of S21 of the NWA are triggered.

Section 21 of the National Water Act, (Act 36 of 1998) (NWA), defines water use as below:
"21. For the purposes of this Act, water use includes -
(a) taking water from a water resource;
(b) storing water;
(c) impeding or diverting the flow of water in a watercourse;
(d) engaging in a stream flow reduction activity contemplated in section 36;
(e) engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);
(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
(g) disposing of waste in a manner which may detrimentally impact on a water resource;
(h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
(i) altering the bed, banks, course or characteristics of a watercourse;
(j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
(k) using water for recreational purposes."

Depending on the exact process that will be undertaken by the mine, which will be further investigated during the EIA phase of the project, one or more of the following water uses listed above will be triggered. The entire EIA process and the compilation of the IWWMP will however inform the WUL process and there is potential that a number of the water uses will need to be applied for.

Section 19 of the NWA also places a general duty to care in so far as the pollution of water resources is concerned. This will need to be taken into consideration during the WUL application process and the compilation of the EMPR.

4.6.3 IWWMP

An Integrated Water and Waste Management Plan (IWWMP) is compiled in order to promote the environmentally sustainable and equitable use of water in relation to the proposed mining operations. The IWWMP is intended to be a simple, feasible, implementable plan for the Mine based on site specific programmes, also taking into account the National Water Resource Strategy (NWRS), relevant Catchment Management Strategy (CS), Resource Quality Objectives (RQO) and the sensitivity of the receiving water resources and down-stream water users in the vicinity of the mine (Figure 3-4).

This plan would consolidate a number of so-called 'sectorial' water and waste management programmes, relating to specific mine water and waste management aspects, into a single stand-alone document for ease of implementation by the mandated parties at the mine (Figure 3 – 4). The 'sectorial' programmes referred to above cover, inter alia, the following aspects:

- Pollution prevention;
- Water re-use and reclamation;
- Water treatment;
- Storm water management; and
- Water balances.

The consolidation of the above has been done taking cognisance of the resource quality objectives of the National Water Resource Strategy, as well as the relevant Catchment Management Strategy. The formulation of the IWWMP is, furthermore, based on an understanding of the above objectives in conjunction with an impact assessment for all those on site activities that have the potential to impact upon receiving water resources and users in the vicinity of the mine.

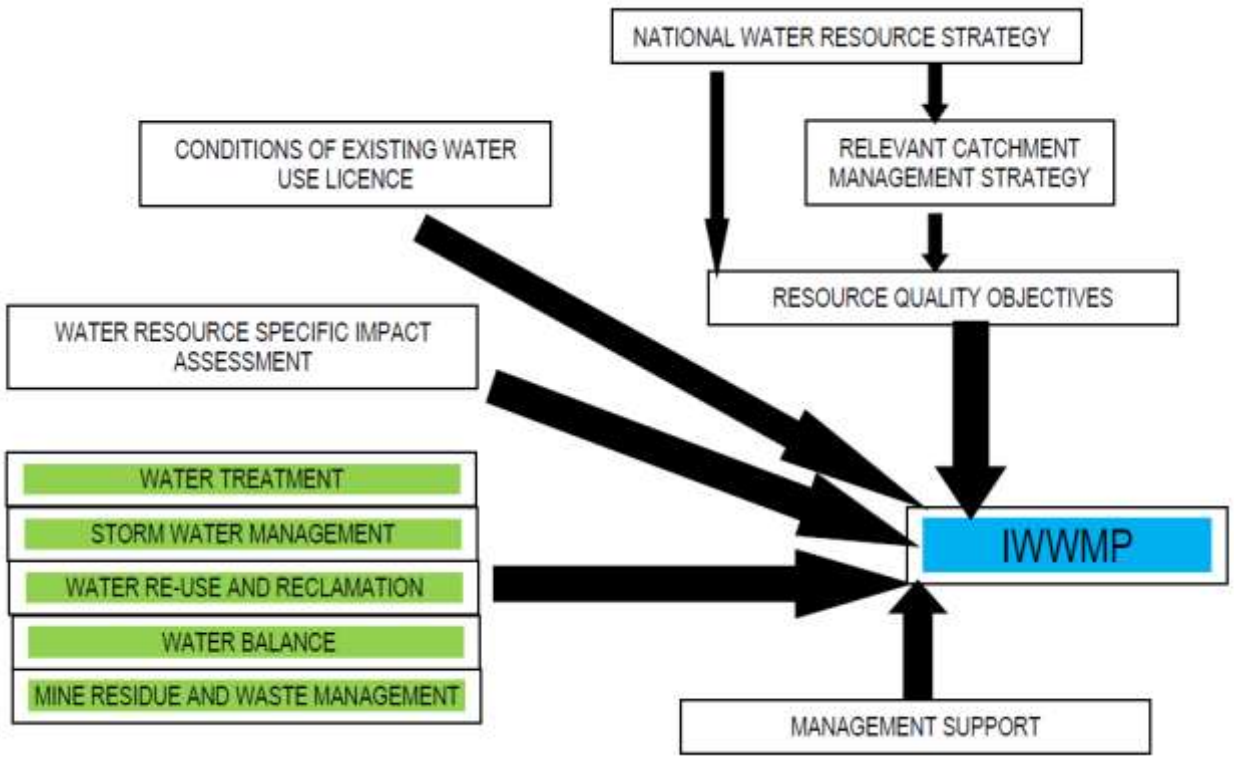


Figure 4-9 Approach to Integrated Waste and Water Management Planning (Adapted from DWAF IWWMP Operational Guidelines, 2008).

The objective of an IWWMP is not to merely compile all existing site knowledge from prior EIA processes or EMPRs into a single unmanageable document (DWA, 2008). It rather, however, applies the principles of the hierarchy for Water Quality Management (WQM) to focus mine management's attention on dealing expressly with those site activities that impact either directly, or indirectly, on water resources and sets clear action plans for the control of water (containing waste) and waste as sources of pollution (Figure 3-5). The hierarchy makes use of precautionary principles and sets an order of priority for mine water and waste management decisions and actions

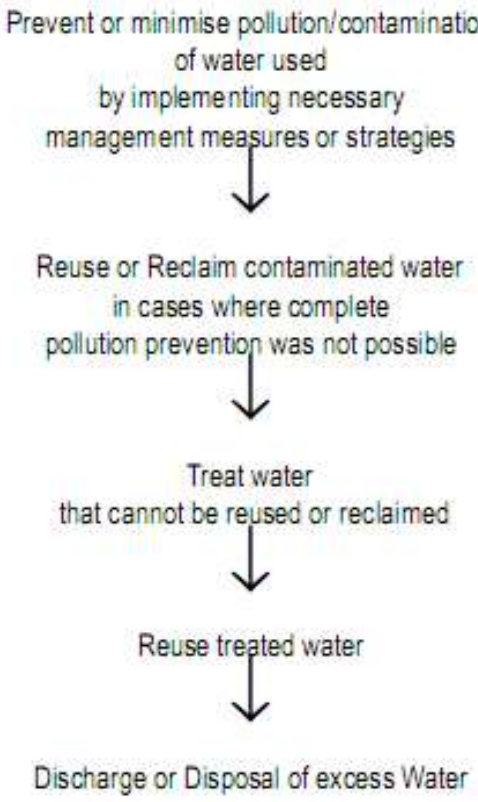


Figure 4-10: Hierarchy of Water Quality Management (DWAF, 2006).

This plan also considers, to the greatest extent possible, the waste and water management actions required for implementation through the entire Life of Mine (including the post closure and rehabilitation phase), whilst remaining dynamic enough to respond to changes in the receiving environment and available Best Practise Environmental Technology alternatives.

The National Water Resource Strategy describes the central objective of managing water resources as follows (DWAF, 2004):

"...to ensure that water is used to support equitable and sustainable social and economic transformation and development."

Strategic Water Resource Management requires the party mandated to manage water and waste at the mine to have an informed understanding of the existing development pressures and water resource quality and quantity issues within the greater catchment. The potential impacts of the mine's activities can then be managed to minimise not only the local/direct impacts of the mine's operations on localised water resources, but also to ensure that the mine's activities do not further exacerbate any existing catchment management issues through indirect and cumulative impacts.

4.6.4 OPERATIONAL GUIDELINES FOR IWWMP

In February 2010, the Department of Water Affairs (DWA) produced an "Operational Guideline: Integrated Water and Waste Management Plan", which was compiled to assist mines and industries who apply for a licence in terms of section 40 (1) of the National Water Act (Act 36 of 1998). The aim of the guidelines document is to assist in compiling water quality management technical documents in accordance with an established approach acceptable to all stakeholders concerned and to assist in the motivation of the

application as well as to assist the decision makers with the consideration of the application (DWA, 2010).

This guideline advocates that the IWWMP is a living document that needs to be updated and "kept alive" as new information becomes available to provide on-going and updated guidance to the water user on their water and waste management (DWA, 2010).

This IWWMP guideline document will be strictly adhered to during the compilation of the IWWMP for the Volspruit Project.

4.6.5 GOVERNMENT NOTICE 704

Mining and associated infrastructure development is guided by the provisos in the Government Notice Regulation 704 of 4 June 1999. GN 704 is the "*Regulations on the use of water for mining and related activities aimed at the protection of water resources*".

Regulations 4, 6 and 7 of GN704 place restrictions on locality of mines, capacity requirements of clean and dirty water systems and protection of water resources respectively. These three sections are critical to this particular project as the area is sensitive and protection of water resources in the area is highest priority.

Regulation 4 of GN704 states amongst others, the following:

"No person in control of a mine or activity may -

a. *locate or place any reside deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year flood line or within a horizontal distance of 100m from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on water-logged ground, or on ground likely to become water-logged, undermined, unstable or cracked;*
b. *except in relation to a matter contemplated in regulation 10, carry on any underground or opencast mining, prospecting or any other operation or activity under or within the 1:50 year flood line or within a horizontal distance of 100 meter from any watercourse or estuary, whichever is the greatest.*
c. *Place or dispose of any reside or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation; or*
d. *Use any area or locate any sanitary convenience, fuel depots, reservoirs or depots for any substance which causes or is likely to cause pollution of a water resource within the 1:50 year flood line of any watercourse or estuary.*"

The North Pit of the proposed Volspruit Mine falls within the current 1:100 and 1:50 year flood lines of the Nyl River and this will be addressed in detail during the EIA phase. Proposals include the establishment of a flood berm to essentially alter the flood lines of the river, thereby making mining possible. The flood berm will not only alter the flood lines, but would protect the open cast pit from flooding. Other mitigation options will also be tabled during the EIA phase, once impacts are known. Due to the proposed altering of the flood lines by means of a flood berm, an application for exemption to mine within the flood line may not be required. However, a licence will still be required for the flood berm, and this will not be overlooked.

It must be noted that the only facilities and/or structures proposed to be inside the *current* delineated 1:50 or 1:100 flood line or within 100 metres of the river is the north open cast pit

and the proposed flood berm. Following the proposed mitigation (i.e. proposed construction of a flood berm) only the flood berm would then be inside the revised (altered) 1:50 and 1:100 year flood lines. If the flood berm is accepted (by DWA and LEDET) and then constructed as such, this would thus artificially alter the *current* flood lines, which would mean that no mining would actually occur inside the "altered flood lines", but would occur on the edge of the altered flood lines. All other structures including dams and tailing storage facilities will be well outside of the 1:100 year flood line and more than 100 metres away from the flood plain and wetland.

4.7 HERITAGE

Aspects concerning the conservation of cultural resources are dealt with mainly in two acts. These are the National Heritage Resources Act (Act 25 of 1999) and to a lesser extent the National Environmental Management Act (Act 107 of 1998).

4.7.1 NATIONAL HERITAGE RESOURCES ACT (NHRA) (ACT 25 OF 1999)

According to the above-mentioned act the following is protected as cultural heritage resources:

a. Archaeological artefacts, structures and sites older than 100 years
b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography
c. Objects of decorative and visual arts
d. Military objects, structures and sites older than 75 years
e. Historical objects, structures and sites older than 60 years
f. Proclaimed heritage sites
g. Grave yards and graves older than 60 years
h. Meteorites and fossils
i. Objects, structures and sites or scientific or technological value.

A Heritage Impact Assessment (HIA) is the process to be followed in order to determine whether any heritage resources are located within the area to be developed as well as the possible impact of the proposed development thereon. An Archaeological Impact Assessment (AIA) only looks at archaeological resources. An HIA must be done under the following circumstances:

i. The construction of a linear development (road, wall, power line, canal etc.) exceeding 300m in length
ii. The construction of a bridge or similar structure exceeding 50m in length
iii. Any development or other activity that will change the character of a site and exceed 5 000m^2 or involve three or more existing erven or subdivisions thereof
iv. Re-zoning of a site exceeding 10 000 m^2
v. Any other category provided for in the regulations of South African Heritage Resources Agency (SAHRA) or a provincial heritage authority

Structures

Section 34 (1) of the NHRA states that no person may demolish any structure or part thereof which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

A structure means any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith.

Alter means any action affecting the structure, appearance or physical properties of a place or object, whether by way of structural or other works, by painting, plastering or the decoration or any other means.

Archaeology, palaeontology and meteorites

Section 35(4) of this act deals with archaeology, palaeontology and meteorites. The Act states that no person may, without a permit issued by the responsible heritage resources authority (national or provincial):

a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site or any meteorite;
b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or paleontological material or object or any meteorite;
c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or paleontological material or object, or any meteorite; or
d) bring onto or use at an archaeological or paleontological site any excavation equipment or any equipment that assists in the detection or recovery of metals or archaeological and paleontological material or objects, or use such equipment for the recovery of meteorites; and
e) alter or demolish any structure or part of a structure which is older than 60 years as protected.

The above-mentioned may only be disturbed or moved by an archaeologist, after receiving a permit from the South African Heritage Resources Agency (SAHRA). In order to demolish such a site or structure, a destruction permit from SAHRA will also be needed.

Human remains

Graves and burial grounds are divided into the following:

A. ancestral graves
B. royal graves and graves of traditional leaders
C. graves of victims of conflict
D. graves designated by the Minister
E. historical graves and cemeteries
F. human remains

In terms of section 36(3) of the National Heritage Resources Act, no person may, without a permit issued by the relevant heritage resources authority:

a) destroy, damage, alter, exhume or remove from its original position of otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
b) destroy, damage, alter, exhume or remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation, or any equipment which assists in the detection or recovery of metals.

Human remains that are less than 60 years old are subject to provisions of the Human Tissue Act (Act 65 of 1983) and to local regulations. Exhumation of graves must conform to

the standards set out in the Ordinance on Excavations (Ordinance No. 12 of 1980) (replacing the old Transvaal Ordinance No. 7 of 1925).

Permission must also be gained from the descendants (where known), the National Department of Health, Provincial Department of Health, Premier of the Province and local police. Furthermore, permission must also be gained from the various landowners (i.e. where the graves are located and where they are to be relocated) before exhumation can take place.

Human remains can only be handled by a registered undertaker or an institution declared under the Human Tissues Act (Act 65 of 1983 as amended).

Unidentified/unknown graves are also handled as older than 60 until proven otherwise.

Following the completion of the AIA and HIA the coordinates of the entities identified will be added to the location map. The entities will be classified in terms of the ranking afforded to each in the report. The Applicant will aim to minimise the impact on any identified entities throughout the detail design phase and prior to finalising permits for destruction and/or exhumation, which will only be considered in circumstances when mitigation is impossible.

4.8 OCCUPATIONAL HEALTH AND SAFETY

The EIA process assesses impacts on the environment and does not specifically focus on issues of internal health and safety, as these are regulated by other legislation such as the Occupational Health and Safety Amendment Act, Act No. 181 of 1993, (OHSA). However there are instances in which the application of health and safety regulation is relevant within the domain of impact on the environment. The OHSA regulations include Regulation 1179 (Hazardous Chemical Substances) and Regulation 7122 (Major Hazard Installations). A "hazardous chemical substance" is defined in Government Notice R.1179 Hazardous Chemical Substances Regulations (1995) as any toxic, harmful, corrosive, irritant or asphyxiant substance, or a mixture of such substances for which (a) an occupational exposure limit is prescribed, or (b) an occupational exposure limit is not prescribed; but which creates a hazard to health.

Certain emissions from the proposed Volspruit mine may be seen as potentially creating a hazard to health. In terms of section 8(2d) of the OHSA, 1993 the employers have to establish, as far as is reasonably practicable, what hazards to the health or safety of persons are attached to any work which is performed, any article or substance which is produced, processed, used, handled, stored or transported and any plant or machinery which is used in his business. He shall, as far as is reasonably practicable, further establish what precautionary measures should be taken with respect to such work, article, substance, plant or machinery in order to protect the health and safety of persons. The employer shall, furthermore, provide the necessary means to apply such precautionary measures.

A Major Hazardous Installation (MHI) is defined in terms of the OHSA as an installation:

- "*where more than the prescribed quantity of any substance is or may be kept, whether permanently or temporarily*; or
- *where any substance is produced, used, handled or stored in such a form and quantity that it has the potential to cause a major incident*".

A major incident as referred to above is defined as "*an occurrence of catastrophic proportions, resulting from the use of plant or machinery, or from activities at a workplace*". It is impossible to put a specific value to "catastrophic" because it will always differ from person to person and from place to place. However, when the outcome of a risk assessment indicates that there is a possibility that the public will be involved in an incident, then the incident can be seen as catastrophic [Dept. of Labour 2005]. Certain substances listed in Schedule A of the General Machinery Regulations may possibly be used or stored in quantities exceeding the stated thresholds. Previous expert opinion for existing plants similar to that envisaged, however, stated that the proposed installation has no potential to cause a catastrophe, and no further involvement with the MHI Regulations should be required.

4.9 NOISE

4.9.1 NOISE CONTROL REGULATIONS (R 154 GG 13717 OF 10 JANUARY 1992)

The Noise Control Regulations (R 154 GG 13717 of 10 January 1992) promulgated in terms of ECA, defines:

- Nuisance noise, as "*any sound which disturbs or impairs or may disturb or impair the convenience or peace of any person*"
- Disturbing noise, as "*any noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more*".

Regulation 4 states 'No person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof.' In addition, section 28 of NEMA imposes a 'duty of care' on every person who may cause significant pollution to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

4.10 VISUAL

4.10.1 WESTERN CAPE DEPARTMENT OF AND DEVELOPMENT PLANNING: GUIDELINE FOR INVOLVING VISUAL AND AESTHETIC SPECIALISTS IN EIA PROCESSES

A guideline document was developed by the Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning (WCDEADP), which is titled: "Guideline for Involving Visual and Aesthetic Specialists in EIA Processes".

This guideline document, which deals with specialist visual input into the EIA process, has been organised into a sequence of sections, following a logical order covering the following:'

- the background and context for specialist visual input;
- the triggers and issues that determine the need for visual input;
- the type of skills and scope of visual inputs required in the EIA process;
- the methodology, information and steps required for visual input;
- finally, the review or evaluation of the visual assessment process.

4.10.1.1 PRINCIPLES AND CONCEPTS UNDERPINNING VISUAL INPUT

The following key principles and concepts will be considered during visual input into the EIA process (WCDEADP, 2005):

- An awareness that 'visual' implies the full range of visual, aesthetic, cultural and spiritual aspects of the environment that contribute to the area's sense of place.
- The consideration of both the natural and the cultural landscape and their inter-relatedness.
- The identification of all scenic resources, protected areas and sites of special interest, together with their relative importance in the region.
- An understanding of the landscape processes, including geological, vegetation and settlement patterns, which give the landscape its particular character or scenic attributes.
- The need to include both quantitative criteria, such as 'visibility' and qualitative criteria, such as landscape or townscape 'character'.
- The need to include visual input as an integral part of the project planning and design process, so that the findings and recommended mitigation measures can inform the final design and hopefully the quality of the project.

4.11 GUIDELINES ON THE INVOLVEMENT OF SPECIALISTS IN THE EIA PROCESS

The Western Cape Department of Environmental Affairs and Development Planning (WC DEADP) has developed policy guidelines around specialist involvement in EIA processes. The guidelines aim to improve the quality of specialist input and facilitate informed decision-making. The guidelines clarify the roles and responsibilities of all role players with regard to specialist input in the EIA process. These guidelines have been derived to help practitioners draft appropriate terms of reference for specialist input and assist role-players to evaluate the appropriateness of specialist inputs in individual cases. Although these guidelines have been developed by the Western Cape, they can be adopted for use anywhere in the country.

Hence, the EIA process will endeavour to adhere to this set of guidelines, in order to be in line with provincial guidelines relevant to EIAs.

These guidelines include:

- Guideline for Determining the Scope of Specialist involvement in EIA processes (June 2005)
- Guideline for the Review of Specialist input in EIA processes (June 2005)
- Guideline for involving Biodiversity specialists in EIA processes (June 2005)
- Guideline for involving Hydrogeologists in EIA processes (June 2005)
- Guideline for involving Heritage specialists in EIA processes (June 2005)
- Guideline for involving Visual and Aesthetic specialists in EIA processes (June 2005)
- Guideline for involving Economists in EIA processes (June 2005)
- Guideline for Environmental Management Plans
- Guideline for Involving Social Assessment Specialists in EIA Processes

The full versions of these reports can be downloaded from: http://www.capegateway.gov.za/eng/pubs/guides/G/103381

5. LOCAL SDFS AND IDPS RELEVANT TO THE VOLSPRUIT PROJECT AREA

5.1.1 MOGALAKWENA LOCAL MUNICIPALITY SPATIAL DEVELOPMENT FRAMEWORK (SDF)

A Spatial Development Framework (SDF) is regarded as an integral part of the Integrated Development Plan (IDP) as required by section 26 of the Municipal Systems Act of 2000 (Act 32 of 2000). In terms of the act, a SDF "*…must include the provision of basic guidelines for a land use management system for the municipality*." However, a SDF is not a one-dimensional map or plan. It seeks to arrange development activities, land uses and the built form - in such a manner that they can accommodate the ideas and desires of people - without compromising the natural environment and how services are delivered (Mogalakwena SDF, 2009).

Further to the statement above, the Waterberg District Municipality SDF, 2009 states that: "*While mining is recognised as a pillar of the local economic base and key job provider, the long term impact thereof should be carefully considered. Current indications are that with the exception of one or two protected areas there is no direct conflict between mining and prospective mining activities and the major tourism and conservation areas in the municipality*."

The above statement clearly indicates that mining is recognised in the SDF as an economic pillar, however, the impact thereof should be carefully considered. The EIA process which has been initiated (to which this scoping report forms the first documentation thereof) seeks to better understand and quantify these potential impacts.

The Mogalakwena SDF (2009) states that: "*The increasingly important role of mining in the local economy is recognised by the Council. However, mining is driven by international commodity prices and economic conditions. The Council will therefore support the mining sector in terms of land and services availability but in such a way that it does not take on responsibilities in terms of business risks of the mines*".

The Mogalakwena SDF contains various sections on water; Land use; biospheres etc… and one of the sections in the SDF described "Environmental Features". These features are described as follows: "*The environmental features of the municipal area are dominated by the river and specifically the river buffer along it…. River buffers are ecologically important for the protection of ecosystems and should therefore be avoided and not disturbed through development. In this respect, river buffers should be protected from urban, rural, mining and crop farming activities as far as practically possible.*"

This important statement that river buffers are ecologically important and should be avoided as far as practically possible is noted. It is agreed that river buffers are important, and this will be properly investigated during the EIA phase, where biodiversity and wetland specialists' reports will guide the applicability of these guidelines, looking at the site specific characteristics. It must be considered that if feasible and defensible mitigation measures are implemented, (specifically pertaining the management of the buffer area) that these be considered.

Furthermore, as stated in the section above pertaining to the Waterberg EMF, this SDF is a decision-making tool, which, along with other tools (such as the EMF and EIA) will guide

decision-makers in reaching a defensible and realistic decision. These tools together will be used to evaluate the proposed Volspruit mine development.

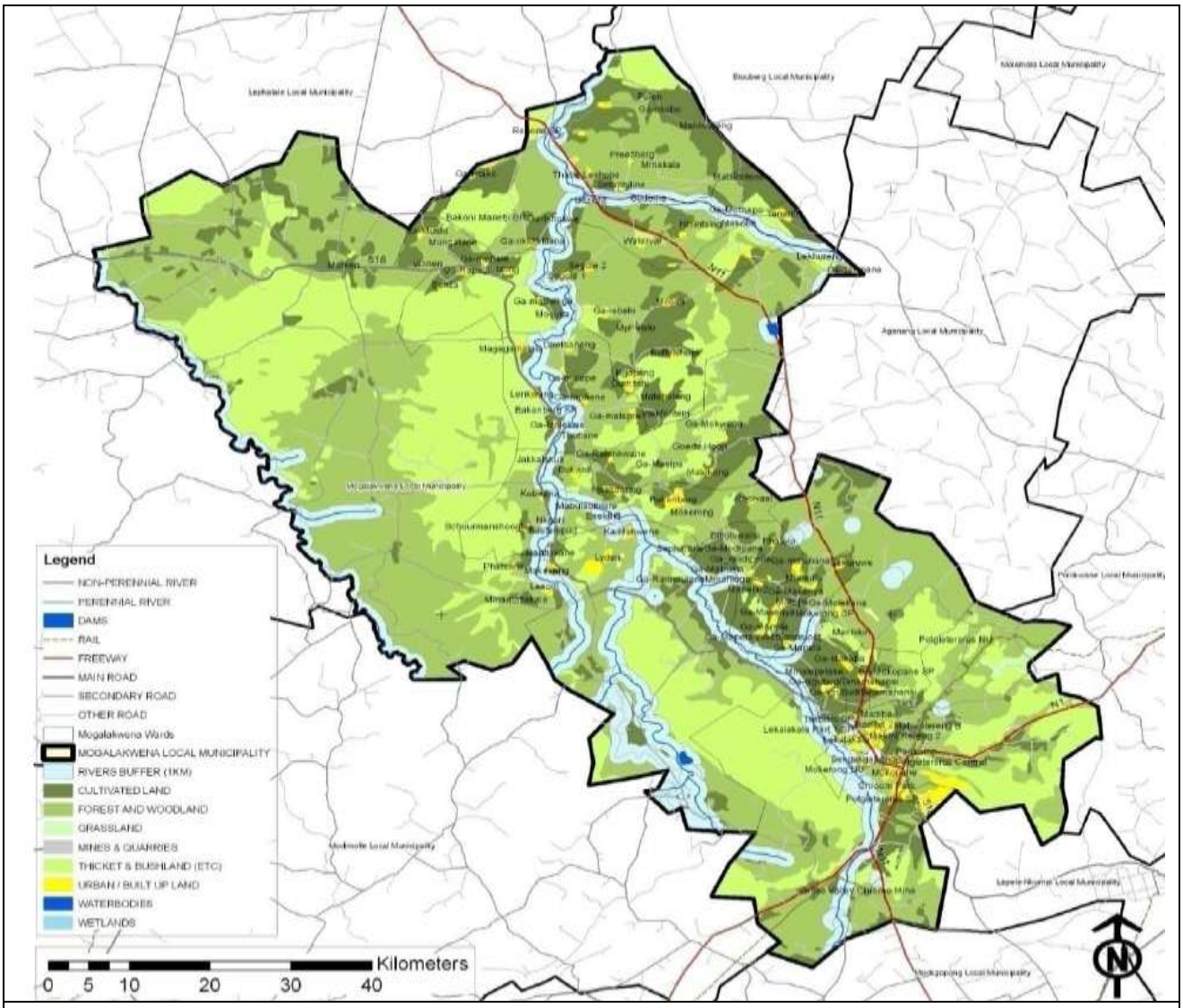


Figure 5-1: Environmental features (Mogalakwena SDF, 2009)

5.1.2 INTEGRATED DEVELOPMENT PLAN (IDP)

An Integrated Development Plan (IDP) is a management tool for assisting municipalities in achieving their developmental mandates. Every municipality is required by law to develop and adopt its IDP through the legal framework provided (Mogalakwena IDP, 2009).

The Mogalakwena IDP further described the following: "*Minerals can be considered a finite resource. In addition, mineral deposits are also fixed in space (i.e. their geographic location). As such, mineral deposits influence and determine the macro spatial patterns in terms of the location of mining activities and mineral processing activities. It is therefore important to locate and describe those mineral occurrences that can be considered significant in terms of the type of mineral, the degree of the deposit, the current and possible future demand and price levels. The significant mineral deposits can be considered mineral/mining zones that impact and determine land uses. Some of these zones have been, or are being, exploited at present. In cases where no exploitation has taken place as yet, it is important to highlight the location of these particular zones in order to prevent or minimize their sterilization with other land-uses (e.g. urban*

development). The Waterberg District has significant mineral zones with the most important being the Platreef, the Mogalakwena Area and the Mogalakwena tin fields."

The Mogalakwena IDP also identified this proposed Volspruit mining project, by indicating that: "*The establishment of another Mine (Pan Palladium in joint venture with Impala Platinum) is currently being investigated on the farm Volspruit 326 KP, approximately 20km south of Mokopane. Consultants have been appointed to investigate the environmental and social aspects of the feasibility study. It is envisaged that mineralised ore containing platinum group metals, base metals (nickel and copper) and gold will be extracted*."

As has been determined in this scoping report, water resources on the farm Volspruit and surrounding areas are a key concern and consideration in the entire EIA process. This is further reiterated by the statement in the IDP that: "*Underground water is another key environmental issue that has to be protected*."

In conclusion the IDP identifies the following strategic guidelines that emanate from relevant legislation and need to be taken into consideration:

- avoid pollution and degradation of the environment;
- avoid waste, promote responsible waste management;
- minimize negative impacts on the environment;
- consider consequences of exploitation of non-renewable natural resources;
- avoid placing ecosystems at risk;
- protect vulnerable ecosystems;
- protect biological diversity; and
- protect cultural heritage sites.

The municipality has adopted the following principles in respect of environmental conservation:

- Efficient waste management services;
- Public education programmes;
- Promotion of recycling initiatives/drives;
- Preventative and curative programmes for air and ground pollution;
- Environmental education programmes.

The above guidelines will be adhered to and incorporated in to the overall EMPR for the proposed Volspruit mine. Environmental protection and minimization of pollution and waste generation will be addressed in the full EMPR document.

6. PUBLIC PARTICIPATION

6.1 INTRODUCTION

Public participation provides the opportunity for Interested and Affected Parties (IAPs) to participate on an informed basis and to ensure that their needs and concerns are considered during the impact assessment process. In so doing, a sense of ownership of the project is vested in both the project proponent and interested or affected parties. The Public Participation Process is aimed at achieving the following:

- Provide opportunities for IAPs and the authorities to obtain clear, accurate and understandable information about the expected environmental and socio-economic impacts of the proposed development.
- Establish a formal platform for the public with the opportunity to voice their concerns and to raise questions regarding the project.
- Utilise the opportunity to formulate ways for reducing or mitigating any negative impacts of the project, and for enhancing its benefits.
- Enable the project proponent to consider the needs, preferences and values of IAPs in their decisions.
- Clear up any misunderstandings about technical issues, resolving disputes and reconciling conflicting interests.
- Provide a proactive indication of issues which may inhibit project progress resulting in delays, or which may result in enhanced and shared benefits.
- Ensure transparency and accountability in decision-making.

The public participation process which will commence shortly is discussed below and will involve the following: (Appendix 4 – Public participation information will be added and updated before the FINAL scoping report is submitted to the authorities)

- The project Background Information Document (BID);
- Proof of notifications to IAPs of the application to LEDET for Environmental Authorization;
- Proof of notifications to IAPs of the application to National DEA for the Waste Management licence application
- Proof of press advertisements and site notices;
- List of IAPs; and
- Comments and Responses Report (C&RR).

6.2 IAP NOTIFICATION AND CONSULTATION

The first step in the public participation process was to advertise the project as required by the 2010 EIA Regulations, in order to inform potential IAPs of the proposed project and EIA process. This was done by means of the following:

- A Background Information Document (BID) was compiled giving detail on the applicant, the Environmental Assessment Practitioner (EAP), the scope and locality of the proposed project, the EIA process, purpose and process of public participation, and included an invitation to register as an IAP and provide comment, as well as an open invitation to the first public meeting.
- Pre-identification of IAPs, including adjacent landowners, using existing databases, and distributing the BID to these stakeholders. The BID was also sent to any other IAPs who responded to site or press notifications.

- Advertising the proposed project and associated EIA process in "The Business Day" on Wednesday 6 April 2011, as well as the "The Daily Sun" newspaper on Wednesday 6 April 2011 and "Die Bosvelder" on Thursday 7 April 2011. The advertisements indicated where written comments may be directed to and were placed in English, Afrikaans and North-Sotho.
- Further to the above, a re-advertisement notification was placed in "The Business Day" and "Die Beeld" on Thursday 12 May 2011, as well as in "Die Bosvelder" on Friday 13 May 2011. This re-advertisement notification was done to include the additional smelter complex and air quality legislation relating to the smelter complex.
- A2-size site notices were erected on the site, as well as at selected shops in the town of Mokopane in all 3 languages as stated above.

Proof of these advertisements, sending of the BID, proof of site notices, communications with IAPs and others are contained in the public participation report attached as Appendix 4 to this report.

6.3 COMMENTS AND ISSUES RAISED BY IAPS

The initial registration phase of the project yielded many comments from various IAPs. These comments were collated from forms which IAPs filled in as questions asked at meetings attended. An updated Comments and Responses (C&R) Report is contained in the public participation report, which is included in Appendix 4 hereto.

6.4 PUBLIC PARTICIPATION – MEETINGS HELD TO DATE

During the months from March to August 2011, various meetings were held with NGOs, stakeholders, farmers and the general public. Only three of these meetings were called by EScience Associates, with the other three meetings being privately arranged meetings, where EScience Associates gave a presentation and or discussed the project.

The meetings held were as follows:

1. On 31 March 2011, a Key Stakeholder meeting was held at the South African National Biodiversity Institute (SANBI) in Pretoria, where key non-governmental stakeholders were invited to attend. Attendees included SANBI, Friends of Nylsvley, Endangered Wildlife Trust (EWT) and the International Mire Conservation Group. Birdlife South Africa was also invited, but could not attend. Minutes and Notes made at this meeting are contained in the public participation report in Appendix 4 to this report.
2. EScience Associates and Sylvania were invited by the Limpopo Wetland Forum to give a presentation on the Volspruit Mine project to the Limpopo Wetland Forum meeting at Potlake Nature Reserve in Limpopo Province on 12 April 2011. The questions posed at that meeting are contained in the comments and responses report, which is included in Appendix 4: Public Participation Report.
3. On 19 April 2011, EScience Associates were invited to give a presentation of the project to the Mokopane Farmers. This meeting was not a formal public participation meeting, but a meeting arranged by the Mokopane Farmers, to which EScience was invited to present. The questions which came out of this meeting, after the presentation was given, are included in Appendix 4: Public Participation Report.
4. On 27 July 2011, EScience Associates held a focus group meeting, specifically for Volspruit and Zoetveld property owners and directly affected farmers surrounding

the two farms. The meeting was held at Kanniedood Guest House close to the farm Zoetveld. The minutes of the meeting and presentation given are included in Section 4.5.4 of the Public Participation Report (Appendix 4).

5. On 28 July 2011, EScience Associates held a Public Meeting at Protea Hotel: The Park, in Mokopane. This meeting was open to any member of the public interested in the proposed project. The minutes of the meeting and presentation given are included in Section 4.5.5 of the Public Participation Report (Appendix 4).
6. On 31 August 2011, Mr Brian Gardner held a meeting with Dr Piet Prinsloo, who represented a number of concerned Mookgopong stakeholders especially with regards to groundwater related issues. The minutes/notes taken at this meeting are presented in section 4.5.6 of the Public Participation Report (Appendix 4).

It is still planned to have two formal public meetings in the Mokopane area, as well as a formal open day where stakeholders can view images and photos, and read reports during the course of the day.

6.5 MEETINGS HELD WITH COMPETENT AUTHORITIES AND GOVERNMENT DEPARTMENTS

To date two (2) meetings have been held with the leading competent authority for the EIA process, which is LEDET. The initial meeting on 10 March 2011 was to outline the project to LEDET and submit the EIA application forms.

The second authority meeting held at LEDET on 2 June 2011 was aimed at clarifying various aspects around environmental legislation, guidelines and policies, and how these are to be dealt with during the compilation of the scoping report and in context of the entire EIA process.

A meeting with the Limpopo Department of Agriculture was also held on 22 August 2011 to discuss the direct issues that this department has with the proposed Volspruit mine project, with specific reference to the impact on Agricultural land and agricultural practices in the area.

A meeting was also held with the Mogalakwena Municipality on 27 July 2011 at 10:00. This meeting was primarily to discuss the project directly with the municipality.

A further meeting on 30 September 2011 was held in Polokwane with the Department of Water Affairs.

The minutes of these five meetings as discussed above (and the presentation given at the first meeting) are provided in section 4.5.7 of the Public Participation Report (Appendix 4).

7. DESCRIPTION OF THE ENVIRONMENT AND POTENTIAL IMPACTS

7.1.1 LAND-USE AND LAND-COVER OF THE STUDY AREA

The general land cover of the study area indicates that a significant portion of the farm Volspruit consists of cultivated land and the remainder of natural vegetation and low koppies. The Nyl River flows through the property from south to north, with roughly two-thirds of the farm located east from this river. The farm Zoetveld on the other hand is characterized chiefly by indigenous bushveld vegetation, with localized areas having been disturbed by previous agricultural activities.

The regional use of land on the surrounding properties is predominantly crop agriculture, cattle grazing and game farming. The abandoned Grass Valley Chrome mine is located on the north-eastern border of the farm Zoetveld.

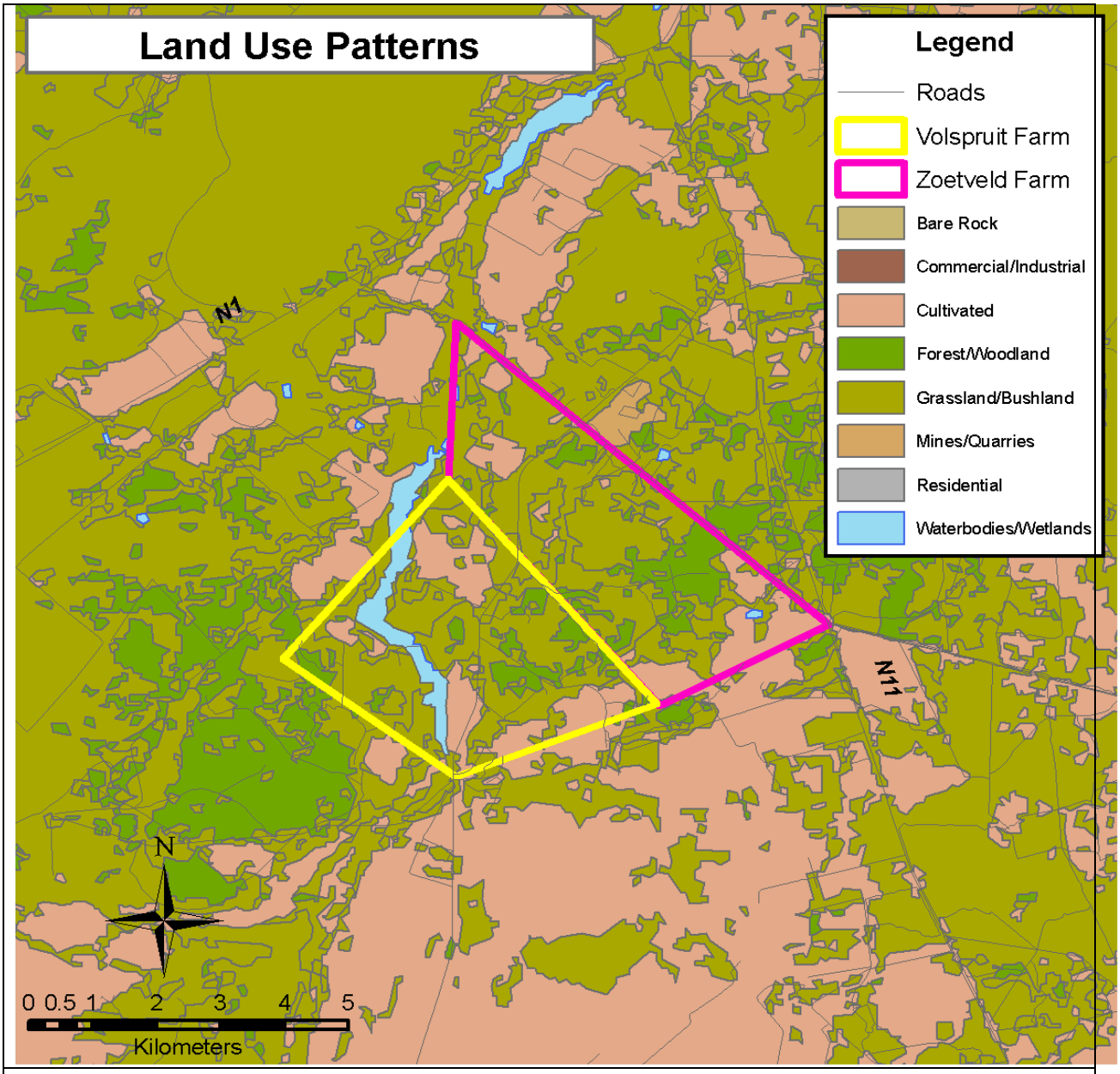


Figure 7-1: Land-use patterns on the farms Volspruit and Zoetveld, as well as surrounding areas.

7.2 CLIMATE

The proposed site is located in the summer rainfall region of Southern Africa with precipitation usually occurring in the form of convectional thunderstorms. The area experiences warm to hot summers with an average maximum temperature of 26°C and an average minimum of 17°C. Winters are mild with an average maximum of 17°C and an average minimum of 8°C. Rainfall is during the summer months and averages 95mm per month. The mean annual rainfall is 625mm per annum. The S-pan evaporation data from the Doorndraai Dam located ~18km north-west of the proposed mine estimated an average annual evaporation of 1 770mm (Table 7-1: S-pan evaporation data (Doorndraai dam) – Sourced from GPT, 2010).

Month	S- pan Evaporation (mm)
October	192.1
November	184.9
December	193.5
January	193
February	163.8
March	156.3
April	122.8
May	101.7
June	80.9
July	88
August	122.7
September	161.8
Total	1770.1

Table 7-1: S-pan evaporation data (Doorndraai dam) – Sourced from GPT, 2010

The annual average temperature at the Mokopane (formally Potgietersrus) meteorological stations is relatively cool throughout the year. The coolest temperatures occur in winter months between June and August.

Maximum monthly average temperatures occur in the summer months, November, December, January and February. The annual average temperature at Potgietersrus meteorological station is 20.5°C. Mean monthly temperatures recorded at the Potgietersrus SAWS station in 2008 are illustrated in Figure 7-2.

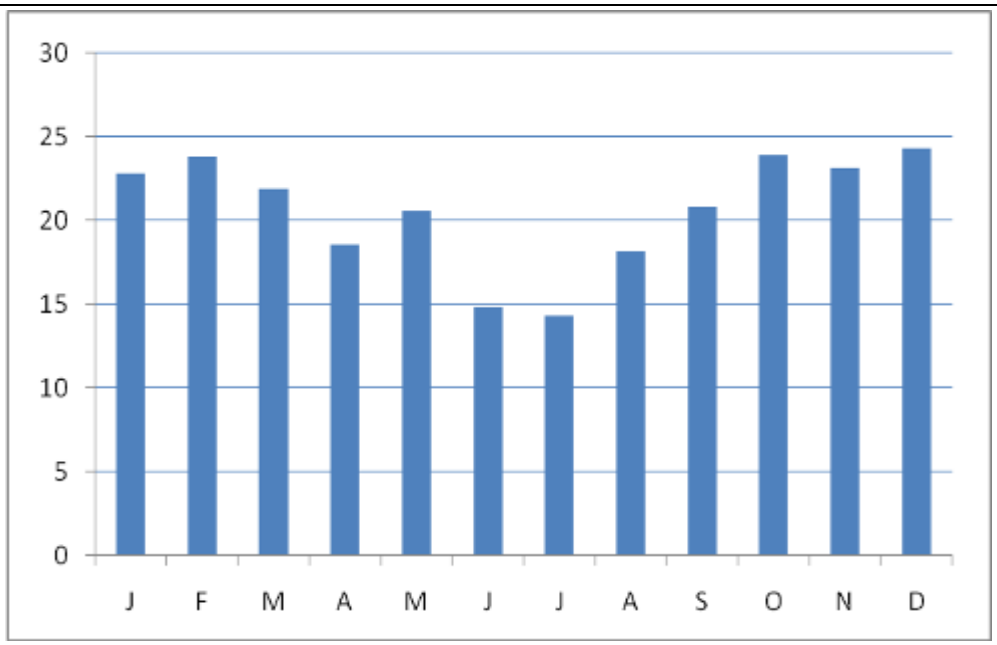


Figure 7-2 : Monthly average temperature profile at Potgietersrus meteorological station (2008).

Table 7-2: Table below shows the mean annual precipitation, run-off and potential evaporation per quaternary catchment (Middleton, B.J., Midgley, D.C and Pitman, W.V., 1990). – As cited in WCS, 2010 report.

Quaternary Catchment	Catchment Surface Area (ha)	Mean Annual Rainfall (MAP) in mm	Mean Annual Run-off (MAR) in mm	Potential Evaporation (mm)	MAR as a % of MAP
A61E	48 698	624.6	46.3	1 600 – 1 800	7.41 %
A61B	32 318	629.1	49.1	1 600 – 1 800	7.80 %
A61C	52 330	632.7	50.2	1 600 – 1 800	7.93 %
A61D	40 607	630.2	47.7	1 600 – 1 800	7.57 %

7.2.1 LOCAL WIND PATTERNS

The Potgietersrus meteorological station is the nearest SAWS observation station (some 16.5 km north north-east from the Zoetveld farm centre) to the proposed Volspruit mine location. Roedtan is the only other meteorological station that falls within the modelling domain. It is, as the crow flies, some 30.5 km south south-east from the centre of the location of Volspruit farm (Figure 7-3).

Wind roses have been developed from wind speed and wind direction data from the closest (Potgietersrus) SAWS meteorological stations in proximity to the proposed development. These are presented in Figure 7-4. The data represent the full year of data collection for 2008. The wind roses show the wind direction and distribution of wind speeds experienced in the year 2008 and for each season within the year. The length of the colour-coded line is proportional to the frequency of occurrence of wind blowing from that direction. Wind speed classes are also colour coded, and the length of each class/category is proportional to the frequency of occurrence of wind speed.

In general, wind speeds throughout the year, and within each season, vary from calm 0.5 m/s – 1.4 m/s (41% frequency) to light 1.4 m/s – 2m/s (24% frequency) to stronger

gusts (>2 m/s) (35 % frequency) at the site. The predominant wind direction at Potgietersrus meteorological station throughout the year is north-westerly.

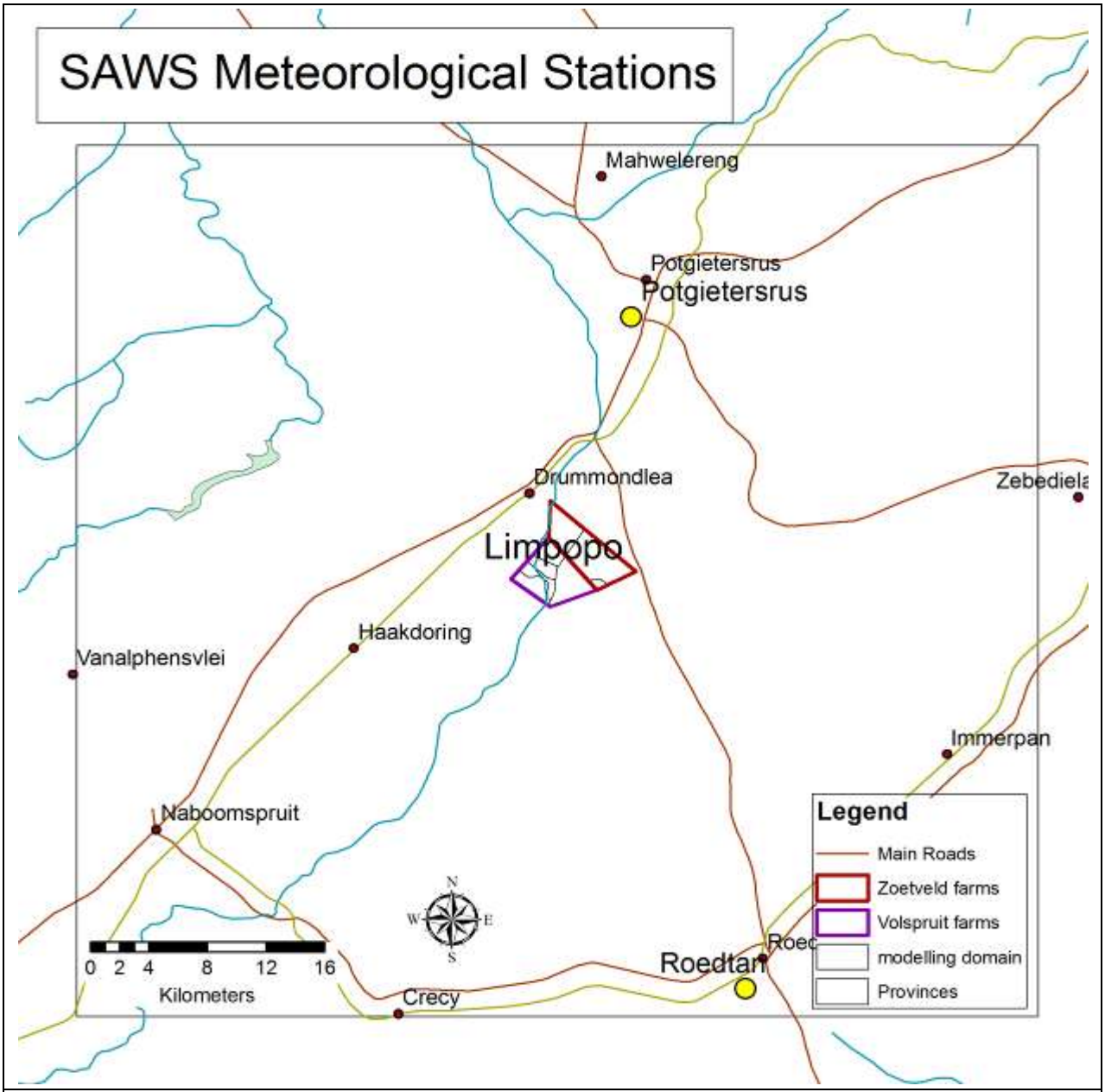


Figure 7-3: SAWS meteorological stations within the modelling domain

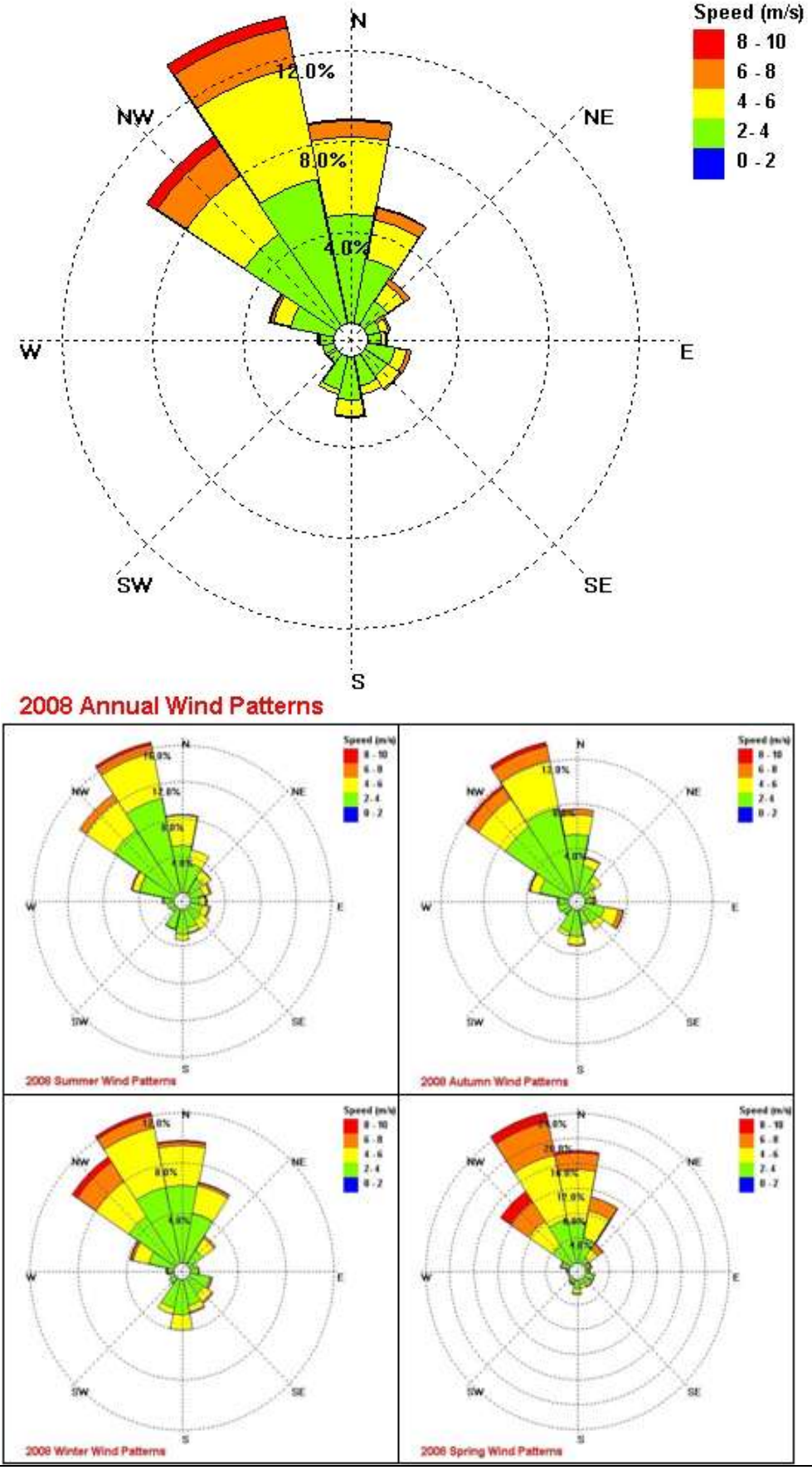


Figure 7-4: Annual and seasonal wind rose plots and proposed modelling domain and receptor grid at Potgietersrus Meteorological station (2008)

7.3 TOPOGRAPHY AND SOILS

The study area lies on the flats to the east of the Nyl River. The terrain is very gently sloping towards the river in the west. There is also a small koppie in the north-eastern corner on the boundary of the site, as well as a larger koppie in the middle of the site. The elevation ranges from 1061 to 1 113 masl across the site.

7.4 GEOLOGY

7.4.1 REGIONAL GEOLOGY

The Bushveld complex consists of the eastern, western, northern and southern limbs as well as satellite outcrops at Nietverdiend (far west) and Villa Nora (far north). According to dating of the rocks, they fall partly into the Vaalian Erathem and partly in the Mokolian Erathem. The main Bushveld igneous complex intruded into rocks of the Transvaal Supergroup, largely along an unconformity between the Magaliesberg quartzite of the Pretoria Group and the overlying Rooiberg felsites. The total extent of the Bushveld complex is approximately 66 000km^2, just over half of which is covered by younger formations (IGS, 2010).

The Volspruit Project is situated on the northern limb, where the mafic rocks have a different sequence to those of the eastern and western limbs. Furthermore, the Bushveld rocks transgress the Transvaal Supergroup from the Smelterskop and Magaliesberg formations in the south to the ironstones of the Penge formation further north, the dolomites of the Malmani Subgroup and eventually resting on the Archaean Turfloop granite in the extreme north (IGS 2010).

The mafic rocks of the Bushveld complex host layers rich in Platinum Group Elements (PGEs), chromium and vanadium, and constitute the world's largest known resource of these metals. In addition, nickel and copper are generally associated with the deposits and are significant by-products. The mafic rocks of the eastern and western limbs (collectively termed the Rustenburg Layered Suite) have been divided into five zones known as the Marginal, Lower, Critical, Main and Upper Zones, from the base upwards.

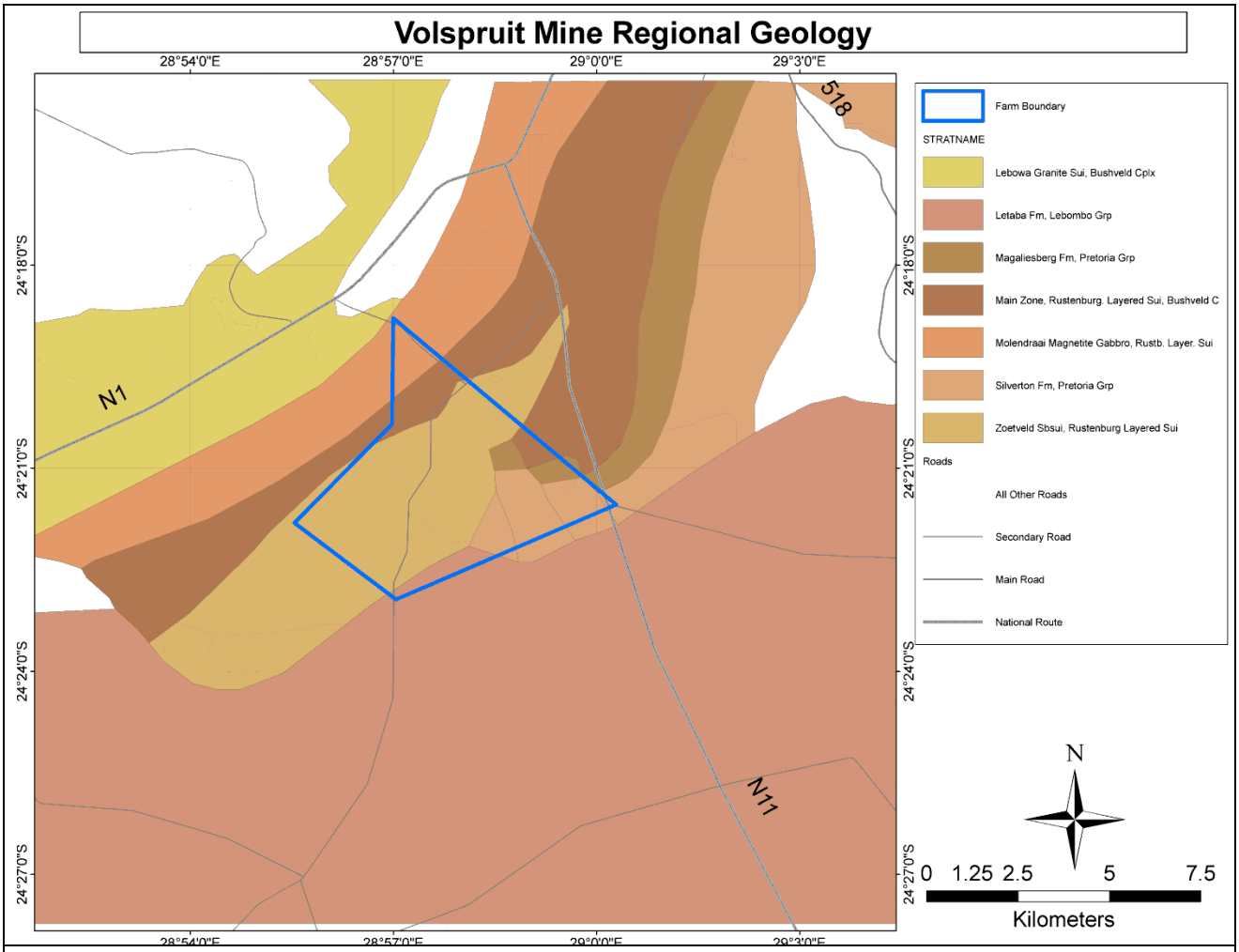


Figure 7-5: Regional geology of the Volspruit area (adapted from MetroGIS, 2010)

7.4.2 SITE GEOLOGY

The rocks underlying the Volspruit Project comprise cumulates of the Lower Zone of the Rustenburg Layered Suite of the Bushveld complex and its immediate floor rocks consisting of the Transvaal Supergroup. The succession is dominated by ultramafic cumulates which range in composition from dunites and harzburgites to orthopyroxenites (IGS, 2010)

The zone of PGE and base metal sulphide mineralisation which has been targeted by the Volspruit exploration (informally referred to as the Volspruit PGE-Ni Reef) is hosted in pyroxenites (orthopyroxenites cumulates) in the lower portion of the upper Volspruit sub-zone. This zone usually occurs several tens of metres above an approximately 100m thick zone of harzburgites (olivine cumulates), which is the only significant sequence of harzburgites in the Volspruit subzone (IGSM 2010).

The current distribution of the various Lower Zone units is controlled by several major episodes of post and possibly syn-Bushveld faulting. Outcrop is extremely poor in the Volspruit area and structure is best revealed by the aeromagnetic data acquired by IGS. Faulting most likely occurred in three phases: an initial, block faulting episode (reverse-faulting) resulted in horsts of Lower Zone being emplaced into the upper portions of the Rustenburg Layered Suite and into higher sediments. The second generation of faulting, along a WNW-ESE trend, was also reverse faulting, resulting in a stepped arrangement in the Rustenburg Layered Suite. The third phase of faulting along a south-westerly trend resulted in the uplift of wedges of Transvaal sediments into the Rustenburg Layered Suite (IGS 2010).

Contamination of the sequence by partly digested country rock xenoliths and by melts of floor rock litho-types is more common in the footwall harzburgite than in the pyroxenitic sequence. Often a coarse-grained to pegmatoidal feldspathic pyroxenite/norite is encountered that may contain coarse nuggets of sulphide (IGS, 2010).

The ore body has a fairly flat lying disposition: the ore zone is shallowest in the north-east, but down-faulted to the south and west to a depth of approximately 70 to 90 metres at the south-western extent of the body. The eastern and southern margins of the body are fault-bounded; exploration of the western edge is constrained by the floodplain of the Nyl River; the property boundary defines the northern limit of the body (IGS, 2010).

7.5 SOIL

The area is currently used for commercial agriculture, both arable cultivation and grazing. The dominant soil types in the area are Hutton (Hu), Glenrosa (Gs), Mispah (Ms) and Katspuit (Ka). The area is mainly Hutton form soils, with small Katspruit areas near the river, while Mispah and Glenrosa form soils are generally found in the elevated areas.

There are three land types on the site. The land type that covers most of the site is the Ae land type (Land Type Survey Staff, 1987). There are also two smaller areas of the Ca land type and the Bd land type. A land type refers to yellow and red soils without water tables belonging to one or more of the following soil forms: Inanda, Kranskop, Magwa, Hutton, Griffin, Clovelly. The Ae land type consists of red, high base status, > 300mm deep soils (MacVicar *et al*. 1974).

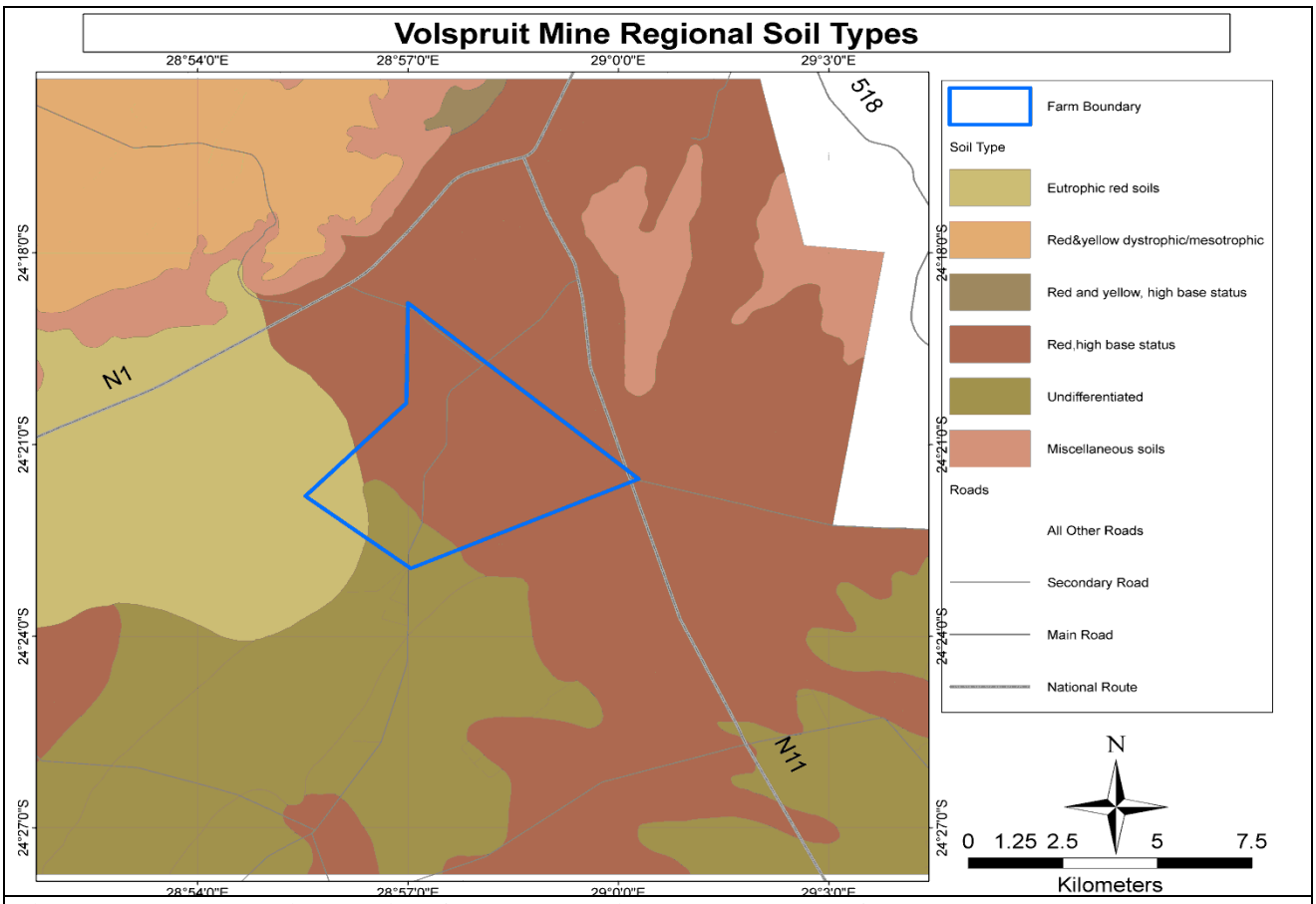


Figure 7-6: Generalized soils of the Volspruit area (adapted from MetroGIS, 2010)

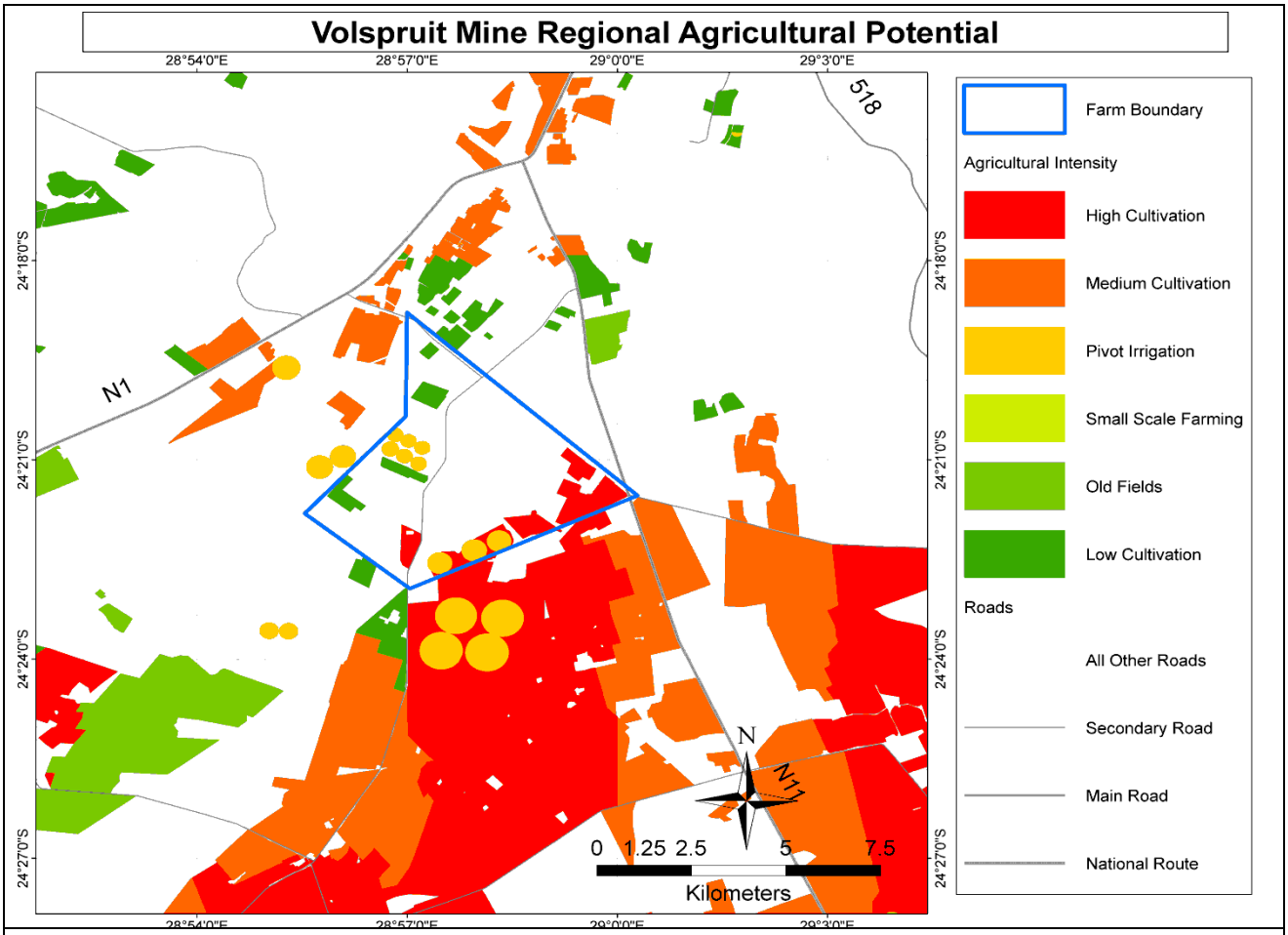


Figure 7-7: Agricultural potential of Volspruit area (adapted from MetroGIS, 2010)

7.6 VEGETATION

The study area falls within the Savannah Biome (Rutherford & Westfall 1986, Mucina & Rutherford 2006). The most recent and detailed description of the vegetation of this region is part of a national map (Mucina, Rutherford & Powrie, 2005; Mucina *et al*. 2006). This national map shows three vegetation types occurring in the study area, all of which occur within the study site, namely Central Sandy Bushveld, Subtropical Freshwater Wetlands and Springbokvlakte Thornveld. A pre-feasibility desktop biodiversity study of the farm Volspruit was undertaken in 2010. A section on the summary of this report is attached as Appendix 5.

7.6.1 CENTRAL SANDY BUSHVELD

This vegetation type occurs in low undulating areas, sometimes between mountains and sandy plains and catenas. The vegetation is a tall, deciduous *Terminalia sericea* and *Burkea africana* woodland on deep sandy soils and low, broad-leaved Combretum woodland on shallow rocky or gravelly soils. The understory is a grass-dominated herbaceous layer with relatively low basal cover. There are two known Central Bushveld endemics in this vegetation (Mucina *et al*. 2006), the grass *Mosdenia leptostachys* and the herb *Oxygonum dregeanum* subsp. *canescens* var. *dissectum*. At a national scale this vegetation type has been transformed approximately 24% and only 2% is conserved of a target of 19%; it is therefore considered to be a vulnerable vegetation type (Mucina *et al*. 2006).

7.6.2 SPRINGBOKVLAKTE THORNVELD

This is an open-to-dense, low thorn savannah dominated by Acacia species or shrubby grassland with a very low shrub layer karroid shrubland occurring on flat to slightly undulating plains. Dominant species include the small trees, Acacia karroo, Acacia luederitzii, Acacia nilotica, Acacia mellifera and Ziziphus mucronata, the tall shrubs, Rhus engleri and Euclea undulata, the low shrubs, Acacia tenuispina and Ptycholobium plicatum, and the grasses, Aristida bipartita, Dichanthium annulatum, Ischaemum afrum and Setaria incrassata. There is one known Central Bushveld endemic in this vegetation (Mucina *et al*. 2006), the grass Mosdenia leptostachys. At a national scale this vegetation type has been transformed almost 50%, and only 1% is conserved of a target of 19%. This vegetation type is therefore considered to be Endangered (Table 2, Driver *et al*. 2005, Mucina *et al*. 2006).

7.6.3 SUB-TROPICAL FRESHWATER WETLANDS

This vegetation consists of low beds of reeds, sedges and rushes and waterlogged meadows dominated by grasses found in areas of flat topography in waterlogged clay soil. It is found typically along edges of seasonal pools in aeolian depressions as well as fringing alluvial backwater pans or artificial dams. At a national scale this vegetation type has only been transformed to a small extent and is well-conserved. This vegetation type is therefore considered to be least threatened. Wetlands do, however, constitute important habitats for various species of restricted distribution and represent important hydrological processes in the landscape. In general, wetland vegetation is protected under the National Water Act.

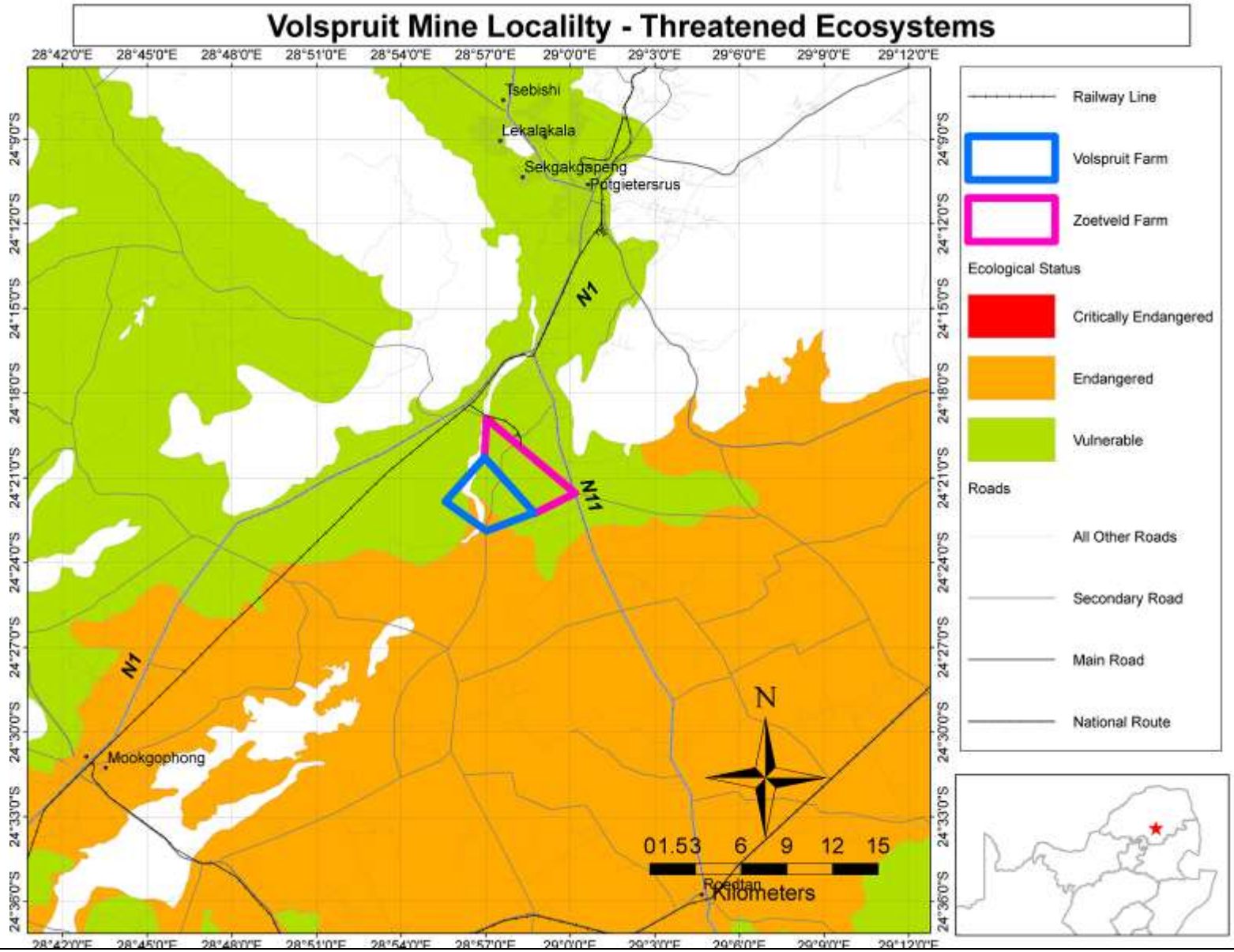


Figure 7-8: Threatened ecosystems on the Volspruit farm (Green = Central Sandy Bushveld, Orange = Springbokvlakte thornveld, White strip through site = freshwater wetland) – GIS layer taken from SANBI national database information

7.6.1 SENSITIVE NATURAL HABITATS ON-SITE

During the biodiversity assessment undertaken by Wetland Consulting Services in 2011, a map was created using satellite imagery and information obtained from a number of site visits. This was done to determine areas on the Farms Volspruit and Zoetveld that are more or less sensitive, depending on current on-site conditions and the status of the bushveld and agricultural lands in terms of their sensitivity to development.

The position of the proposed open cast pits relative to sensitive natural features within the site area is indicated in Figure 7-9. These are the areas likely to be exposed to open-cast mining activities. (WCS, 2011)

It can be seen that the northern open cast pit is almost entirely within a cultivated or previously disturbed area, although it does come very close to the edge of the wetland area on site. A small area of terrestrial natural vegetation is affected by this proposed North Pit. The vegetation that may be affected by the northern extent of the North Pit is plains woodland.

The South Pit is entirely within untransformed terrestrial natural vegetation (WCS, 2011). On site, this consists of a combination of hills woodland and plains woodland. The sensitivity of this habitat on site has been classified as medium.

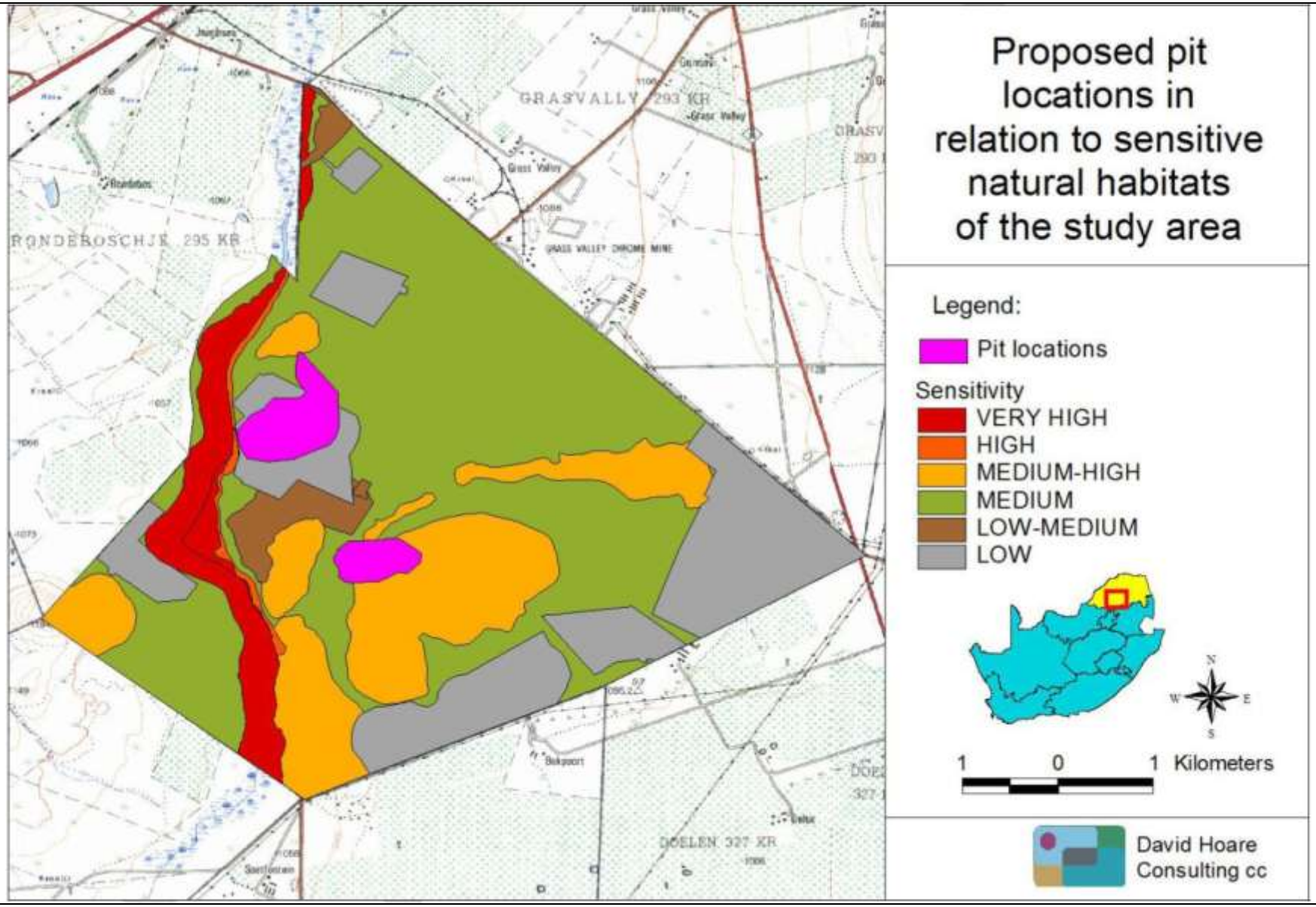


Figure 7-9: Proposed pit location in relation to sensitive natural habitats of Volspruit and Zoetveld (David Hoare Consulting, 2011)

7.7 FAUNA

The results of the desktop study undertaken by Wetland Consulting Services (WCS) (2010) indicated that 32 Red List faunal species have the potential to occur within the study area based on their previously recorded distribution ranges. Of these, 1 amphibian, 3 bird, 27 mammal and 1 reptile red data species potentially occur. All species potentially occurring within the study area were listed in the desktop biodiversity assessment that was undertaken in 2010, a summary of which can be found in Appendix 5 to this report. This list provides only a preliminary assessment of the fauna of the area. Site visits will be essential in better assessing the suitability of the available habitat and determining through observation how many of those species are actually present (WCS, 2010).

7.7.1 AMPHIBIANS

Although 28 amphibian species (all belonging to the order Anura) potentially occur within the Quarter Degree Square (QDS), only one is considered a red data species – the "Near-threatened" Giant bullfrog (*Pyxicephalus adspersus*). This species has a rather specialised habitat, requiring seasonal vleis, pans or other water-filled depressions as well as surrounding grassland to meet its life history requirements.

7.7.2 AVIFAUNA

The Red-billed oxpecker (*Buphagus erythrorhynchus* - "Near-threatened"), Secretary bird (*Sagittarius serpentarius* - "Near-threatened") and Martial eagle (*Polemaetus bellicosus* - "Vulnerable") have all been recorded within the QDS 2428BD during the compilation of the South African Bird Atlas Project 1 (SABAP1).

7.7.3 MAMMALS

Of the 27 Red List mammals potentially occurring, 14 have been previously recorded in the Nylsvley Nature Reserve 40km south-west of the study area (http://www.environment.gov.za/Enviro-Info/sote/nsoer/resource/wetland/ nylsvley_ris.htm, accessed 7 June 2010).

7.7.4 REPTILES

The Southern African rock python (*Python natalensis*) is the only reptile species of special concern which potentially occurs within the study area. A large area of the study site is currently under centre pivot irrigation which can be considered an area of continual disturbance, and is therefore not expected to support a high diversity of species. As the north-eastern mine pit will likely occur primarily within this disturbed, cultivated area, the direct impacts on fauna are expected to be low, but higher in the areas surrounding the south ore body. However, more severe indirect impacts on the fauna may arise as a result of changes in the hydrology and vegetation of the surrounding landscape, brought about by the mining activities.

7.7.5 AQUATICS

According to the Institute of Water Quality Services river coverage for South Africa, based on DWAF desktop estimates of Present Ecological Status of South African Rivers (Kleynhans 1999), within quaternary catchment A61E were classified as being of "High" Ecological Importance and Sensitivity. The Default Ecological Management Class (DEMC) was classified as Category B - ''Sensitive" with "small risk allowed"

7.7.6 MACRO-INVERTEBRATES

Very little aquatic macro invertebrate information was available for the Nyl River but rivers sampled in the vicinity (e.g. within A42 and B51E) indicate moderate South African Scoring System (SASS5) scores, with Average Score Per Taxon (ASPT) ranging from 5 to 6.5, suggesting a moderate to high representation by sensitive taxa and Largely Natural to Moderately Modified conditions for invertebrates (Rivers Database, River Health Programme) (WCS, 2010).

7.7.7 FISH

The study area falls in Water Management Area 1: Limpopo River, quaternary catchment A61E. The main surface water ecosystem that may be influenced in the direct vicinity of the proposed mine is the Nyl River, draining northwards towards the Limpopo River. Based on available information, eight fish species have a high probability and another four a moderate to low probability of occurring in the Nyl River in the study area, while another can be expected in the Nyl River reach of the study area (Table 5). None of these species are currently classified as threatened (red data listed) based on international or national criteria. These species differ in their habitat preferences and requirements, as well as their relative intolerance to changes, and may therefore be impacted in different ways by the proposed development. A detailed specialist investigation will be undertaken to assess the habitat availability and condition as well as fish species composition of the Nyl River and other surface water ecosystems within the study area to determine the potential impacts of the proposed development.

7.8 SURFACE WATER

The Volspruit and Zoetveld farm areas are generally characterized by localized koppies, with a wide and fairly flat river valley. The Nyl River flows through the farm Volspruit and the northern extent of the farm Zoetveld.

The Nyl River floodplain is located within the Limpopo River Catchment (Primary Catchment A), with the Nyl River, which becomes the Mogalakwena River downstream of Mokopane, being a direct tributary of the Limpopo River. The Nyl floodplain itself stretches across four quaternary catchments, with the proposed mining area being located in catchment A61E (WCS, 2010).

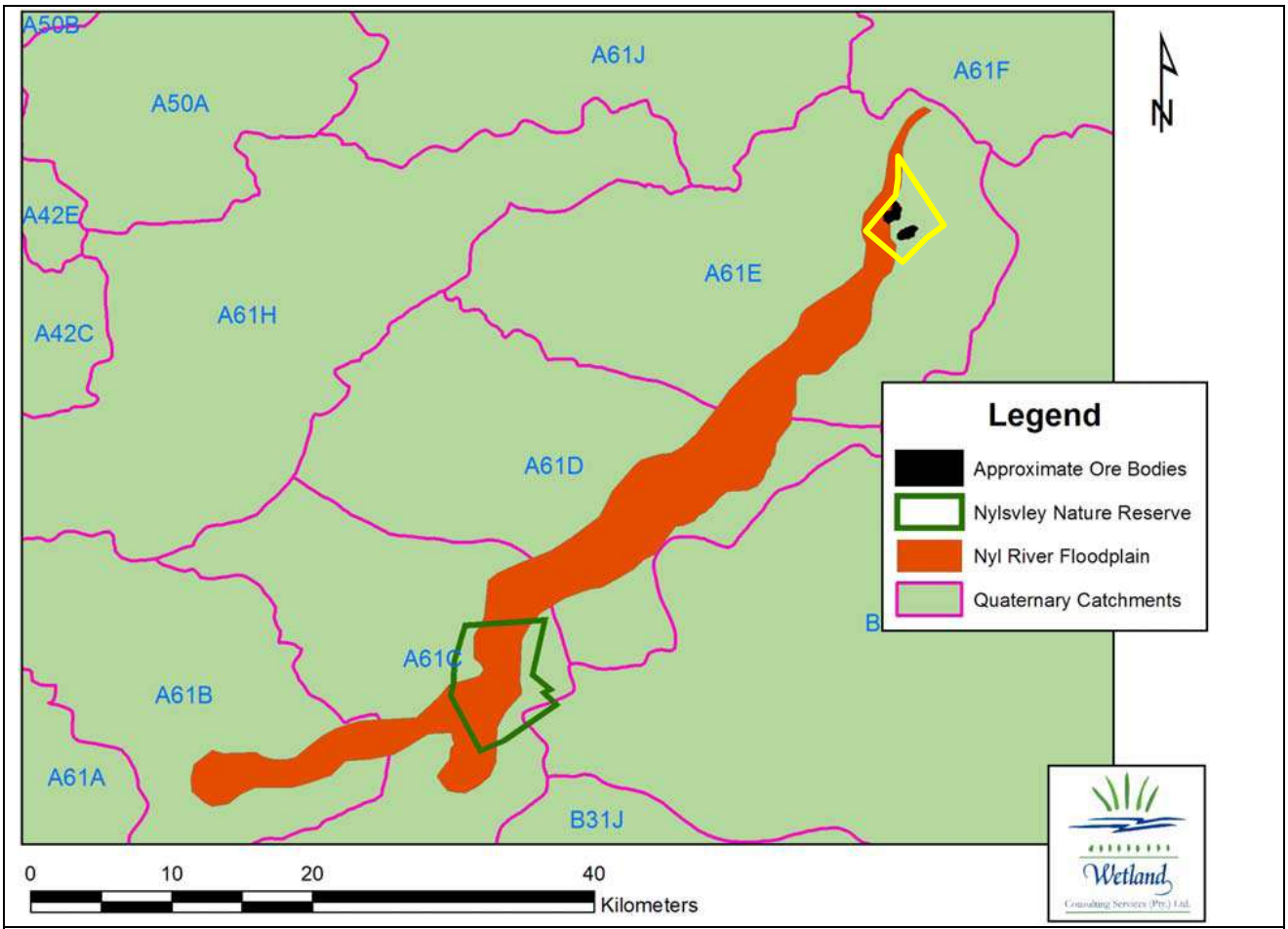


Figure 7-10: Map showing the Nyl River floodplain in relation to the quaternary catchments. The Yellow outline represents the farm boundaries of Volspruit and Zoetveld. Map courtesy of Wetland Consulting Services (2010)

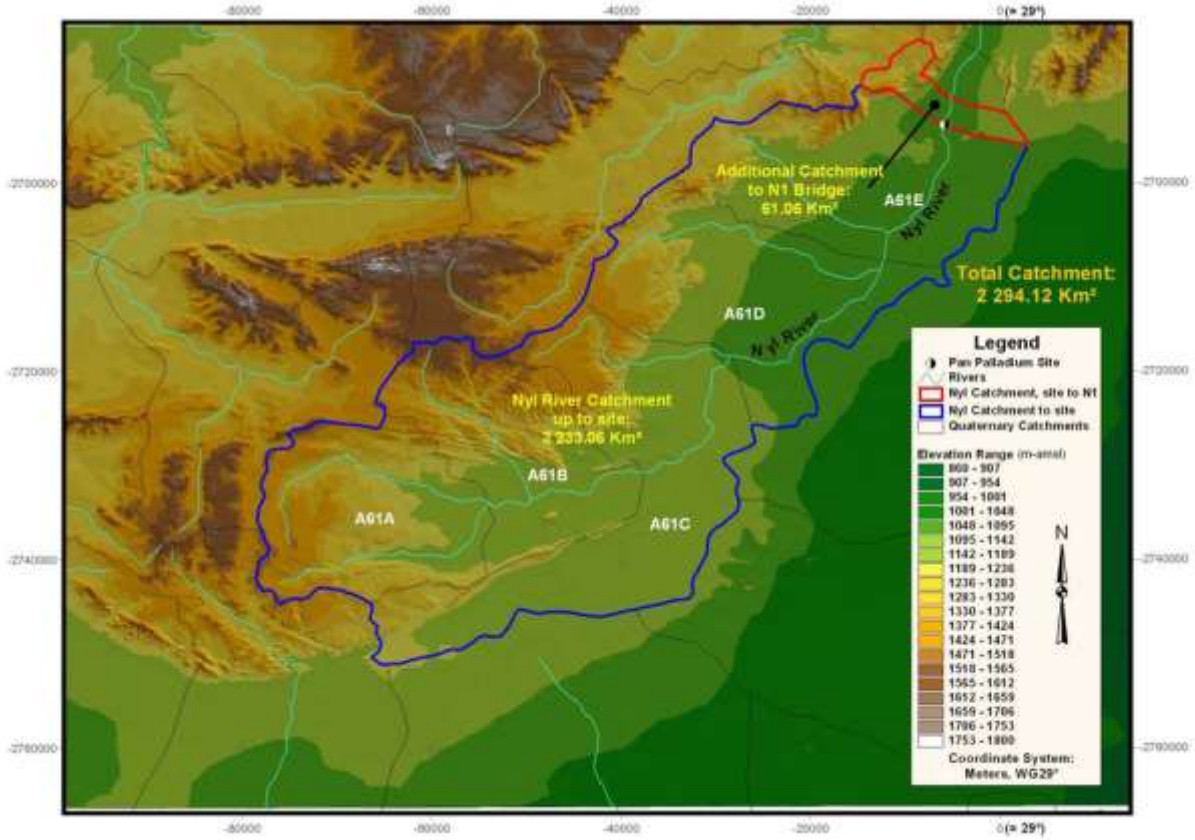


Figure 7-11: The catchment of the Nyl River upstream from the study area, also including the catchment between the study area and the bridge under the N1 freeway on an elevation map. Also shown in this map are the quaternary catchments that make up the total catchment of the study area. (Map Courtesy of AED, 2010)

The Nylsvley Ramsar Site, which constitutes the Nylsvley Nature Reserve, is located within the upper reaches of the floodplain, approximately 40km upstream of the proposed mining area (straight line distance). The reserve protects over 500ha of the floodplain (based on the figures quoted, this represents just more than 2 % of the floodplain).

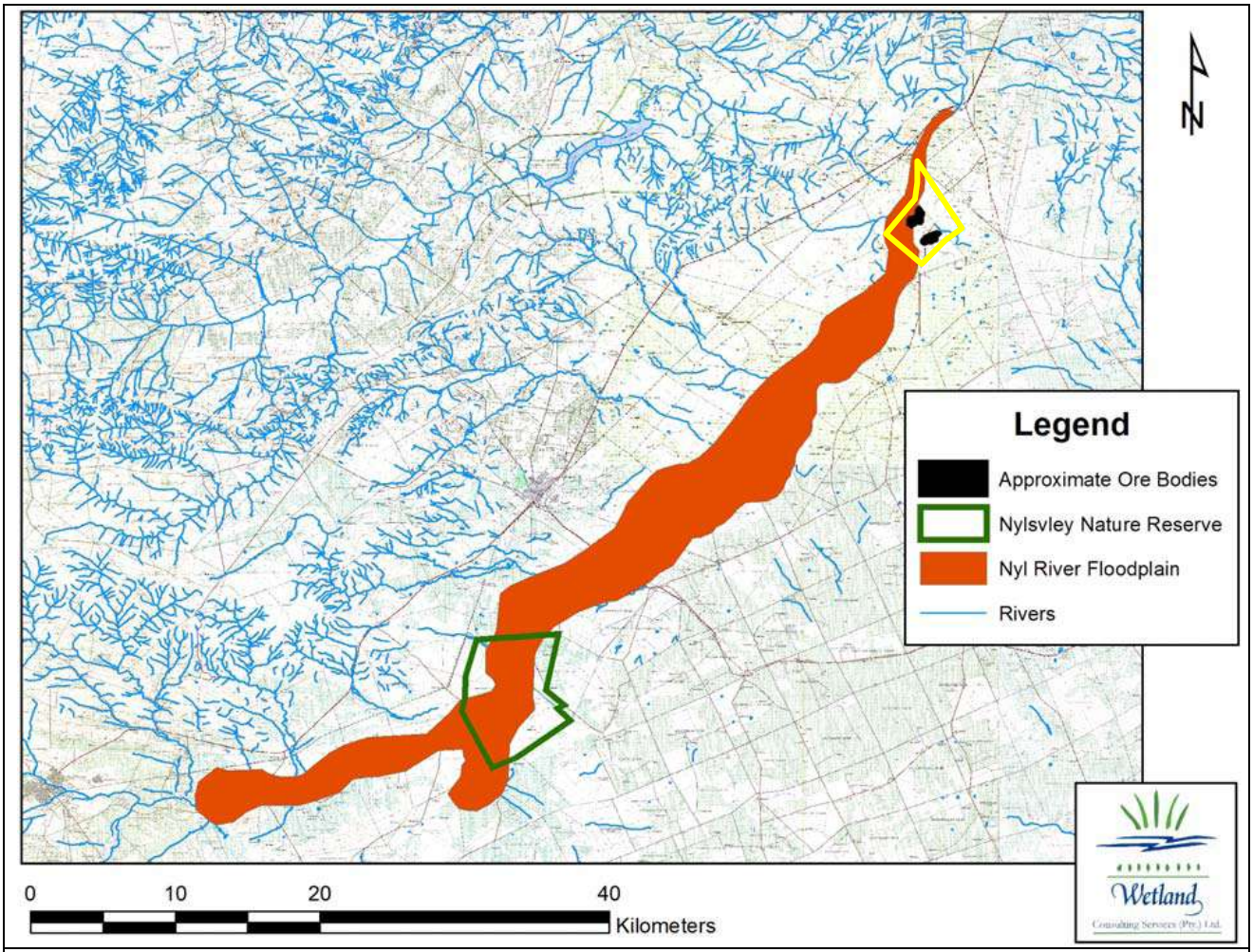


Figure 7-12: Map showing the location and extent of the Nyl River floodplain in relation to the Nylsvley Nature Reserve Ramsar site and the proposed mining area. (Note that the floodplain is mapped here for illustrative purposes only and is not an accurate delineation.) The Yellow outline indicates the farms Volspruit and Zoetveld – Map courtesy of Wetland Consulting Services (2010)

The Nyl River floodplain is located along the Nyl River in the Limpopo Province, roughly between the towns of Modimolle in the south and Mokopane in the north. In its entirety, the floodplain measures approximately 70km in length and stretches from the farm Middelfontein to the farm Moorddrift. The floodplain alone covers approximately 24 250 hectares, while the catchment is roughly 2 300km^2 in size and covers the south-eastern fringe of the Waterberg plateau (WCS, 2010).

7.8.1 WETLANDS ON THE VOLSPRUIT SITE

As the Nyl River traverses the Volspruit farm, detailed wetland delineation was undertaken by Wetland Consulting Services. The delineation was undertaken using aerial imagery (desktop delineation) and ground truthing (field work) of the site.

The following figures show the delineated wetland area (Figure 7-13) and the position of the North and South open cast pits in relation to the wetland (Figure 7-14).

Figure 7-13: Wetlands on the proposed Volspruit mining site. Delineated wetland indicated by the white area (WCS delineation, 2011). Farm boundary of Volspruit and Zoetveld indicated by red line.

Figure 7-14: Position of North (yellow) and South (green) open cast pits in relation to the delineated wetland areas onsite. (WCS wetland delineation, 2011)

It can be seen from the image above that the proposed North Pit lies outside of the wetland area. Currently, and with satellite imagery measurements, the North Pit edge is approximately 19.5 metres from the wetland edge at its nearest point. However the boundary of the North Pit may be even further away from the wetland once final pit wall angles are determined. The pit wall angles which are proposed at this time are not final and there may be scope for improvement during detail design and once the mine

geotechnical study work has been completed. Steeper sidewalls would reduce the footprint of the pit and result in less waste rock mined. At this time, the size and shape of the pit (and the distance from the pit edge to the wetland) indicates a conservatively engineered option.

7.8.2 FLOOD LINES

As part of the pre-feasibility study that was undertaken in 2010 for Sylvania Platinum and Pan Palladium, the flood lines for the property were modelled by African Environmental Development (AED). A summary of the full flood line report is contained in Appendix 5. The two figures below indicate the extent of the flood lines. In summary, the flood line modelling that was undertaken concluded that it was clear that the overriding feature having an impact on the 100-year flood lines in the study area, is the N1 bridge north of the site.

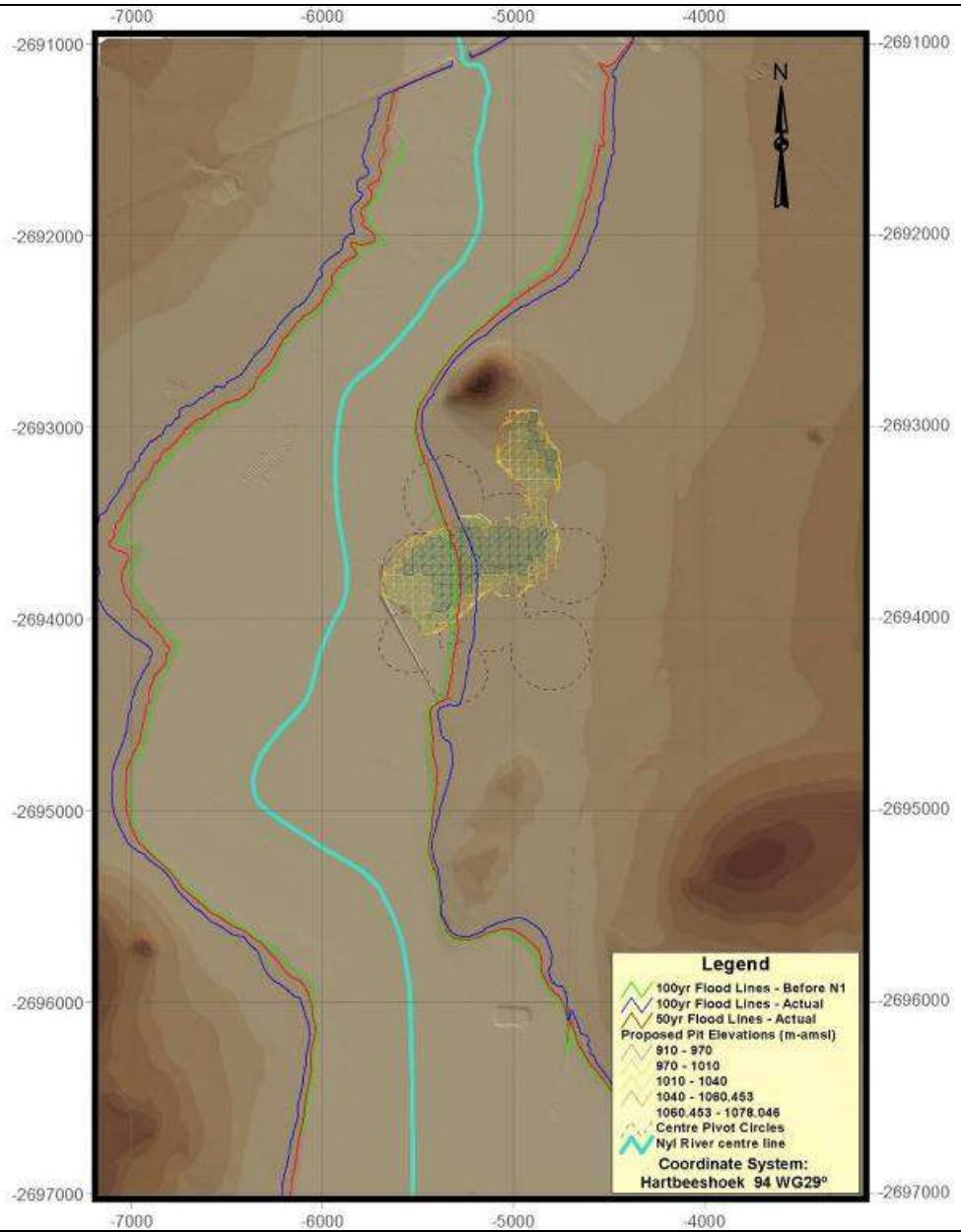


Figure 7-15: The historical 100-year flood lines shown as two green lines on either side of the river are lower than the present-day 50-year flood lines, shown as red lines. The blue lines represent the present 100-year flood lines. (AED, 2010)

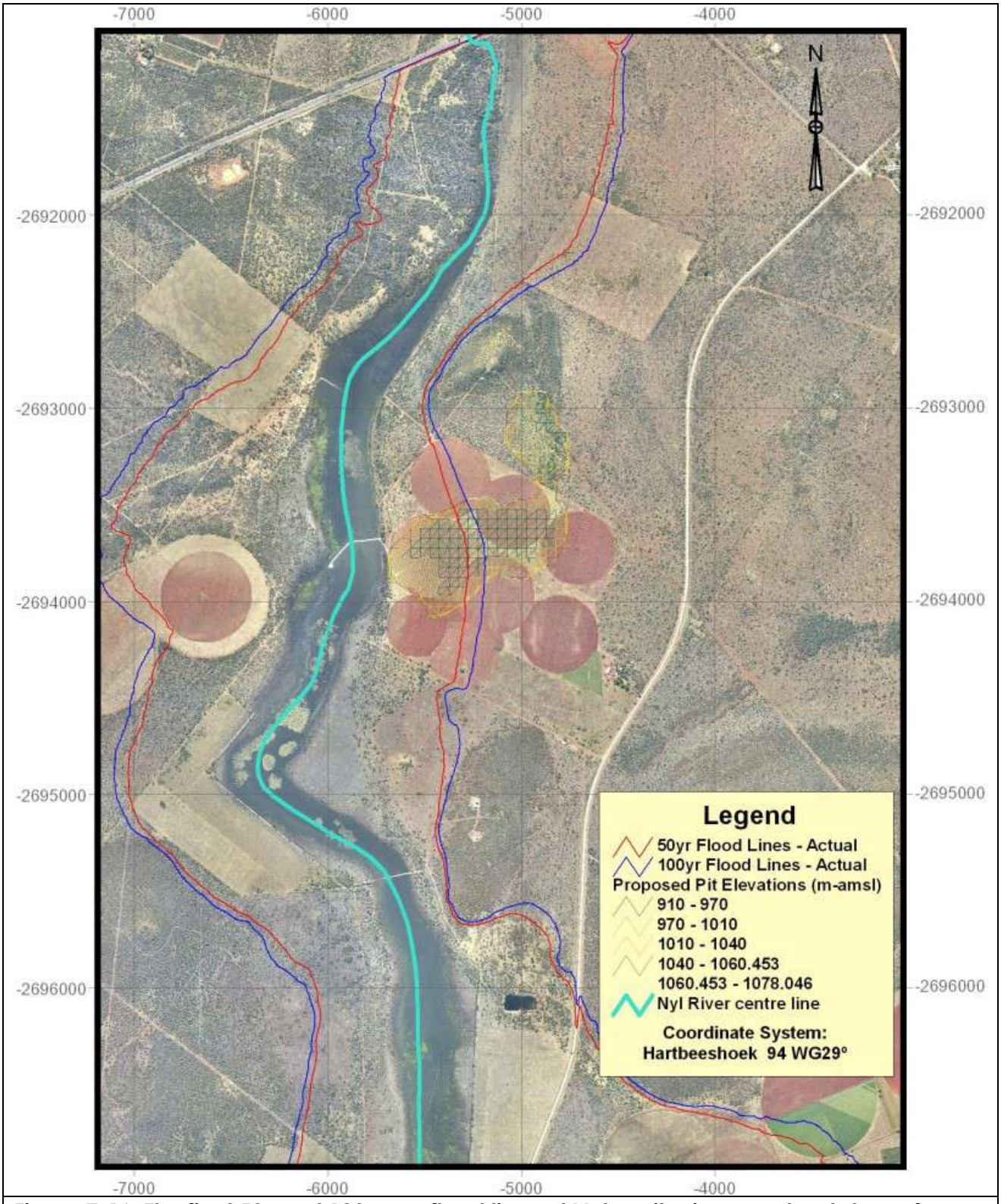


Figure 7-16: The final 50- and 100-year flood lines at Volspruit mine on a backdrop of an orthophoto produced by Southern Mapping Company (Pty) Ltd (AED, 2010)

7.9 REGIONAL GEOHYDROLOGY

The extract below on regional geohydrology has been sourced from the initial hydrogeological report compiled by GeoPollution Technologies (GPT) for the Volspruit mine area. A summarized section of the GPT report is contained in Appendix 5.

The rocks underlying the Volspruit Project comprise cumulates of the Lower Zone of the Rustenburg Layered Suite of the Bushveld complex and floor rocks consisting of the Transvaal Supergroup. Groundwater in these rocks is usually associated with deeply weathered and fractured mafic rocks. The groundwater yield potential in the northern Limb of the Bushveld complex is regarded as low as 81% of the boreholes on record have a yield less than 2 l/s.

In the Northern Limb, the Rustenburg Layered Suite rocks are mainly found in the valleys and flat areas with widespread groundwater resources. Borehole yields of 0.5 – 2 l/s are common, with >5 l/s found in localised areas. Potgietersrus Platinum Mines (PPL) have a permit to abstract up to 1 500 m^3/d from an abandoned chrome mine south of Mokopane in the catchment A61E (in which the Volspruit Project is found).

In general, the Bushveld complex is characterised by low permeability strata, with transmissivity being dependant on the amount of fracturing. As a result abstraction boreholes in the Bushveld setting usually have poor and unsustainable yields. However, it is apparent that a larger extent of faulting and fracturing is found in certain areas of the Northern Limb than in the rest of the Bushveld complex (as is the case at Volspruit). This occurrence is likely to increase borehole yields and sustainability in these areas.

The groundwater quality is generally classified as good, with isolated NO_3 pollution present in the settlements. Mining in the area has the potential to pollute and should be recognised.

Groundwater contributes to surface water base flow throughout the catchment via sub-surface seepage and springs. The Waterberg and Soutpansberg Ranges are important areas for groundwater recharge and drainage base flow. The relationship between groundwater, base flow and river flow is reasonably well understood where hydrographs are available. However, the impact of groundwater abstraction on surface water resources is less well understood. Recharge of the groundwater system from river flow, especially during flood events, is important.

Figure 7-17 overleaf indicates the geological fracturing on the farms Volspruit and Zoetveld. The red lines are inferred positions of fractures (some of which have been confirmed), and the orange line indicates the position of the large Zebediela Fault.

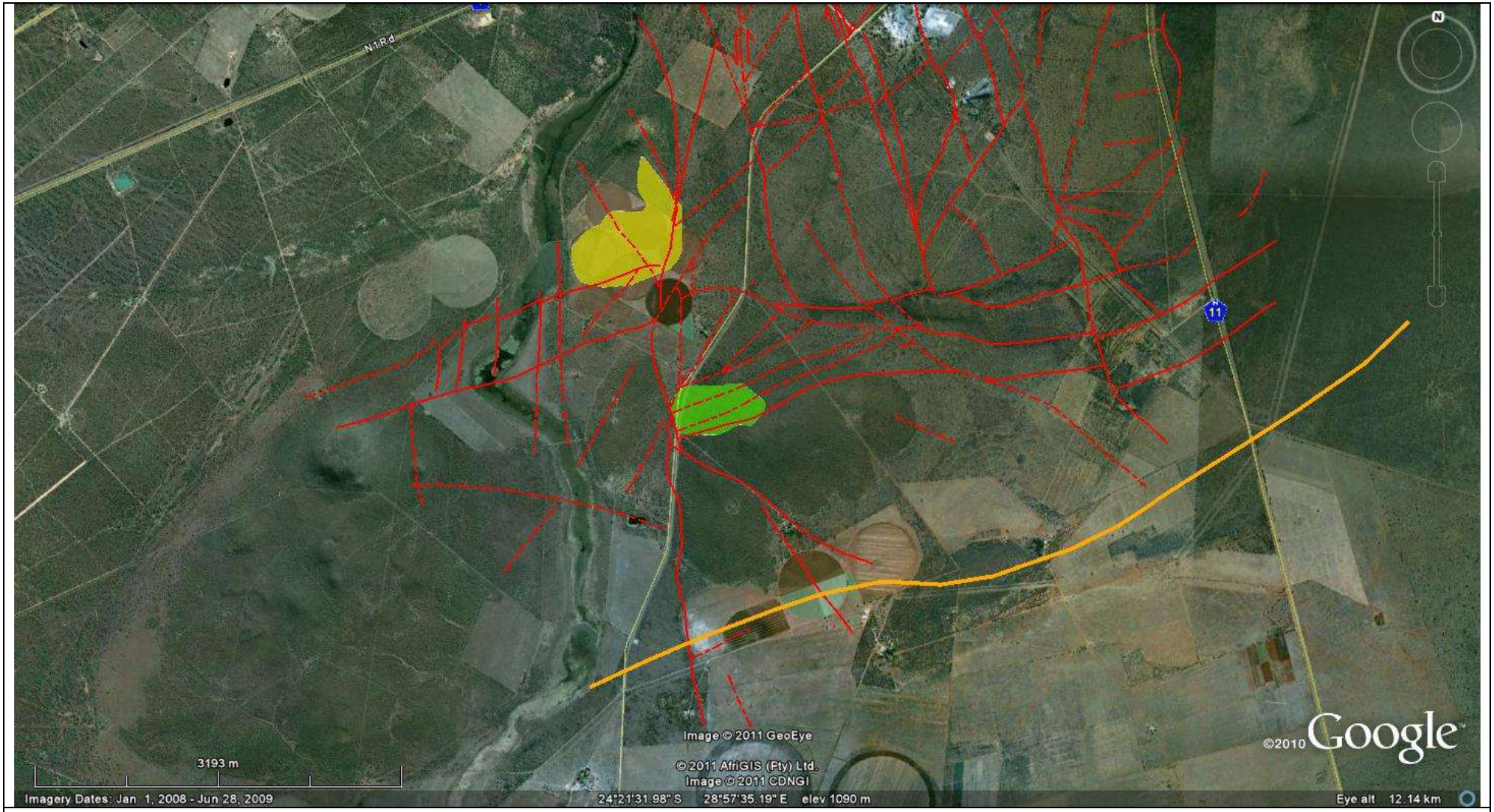


Figure 7-17: Map indicating geological faulting/ fracturing in the Volspruit area. The thicker orange line indicates the Zebediela Fault. The yellow and green areas on the map above indicate the proposed positions of the North and South open cast Pits.

7.10 AIR QUALITY

The farms Volspruit and Zoetveld are predominantly used for crop production in the form of planted and irrigated lands. Much of the farm land is also used for livestock farming and game farming. The only real impact that these current activities could potentially have on the ambient air quality is by the generation of dust from open agricultural lands and movement of vehicles on the farm's gravel roads, and the generation of odour from livestock farming.

The farms Volspruit and Zoetveld also have a public gravel road traversing roughly north-south through the site, and vehicular traffic on this road will certainly have an impact on ambient dust and PM10 (Particulate Matter) levels in the area, especially during dryer times of the year. The construction of an open pit mine and earthmoving associated with the construction will also have a considerable ambient dust impact.

7.11 NOISE

The area is generally characterized by farming and the ambient noise levels are very low. Vehicular traffic on the gravel dirt road will increase ambient noise levels periodically and cause "spikes" in noise levels. The mining operations will contribute to ambient noise levels.

7.12 VISUAL AESTHETICS

The general appearance of the area where Volspruit and Zoetveld lie is dominated by flat agricultural lands, interspersed with small koppies and larger hills. The general "sense of place" of the area is a particular kind of openness.

As the area is dominated by open farmland and bushveld areas, the visual and aesthetic feeling of the area is pleasant.

7.13 ARCHAEOLOGY, HERITAGE AND CULTURE

A short, general, background to archaeology of the general area is given in this section, after which the archaeology and history of the proposed Volspruit mine area is discussed. This section is taken from a report prepared by Mr Anton Pelser of Archaetnos Cultural and Cultural Resource consultants. The full report is contained in Appendix 7.

7.13.1 THE STONE AGE

The Stone Age is the period in human history when lithic (stone) material was mainly used to produce tools (Coertze & Coertze 1996: 293, as referenced by Pelser, 2011). In South Africa the Stone Age can be divided into three periods. It is however important to note that dates are relative and only provide a broad framework for interpretation. The division for the Stone Age according to Korsman and Meyer (1999: 93-94, as referenced by Pelser, 2011) is as follows:

- Early Stone Age (ESA) 2 million – 150 000 years ago
- Middle Stone Age (MSA) 150 000 – 30 000 years ago
- Late Stone Age (LSA) 40 000 years ago – 1850 - AD

A number of Stone Age sites (dating right from the Early to the Later Stone Age) are known in the larger geographical area, such as the famous Makapansgat and Cave of Hearths (Berg 1999: 4; 93-95), as referenced by Pelser, 2011. During a 2002 archaeological/heritage survey of the eastern portion of the farm by Matakoma Consultants, the purpose of the study being unknown, a number of Stone Age sites and finds were recorded (Pelser, 2011).

7.13.2 THE IRON AGE

The Iron Age is the name given to the period of human history when metal was mainly used to produce artefacts (Coertze & Coertze 1996: 346), as referenced by Pelser, 2011. In South Africa it can be divided in two separate phases according to Van der Ryst and Meyer (1999: 96-98), as referenced by Pelser, 2011, namely:

- Early Iron Age (EIA) 200 – 1000 AD
- Late Iron Age (LIA) 1000 – 1850 AD

Huffman (2007: xiii), as referenced by Pelser, 2011 however indicates that a Middle Iron Age should be included. His dates, which now seem to be widely accepted in archaeological circles, are:

- Early Iron Age (EIA) 250 – 900 AD
- Middle Iron Age (MIA) 900 – 1300 AD
- Late Iron Age (LIA) 1300 – 1840 AD

No Early Iron Age sites are known in the area (Berg 1999: 6), although a number of Later Iron Age sites are known to exist in the area around Mokopane (Berg 1999: 7). The 2002 study by Matakoma also located some stone walled features on Volspruit that could be related to the LIA (Pelser, 2011)

7.13.3 THE HISTORICAL AGE

The historical age started with the first recorded oral histories in the area. It includes the moving into the area of people that were able to read and write. The first Europeans to move into the area were early travellers, adventurers, hunters and missionaries such as the Schoon expedition of 1836 (Berg 1999: 13), as referenced by Pelser, 2011, who passed close by to where Mokopane is today, followed by the Voortrekkers (Berg 1999: 14), as referenced by Pelser, 2011.

The town of Potgietersrus (Mokopane) was established at the end of 1860, although plans to establish were already presented in 1852 by Hendrik Potgieter (the plan was to name the town Vredenburg). Nothing came of these plans. The next plan was approved by the ZAR "Volksraad" in September 1858 (for Pieterpotgietersrust), although only in December 1860 did serious work on town establishment commence. In 1870 the town was abandoned because of high incidences of death caused by "fever" (malaria), and only in 1890 people moved in again (Berg 1999: 141-142), as referenced by Pelser, 2011.

The earliest map for Volspruit dates to 1893, and is a map of the farm drawn up by a surveyor for one George W. Compton in June 1893 (http://csg.dla.gov.za). A number of recent historical sites and features were recorded during Matakoma's 2002 survey on Volspruit, including a number of graves and graveyards, as well as the remains of homesteads and old farm structures. These will have to be investigated during the HIA.

7.13.4 CONCLUSIONS

The archaeology of the Mokopane area dates right back to the Early Stone Age, with the well-known Makapans Cave one of the sites located in the area. On Volspruit itself a 2002 study by archaeologists identified a number of Stone Age artefacts and sites. The later Iron Age is also represented in the area and on Volspruit, while the historical period on the farm is represented by a number of grave sites, farmsteads and other related structures.

7.14 SOCIO-ECONOMIC ENVIRONMENT

The following section detailing the baseline socio-economic environment in the Mogalakwena Local Municipality (LM) has been sourced from a scoping phase input report compiled by Urban-Econ Development Economists in Pretoria. The full report is contained in Appendix 6.

7.14.1 POPULATION SIZE AND GROWTH

The population of any geographical area is the cornerstone of the development process, as it affects the economic growth through the provision of labour and entrepreneurial skills, and determines the demand for the production output. Examining population dynamics is essential to gaining an accurate perspective of those who are likely to be affected by any prospective development or project.

In 2011, South Africa's population is expected to be above 50 million (Table 7-3). About one out of every ten people in the country is expected to reside in Limpopo and one out of five in Gauteng. The Mogalakwena Local Municipality is expected to house 342 479 people in 2011, or just more than 6% of the Limpopo population.

Table 7-3: Population size (2011) and historical growth rates (1995-2010) Source: Urban Econ's calculations based on Quantec, 2011

Study area	2010	Historical growth rates			
		1995-2000	2000-2005	2005-2010	1995-2010
South Africa	50 430 328	1.7%	1.3%	1.1%	1.4%
Gauteng	11 371 102	3.4%	2.3%	1.8%	2.5%
Limpopo	5 526 585	1.5%	1.0%	1.0%	1.2%
Mogalakwena LM	342 479	1.1%	1.2%	1.5%	1.3%

As indicated in the table above, the Compounded Annual Growth Rate (CAGR) of the primary study area's population between 1995 and 2010 was 1.3%. It was higher than the CAGR of the provincial population during the same period, but lower than that of Gauteng and South Africa. Whilst the population of Limpopo, Gauteng and South Africa experienced a slowdown in their growth rates, the primary study area's population growth rate has been increasing (Table 7-3).

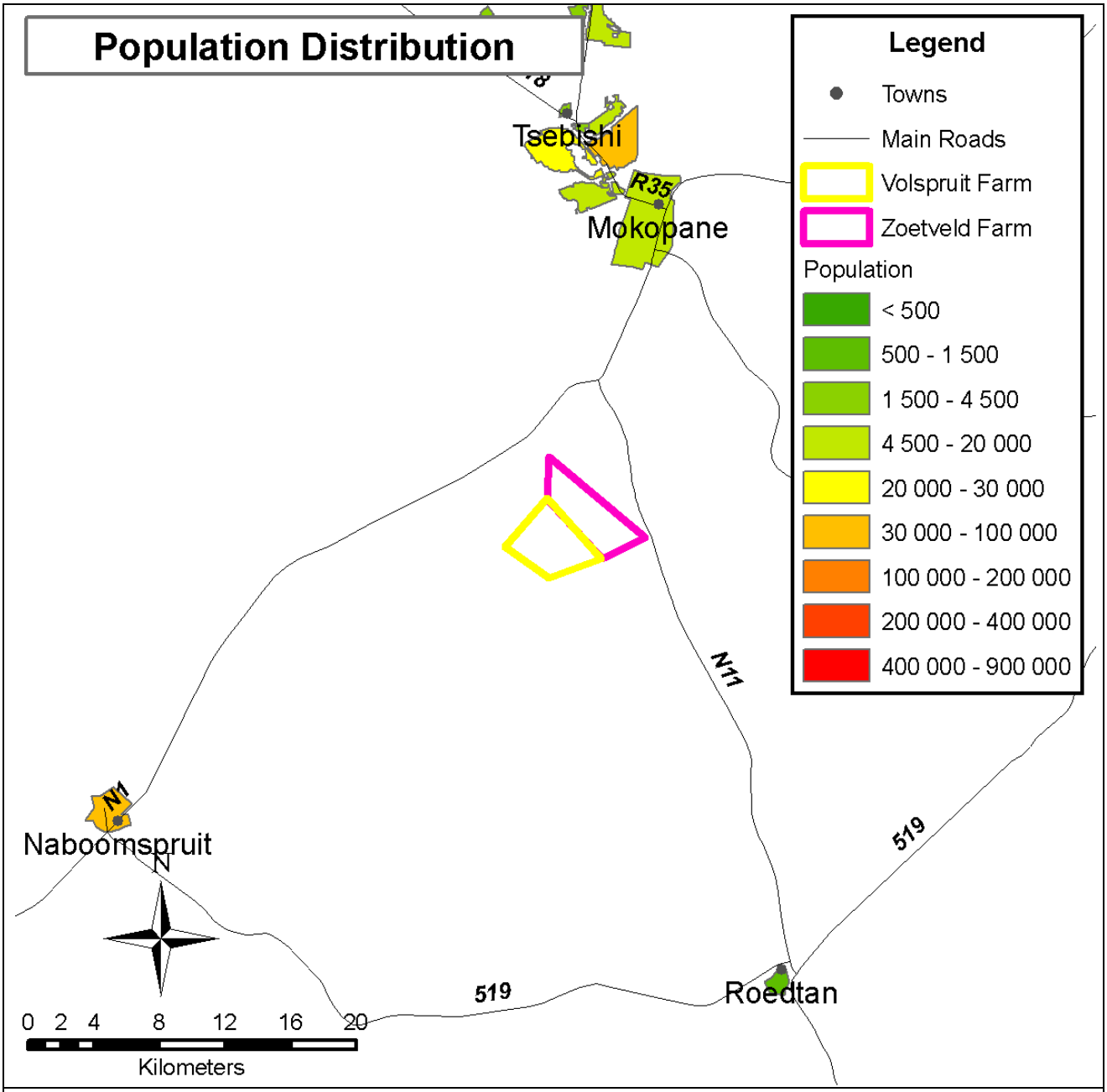


Figure 7-18: Population distribution in the Volspruit mine project area

7.14.2 HOUSEHOLD NUMBERS AND SIZE

Over the years, the rates at which the numbers of households in the secondary and tertiary study areas were increasing have been slowing down, which mirrors the trend observed with respect to population dynamics in these study areas. In the primary study area, the trend though was different – with the population growth rate increasing, the household growth rate was slowing down. When compared with population growth rates, it could be noted that the household growth rate in South Africa was on par with the population growth rate in between 2005 and 2010. In Gauteng, Limpopo and the primary study area, household growth rates were however significantly lower than their population growth rates, which means that the average household size in these areas has been increasing.

The main factors that affect the household growth include, besides the population increase, the change in age structure and incidence rate, or the likelihood of people of a certain age to start a new household. The significant difference between a household

growth rate and a population growth rate, though, is usually attributed to the change in age structure.

7.14.3 INCOME AND EXPENDITURE PATTERNS

Based on the 2007 figures it could be concluded that the household income situation mirrored some of the patterns observed in Limpopo and others observed in the rest of the country. First of all, the percentage of households earning less than R3 200 per month (R38 400 per annum) in the primary study area was slightly less than in the Province, but considerably bigger than in the rest of the country in 2007. Overall, more than half of households earned less than R3 200 per month in Mogalakwena LM in 2007. At the same time the percentage of households without any income at all was considerably lower in the primary study area than in any other study area analysed. From an average household income perspective, an average household in the primary study area earned more or less the same as an average household in the country. This in turn was bigger than in Limpopo but smaller than in Gauteng, which is indicative of their employment profiles.

7.14.4 THE LABOUR MARKET

In 2011, South Africa is expected to have about 32 million people within the working age population. Of these, about 15.4 million are expected to be non-economically active and 17.1 million form part of a labour force. This means that the labour force participation rate in the country will be 52.6% in 2011. The number of employed people in South Africa is expected to be just under12.8 million people, leaving 4.3 million people or 25.3% of the labour force unemployed.

In Gauteng and Limpopo, the employed population in 2011 is expected to be about 3.8 million and just under 900 000 respectively. The unemployment rate is expected to be lower in Gauteng than in Limpopo. At the same time, though the labour force participation rate in Gauteng will be two times higher than that in Limpopo. In Limpopo 37.8% of working age population is expected to comprise of the labour force. This means that only about one out of three people in the working age group in the Limpopo Province participates in the economic activities. A considerable portion of those who are non-economically active are discouraged job seekers, i.e. people who would otherwise look for employment opportunities but decided to stop doing it because of the perception that they would have very little chance to find employment.

The situation in the primary study area is expected to largely mirror that of the Province where it is located. However, the labour force participation rate in Mogalakwena and its unemployment rate, is expected to be better than that of Limpopo. This means that households in the primary study area have better access to income. Overall, it is expected that the labour force in the primary study area will be equal to 81 886 people in 2011, of which 61 442 will have employment.

7.14.5 ECONOMIC PRODUCTION AND GDP-R

The Interpretation of economic impacts requires a sound understanding of the size of the economy and its dynamics in the past. A number of indicators exist that can describe the economy of a region or an area. The most common variables that are used for the analysis include production and Gross Domestic Product per Region (GDP-R). The former represents the total value of sales of goods and services, or the turnover of all economic agents in a region; whilst the latter, using the output approach, means the sum of value added created by all residents within a certain period of time, which is usually a year. The

trend at which the GDP-R has been changing in the past is also referred to as economic growth indicator. It is a measure of both the performance of an area and the well-being of the citizens of an area. Faster economic growth than population growth is taken as an indicator of a healthy economy and an improvement in citizens' well-being

Business sales in South Africa are expected to amount to R5 479 billion in 2011, which equates to R2 475 billion of value added. Limpopo accounted for 7.0% of the national GDP-R in 2010, whilst the primary study area contributed 6.1% to the provincial economy

7.14.6 EMPLOYMENT STRUCTURE

The structure of the Mogalakwena LM's economy is different from that of South Africa, but is quite similar to that of Limpopo. It is clear that it is more dependent on the mining sector than any of the other economies. Because of it, its tertiary sector is smaller than the tertiary sector in Limpopo. Following the biggest sector in the municipality – mining – are the community services sector, finance sector and trade.

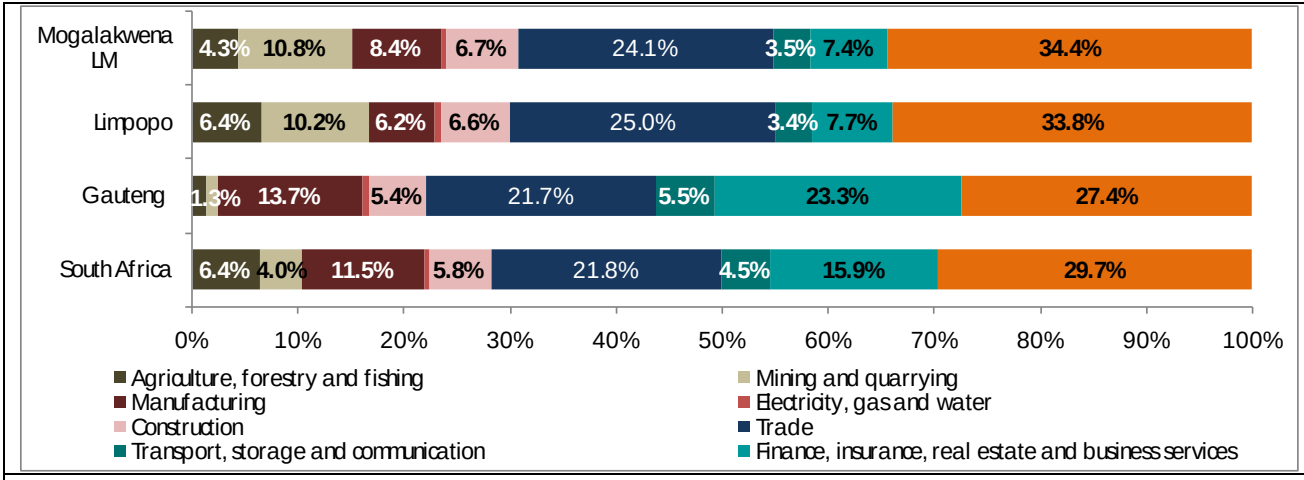


Figure 7-19: Employment structure (2011)

The employment structure presented largely corresponds with the structure of the economy with the tertiary sector making the largest contribution towards employment creation in all areas under analysis.

- More than two-thirds of people employed in South Africa work in the tertiary sector, in particular the community and government services sector and the trade sector. Agriculture, which accounted for 3% of the national GDP-R in 2010, on the other hand, provided 6.4% of all employment opportunities; whilst the contribution of the mining industry towards the employment in the country was smaller than its contribution towards GDP-R. Nevertheless, both the sectors are labour-intensive and create a notable number of employment opportunities in the country, particularly in rural areas.
- Employment structure in Gauteng is also dominated by the number of people who are working in the tertiary sector, specifically in the finance sector, trade and community and government services. Its secondary sector creates 19.7% of jobs in the Province, whilst its primary sector creates 2.3% of all employment opportunities.
- Most of the people employed in Limpopo are working in the tertiary sector, specifically in the finance sector, trade and community and government services.

Its secondary sector creates 15.2% of jobs in the Province, whilst its primary sector creates 16.6%.

- The employment composition in the Mogalakwena Local Municipality is quite similar to that of Limpopo with the sectors providing the largest numbers of jobs being the trade, community and government services, and mining sectors. The mining sector, which contributes 35% to the GDP-R (in nominal prices), provides only 10.8% of employment opportunities in the area. At the same time, the trade sector's employment contribution is greater than its contribution towards GDP-R.

7.15 KEY SENSITIVITIES AND VULNERABILITIES OF THE SITE AND RECEIVING ENVIRONMENT

Having thoroughly detailed the receiving environment of the Volspruit site in this chapter, there are a number of key sensitivities and site vulnerabilities that have been highlighted in the project area. These key sensitive areas include:

1. Wetland on site
2. Presence of Ramsar Wetland site upstream of proposed Volspruit mine
3. Groundwater resources
4. Surface water
5. Biodiversity

These key sensitivities or vulnerabilities of the site show that the area has many complex interactions that need to be taken into consideration during the EIA phase, not only individually, but cumulatively as well.

8. ENVIRONMENTAL ASPECTS AND IMPACTS

This section provides an overview and initial assessment of the main environmental aspects and their associated impacts related to the proposed project, as well as some mitigation measures to minimise negative end enhance positive impacts.

Activities which constitute construction and site establishment activities include (but are not limited to) the following activities:

1. Top soil stripping and stockpiling at pit, tailings dam, above ground infrastructure, internal road and waste disposal site locations.
2. Removal and/or relocation of large protected trees
3. Placement and construction of the proposed flood barrier wall/berm (refer to section 9.1.9 of this report)
4. Actual construction activities associated with the building of administration and office blocks, smelter complex, CVMR plant and processing plant
5. Construction of the road diversion around the South Pit

8.1 CONSTRUCTION PHASE

8.1.1 DUST AND OTHER EMISSIONS

During construction, ground- and civil works, excavations, heavy vehicle movement over bare soil surfaces would lead to the generation of dust. Although the impact is likely to be limited to the site, dust suppression techniques such as wetting roads would be required. Other emissions, e.g. construction vehicle and machinery exhausts are not expected to be significant.

8.1.2 NOISE

Construction activities (i.e. heavy vehicle movement, blasting), and installation and assembly of equipment would lead to temporary increases in localised noise levels. It is however not expected that noise from the construction of the proposed mine will pose a significant nuisance. Workers on-site must wear ear protection as per health and safety requirements as per the OHSA.

8.1.3 CONSTRUCTION AND INSTALLATION WASTE

It is expected that some waste will be generated during the construction of the proposed structures and installation of equipment. The waste would comprise of building rubble, packaging and fabrication waste etc. Steel and electric cabling waste and packaging waste are also expected from installation. It is likely that most, if not all, of the waste would be non-hazardous, except oil and diesel used in construction machinery, which will need to be stored in accordance with legislated requirements.

8.1.4 SURFACE- AND GROUNDWATER

During construction, temporary stockpiles of building material, excavated sand and rock, waste etc. will be produced. It is important that these stockpiles are located in a centralised area where temporary measures such as berms will prevent sediment run-off, specifically during heavy rain episodes. This would be particularly important until the site's storm water management system has been completed. These waste materials are, however, not expected to be hazardous, and will not have the potential to affect groundwater. The potential for hydrocarbon leaks and spillages associated with construction vehicles and processing plant construction, as well as any inappropriate

storage of fuel, oils and other potentially hazardous substances would potentially have an impact on water resources.

8.1.5 IMPACT ON BIODIVERSITY AND WETLANDS

Biodiversity (specifically fauna and flora) will be disturbed during construction activities, as workers and vehicles will move on and off site at very regular intervals. This impact is expected to primarily occur in the area west of the North Pit, on the wetland edge, during construction of the proposed flood berm. It is however envisaged that the actual delineated wetland area is proposed to not be directly impacted upon, as all infrastructure will be located some distance from the wetland. The flood berm will be the closest structure to the wetland. Other areas that would potentially be affected are pit areas, tailings dam site and internal roads. Any protected trees that may need to be moved will be done before any construction commences, and permits will be obtained for this removal/relocation. Fauna will most likely move away from areas of human activity to other sections of the farms.

8.1.6 SOCIO-ECONOMIC IMPACTS

During construction, it is predicted that the local economy will be positively impacted upon, as there is potential for skills development and job creation. Both formal and informal jobs are predicted to be created, bringing more money into the local communities around Mokopane, and into Mokopane itself. Although there are many positive economic spin-offs, it is acknowledged that there are potential negative impacts including increase in crime and influx of job seekers. The impact on current on-site activities (i.e. crop agriculture) would also be impacted on negatively. Quantification of this will be undertaken in the EIA phase.

8.2 OPERATIONAL PHASE

8.2.1 SURFACE AND GROUNDWATER

The proposed development of this open cast mine right next to the Nyl River would potentially have negative impacts on both the ground and surface water regimes in the area, as it is predicted, from the geohydrological modelling that has already taken place, that large amounts of water will need to be pumped (dewatered) in order for the mine to be viable. The predicted interconnectedness of the ground and surface water in the area will be a crucial aspect that will be dealt with at length in this EIA.

Potential impacts on ground and surface water can to a large extent be avoided through proper water management. The pollution generating potential of the mine's ore and associated tailings is to be comprehensively investigated in the EIA phase of the project, and how this would or could potentially impact on ground or surface water quality and quantity. The 'pollution generating potential' refers to the nature of chemical pollutants present and how available these contaminants are to leach into the groundwater pathway. There is also potential for surface water drainage patterns to be disrupted by the mining activities, through the placement of surface infrastructure and development of internal road networks.

8.2.2 IMPACT ON BIODIVERSITY AND WETLANDS

During the operational phase, there will be certain impacts on biodiversity, especially with fauna and flora. These impacts are expected to be disturbance of fauna and destruction of flora. However, management measures will be put in place and properly assessed

during the EIA phase to limit any further unnecessary degradation or removal of flora and disruption to fauna around the open cast pit and stockpile areas.

8.2.3 AIR QUALITY (DUST, SMELTER COMPLEX EMISSIONS AND OTHER EMISSIONS)

During operation heavy vehicle movement would lead to the generation of dust. Although the impact is likely to be localised to the site, dust suppression techniques such as wetting roads would be required. Other emissions, e.g. vehicle and machinery exhausts are not expected to be significant. Emissions from the smelter complex will be properly quantified during the Air Quality Impact Assessment, and mitigation measures formulated.

8.2.4 WASTE

During the operations phase of the mine, there will be various waste streams that will be produced, from waste rock, to tailings to used diesel and oils. The management of all of these waste streams will be dealt with at length in the EIA as well as in the IWWMP. The tailings storage facility has the potential to impact on groundwater quality and, by virtue of the relative proximity to the Nyl River, could also degrade the quality in surface water resources. This will be assessed in detail in the EIA.

8.2.5 NOISE

It is not certain what the impact of noise generated by the operation of the open cast mine and plant would be on the surrounding areas. The site operations, including crushing and screening plant, processing plant and other associated vehicular traffic would be the chief sources of noise. The impact of this will be assessed in a Noise and Vibration impact assessment.

8.2.1 SOCIO-ECONOMIC IMPACTS

During the operation of the mine, it is predicted that the local economy will be positively impacted upon, as there is potential for skills development and job creation. Both formal and informal jobs are predicted to be created, bringing more money into the local communities around Mokopane, and into Mokopane itself. Although there are many positive economic spin-offs, it is acknowledged that there are potential negative impacts including increase in crime and influx of job seekers. The impact on current on-site activities (I.e. crop agriculture) would also be impacted on negatively. Quantification of this will be undertaken in the EIA phase.

8.2.2 VISUAL IMPACT

It is certain that there will be a change in visual character of the area, as two open cast pits are proposed, as well as waste rock dumps, above ground surface infrastructure and tailings storage facilities. This impact will be further quantified and assessed during the EIA phase, through a specialist Visual Impact Assessment.

Table 8-1: Environmental Impact Assessment Priority					
Environmental and/or cultural effects		***Location/Extent***	***Timing/ Duration***	***Expected Impact (+/-) & Importance***	
Topography	Definite change in topography due to new open cast pits.	Open cast pit areas	Permanent	–	Moderate
Soils	Topsoil stripping and management. Possible relocation of soils on the site that have high agricultural potential to other parts of the farm for continuation of farming activities.	Site and potentially local	Pre-development, permanent	-	Moderate
Land use	Agriculture to industrial/mining. Loss of potential agricultural soils	Site	Permanent	-	Low
Vegetation and wetland biodiversity	Removal of indigenous vegetation in 'green-fields' areas to make way for the proposed Volspruit mine complex. Impact on wetland area	Site	Permanent/ life of mine	-	High: To be determined by an appropriate specialist in EIA phase.
Animal life	Displacement of fauna species due to the near compete removal of natural vegetation and disturbance by activities through edge effects.	Site & edge effects	Permanent/ life of mine	-	Moderate: To be determined by specialist in EIA phase of project.
Ground and surface water	Impact on ground and surface water reserves due to extensive dewatering. Impact on ground and surface water through potential nitrate (from blasting explosives) contamination, as well as via waste rock dumps, disposal sites and/or tailing storage facilities.	Regional	Life of mine	–	High: The connection between the two resources will be addressed in depth in the EIA phase
Air quality	Change in air quality in the general area, from emissions such as dust sources and the various noxious emissions resultant from the smelter complex.	Site and local	Life of mine	-	Medium: To be addressed and quantified during the EIA phase
Waste	Increase in hazardous waste and disposal options for the waste.	Local/ regional	Life of mine	–	Medium: To be addressed and quantified in EIA phase
Aesthetics	Visual impact due to new mine infrastructure.	Regional	Life of mine	–	Moderate
Noise	Increase in noise levels in the near and far field areas around the mine.	Site and local	Life of Mine	–	Low

Table 8-1: Environmental Impact Assessment Priority					
Traffic	Increase in traffic in the general area around the mine.	Local/Regional	Construction & life of mine	–	Moderate, relative to current levels
Socio-economic	Job creation, skills development and economic development.	Regional	Life of mine	+	Moderate
	Labour influx – pressure on infrastructure and social fabric. Pressure in existing infrastructure.	Local	Life of mine	–	Low
Archaeology, Heritage & Culture	Disturbance to potential cultural and or historical features on site.	Industrial site	Potentially permanent	- and +	Moderate
Energy & Raw materials	Additional pressure on raw materials and resources such as water and electricity. The availability and access to water for farming and mining purposes is of particular concern.	Local/Regional	Life of mine	–	High. Most specific factor being that of water availability and electricity availability.

9. PLAN OF STUDY FOR EIA

This plan of study has been formulated to meet the requirements for a Plan of Study for Environmental Impact Assessment (PoSEIA) as set out in regulation 28(n)(i-iv) of GN R.543, promulgated in terms of chapter 5 of the National Environmental Management Act (Act No. 107 of 1998), which states:

"28(1) A scoping report must contain all the information that is necessary for a proper understanding of the nature of issues identified during scoping, and must include:
28(n)(i-iv) a plan of study for environmental impact assessment which sets out the proposed approach to the environmental impact assessment of the application, which must include
(i) a description of the tasks that will be undertaken as part of the environmental impact assessment process, including any specialist reports or specialised processes, and the manner in which such tasks will be undertaken;
(ii) an indication of the stages at which the competent authority will be consulted;
(iii) a description of the proposed method of assessing the environmental issues and alternatives, including the option of not proceeding with the activity; and
(iv) particulars of the public participation process that will be conducted during the environmental impact assessment process;"

9.1 SPECIALIST STUDIES AND REPORTING

The identification and initial assessment of environmental aspects revealed the following potentially significant environmental aspects which require further detailed assessment, to be conducted during the EIA phase:

- Soils assessment (including land capability and land use
- Geotechnical assessment of the proposed surface infrastructure area
- Biodiversity study and impact assessment
- Geohydrology assessment
- Hydrology assessment
- Tailing storage facility site placement and design
- Air Quality Impact Assessment – focussing primarily on smelter complex emissions, and well as considering vehicle and dust emissions
- Archaeology and heritage impact assessment
- Waste management plan/waste disposal plan
- Noise and vibration impact assessment
- Visual impact assessment
- Socio-economic impact assessment
- Closure cost and rehabilitation plan
- Cumulative impact assessment study

9.1.1 LIST OF SPECIALISTS AND SPECIALIST STUDIES PROPOSED TO BE UNDERTAKEN

A brief list of specialists and specialist studies which are proposed to be undertaken are shown in **Table 9-1**below:

Table 9-1: List of Specialists and Specialist Studies

Specialist study		Specialists
1	Environmental legal review	Hanre Crous (ESA)

2	Surface water impact assessment	Garfield Krige (Africa Environment Development)
3	Waste impact/management assessment	Hanre Crous, Bradley Thorpe (ESA)
4	Geotechnical assessment of surface infrastructure areas	Gawie Steyn and Dawid Mouton (Knight Hall Henry)
5	Soils and land capability/land use	Prof. Andries Claassens (UP professor of Soil Science)
6	Noise impact assessment	Barend van der Merwe (dBAcoustics)
7	Biodiversity and wetland assessments	Wetland Consulting Services (Various consultants)
8	Hydrogeology studies	Geo-Pollution Technologies (Various consultants)
9	Archaeology and heritage impact assessment	Mr Anton Pelser (Archaetnos Consultants)
10	Tailings design and site assessment for waste disposal	Johan Boshoff (SRK consulting engineers)
11	Socio-economic impact assessment	Marika Cook and Elena Broughton (Urban-Econ development economists)
12	Air quality impact assessment	Warren Carter, Theo Fischer, Abdul Ebrahim (ESA)
13	Closure cost estimate	Abdul Ebrahim (ESA)
14	Visual impact assessment/GIS/3-D visualizations	Emmanuel Tshuma (ESA) and Kotie Geldenhuys (Propaganda Studios)
15	Cumulative impact assessment	Theo Fischer, Abdul Ebrahim, Brian Gardner (ESA)
16	EMPR, ancillary licensing	Bradley Thorpe, Brian Gardner (ESA)
17	Environmental reporting, public participation, project management	Brian Gardner, Bradley Thorpe, Theo Fischer (ESA)
18	Integrated water and waste management plan	Bradley Thorpe, Brian Gardner, Hanre Crous (ESA)
19	Bird impact assessment	Albert Froneman Consulting (Ornithological Consultant)
20	Grouting feasibility study	Prof. A van Schalkwyk. (AVS Engineering Geology and Geotechnical Consultant)

9.1.2 SOILS ASSESSMENT, LAND CAPABILITY AND LAND USE

A detailed soils assessment will be undertaken by Professor Andries Claassens, a Professor of Soil Science at the University of Pretoria. The scope the assessment is proposed to cover the following:

- A reconnaissance survey will be undertaken to evaluate and record agricultural activities on the farms and on the surrounding farms, as well as the potential in the area of the proposed development.
- A full soil survey will be done over an area of approximately 350 hectares. The areas that will be focussed on for these soil surveys are the preliminary areas identified for surface infrastructure (i.e. tailings facilities, processing plant). This survey will aim to describe and identify soil, classify the soil, observe soil potential, demarcate potential vlei land borders (wetland areas) as well as identifying the main soil types of the area. The soil survey will involve the digging of both profile pits (for detailed soil description), making use of a mechanical back-actor, as well as hand auguring areas in a 100 X 100 m grid, where accessible.
- Each soil profile pit will be analysed and discussed in detail. It is predicted that approximately 10 test pits will be dug at random locations within the 350ha area.
- A detailed soil analysis of soil samples will also be undertaken, and it is estimated that 24 soil samples will be taken for analysis.

A detailed report will be complied, discussing and evaluating the impact of the development on the agricultural activities during the different phases of the mine. The report will include a soil map, soil potential/land capability and sensitivity map for the area.

9.1.3 GEOTECHNICAL ASSESSMENT OF PROPOSED SURFACE INFRASTRUCTURE AREAS

The geotechnical assessment of areas proposed for surface infrastructure, more specifically for areas earmarked for tailings storage facilities and processing plant, will be undertaken by Knight Hall Henry (Knight Piesold) Consulting in Pretoria. It is proposed that the geotechnical investigation will be conducted in two distinct phases

The geotechnical work will comprise two phases for assisting with the positioning of the infrastructure, namely:

1. A resistivity geophysical survey of the area that could identify shallow or competent rock or deeply weathered soil basins.
2. A second phase will comprise test pitting across the identified area(s) to verify the geophysical results as well as to investigate and test the appropriate soils for their geotechnical properties.

Existing drilled boreholes relevant to the areas will also be used to verify thickness of overburden and rock competency, but no site-specific drilling will be required for the work during this proposed investigation phase.

Once the layouts of the surface infrastructure are fixed, a design level geotechnical investigation should follow. This investigation will entail the drilling of shallow (10m to 15m) geotechnical boreholes on the specified structures of the plant to determine the rock competency as per fixed structure. This design level geotechnical investigation has not been included in this EIA scope, as the information gathered through the geophysics assessment is considered adequate for feasibility study phase design purposes. A detailed geotechnical study will be undertaken at a later stage by either Pan Palladium or the proposed Volspruit Mining Company, once the surface layout has been confirmed.

Further to the above, a detailed description is given as to the proposed work during the two phases which will be undertaken for the study.

<u>Site evaluation and resistivity geophysical survey phase:</u>

The initial stage of this investigation phase is essentially a desk study during which all relevant information sources are located, assessed and analysed with a view to compiling a preliminary engineering geological map of the study area.

Geophysical surveys of proposed infrastructure localities will be undertaken. It is proposed that approximately 2 000m worth of resistivity surveys will be undertaken for the areas proposed for surface infrastructure.

Test pitting phase:

Test pitting with a TLB in a grid pattern in the areas identified for infrastructure development to determine the generalized soil profile and foundation conditions. It is proposed that a total of 100 test pits be dug in various locations, to get a generalised idea of the deep soil characteristics.

Limited laboratory testing on representative soil samples to characterize indicator and compaction properties of the soils on site for foundation assessment and reusability purposes (e.g. embankments) will be undertaken. The following tests have been proposed:

- 40x foundation indicator tests
- 20x compaction tests
- 10x permeability of compacted soils
- 10x shear box tests on compacted soils
- 5x consolidation tests on block samples

9.1.4 BIODIVERSITY ASSESSMENT

At present, biodiversity studies and impact assessments are being conducted by Wetland Consulting Services (WCS) which focus on an area immediately surrounding the two proposed opencast pits. This current study by WCS is being undertaken as part of a pre-feasibility study that was commissioned in 2010. However, as part of the Environmental Impact Assessment (EIA) for this proposed project, the impacts of all aspects of the mining activity, including dumps, stockpiles and supporting infrastructure, will need to be assessed, and therefore the study area is expected to expand considerably from what is currently being undertaken by WCS on the farm Volspruit. The purpose of these additional studies is therefore to extend the baseline biodiversity information to include the additional study area and to assess all impacts of the proposed opencast pits and all associated infrastructure on the various aspects covered in the biodiversity study.

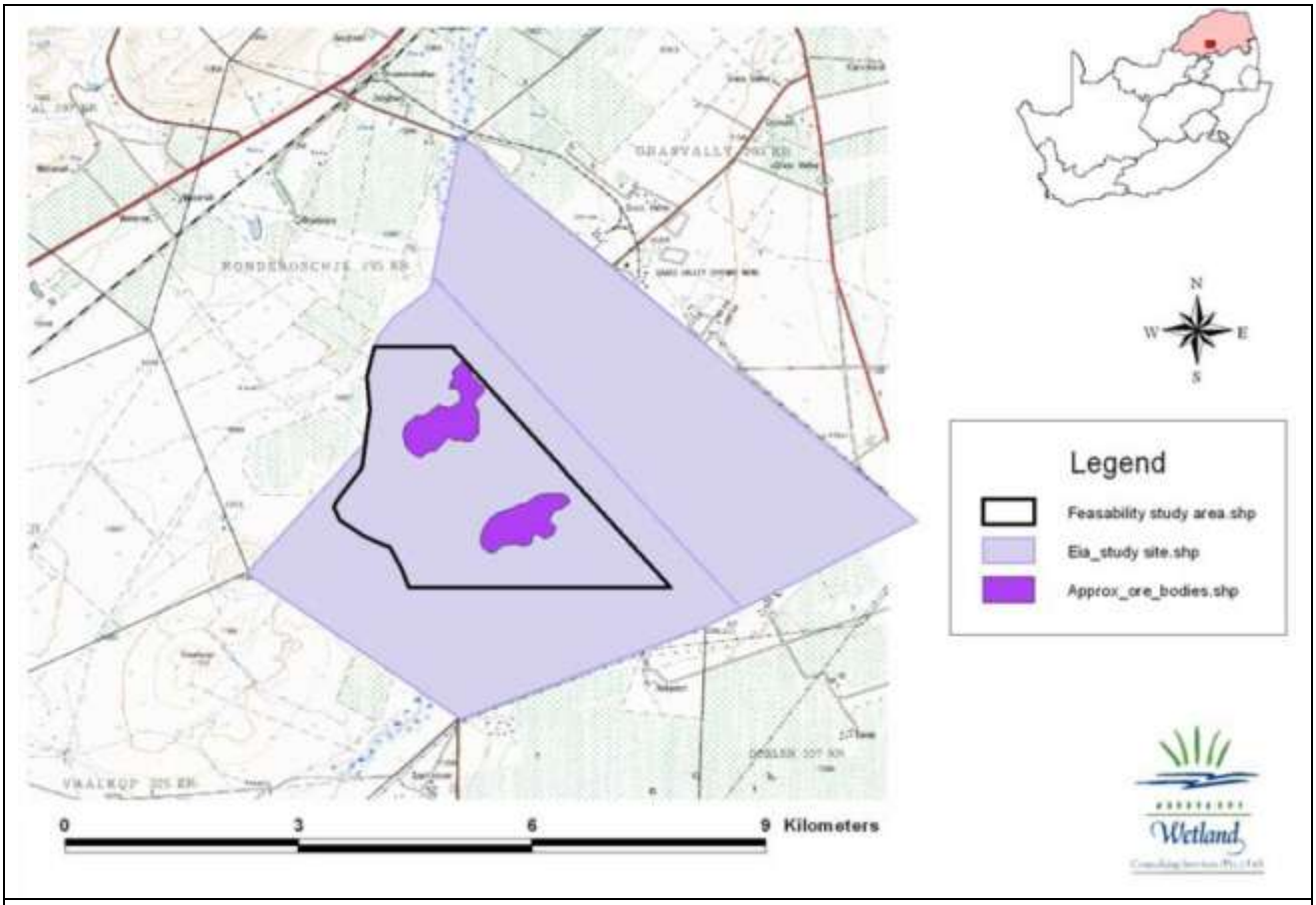


Figure 9-1 Map showing the area covered by the currently on-going biodiversity study (Original Study Area - encompassed in the black line) and the area to be included for this environmental impact assessment (additional area - grey area).

The proposed mine is in close proximity to the Nyl River and a RAMSAR site (The Nylsvley Nature Reserve) is present upstream of the study area. Therefore, it is of utmost importance that this biodiversity study provide a complete picture of the current state of the environment within the area and to this end, will include detailed studies of both aquatic and terrestrial fauna and flora. Surveys of all aspects of biodiversity within the additional area (see Figure 9-1 above) will be undertaken and will provide an assessment of all expected impacts (including recommended mitigation, management and monitoring measures) brought about by the proposed activities.

The following aspects of biodiversity will be covered in the study:

- Wetlands
- Vegetation
- Fauna (focusing on mammals and birds)
- Aquatic ecology (fish and aquatic invertebrates)

Wetland Consulting Services, through previous projects along the Nyl River, as well as through private research undertaken by members of Wetland Consulting Services on the Nyl River floodplain (in the Nylsvley Nature Reserve), has extensive experience of conditions on the Nyl River floodplain and is well positioned to undertake the above-mentioned studies.

Qualified specialists in each of the identified fields will undertake detailed baseline environmental investigations of the proposed mining area. The baseline investigations will

involve both desktop (existing information) and field investigations and will describe the current condition of the site. Where applicable, maps and species lists (red data species and all observed species) will be included in the report.

As the specialists currently conducting assessments in the Original Study Area will also be involved in these additional assessments, it is felt that only a single field survey will be required as the specialists will already have spent time on site during the summer months and will be familiar with the area. Groundtruthing will be limited to the additional area and will involve a single field survey by each of the specialists in the summer season. Further to this, no trapping will be done as part of the faunal surveys – the faunal study will be based on a desktop assessment with limited groundtruthing of the site to assess suitability of habitats and provide limited observations of faunal species occurring on site.

Based on the findings from the baseline studies, impact assessments will be undertaken on all expected impacts. Descriptions of proposed mitigation, management and monitoring measures will be provided (where appropriate and practically feasible) for all impacts during the construction, operation and decommissioning/closure phases of the proposed mining activities.

All the information and recommendations from the various specialist reports will be collated and summarised in one final baseline environmental report which will include both the findings of this study as well as the findings from the on-going study in the Original Study Area. In this way, the final baseline environmental report will constitute a document which covers the entire area to be affected by the proposed mine.

To provide a more complete assessment of the affected environment, surveys should ideally be undertaken across two seasons, with a spring survey (October/November) and a mid-summer (February) survey being highly recommended. With these timeframes in mind, the biodiversity impact assessment was undertaken from June 2009 until March 2011.

9.1.5 GEOHYDROLOGY

A fairly detailed geohydrological study has already been undertaken for Volspruit mine area, but more specifically for the North Pit, and its potential effect on the Nyl River. This study was undertaken by GeoPollution Technologies, who will also be used for this geohydrological study in the EIA phase.

During the EIA phase, a more detailed and updated geohydrology assessment will need to be undertaken to incorporate the South Pit into the modelling and refine various aspect of the study, in order to fit the requirements of impact assessment.

To determine the impact that the proposed mining at Volspruit might have on the receiving environment, a thorough understanding of the hydrogeological parameters of the subsurface (with emphasis on preferred groundwater flow structures such as dykes, faults and fractures) is essential. This knowledge will aid in constructing a realistic groundwater model with which the groundwater cone of depression as a result of dewatering of the mine, as well as the direction and extent of pollution that might emerge from the mine, could be predicted.

In order to generate the required information, and to compile the inputs for the full geohydrological investigation, broadly, the following is proposed to be undertaken for the Environmental Impact assessment:

- Refine hydrocensus around the southern body.
- Determine inflows into the southern ore body. This will be accomplished by undertaking a geophysics survey of the southern ore body in order to determine feasible drilling (borehole) locations. Once boreholes are drilled, full pump tests will be undertaken on each hole.
- Elaborate on the Rock Quality Designation (RQD) of the existing cores that are available for the north and south ore bodies
- Determine permeability (flow characteristics) with depth in both southern and northern ore body.
- Determine aquifer parameters on boreholes used by farmer in the north body.
- Improve confidence limit of modelled pumping rates following updated pit design
- Conduct full impact prediction – groundwater water quality and quantity with the use of:
    - Conducting laboratory testing of wastes and ore (static and kinetic)
    - Undertaking extensive geochemical modelling
- Ground water and surface water interactions (discharge of water from pit into river): This will also be covered by Mr Garfield Krige of AED, who will be undertaking the hydrology study. There will be synergies between these two specialist studies in this area, to determine impact on both surface and groundwater.
- Feasibility study of mine surface infrastructure and alternative locations, considering groundwater characteristics.

Drilling of boreholes at strategic locations and subsequent pump testing to calculate the hydrogeological characteristics of the underlying aquifers is thus an essential part of the groundwater investigation.

In order to generate the required information, and to compile the inputs for the geohydrological investigation, the following methodology is proposed:

- Five boreholes need to be drilled to a depth of ~170m in carefully selected positions which coincide with the geophysical anomalies. The boreholes should also be suitable as monitoring boreholes and/or dewatering points, and it should thus be drilled at a practical diameter for the purpose. Percussion drilling at 210mm with a 165mm screen is desired at minimum.
- Although data on the position of faults are potentially available, it is essential to determine the precise location of the fault at the position of the intended borehole to ensure intersection. This is best done by a ground-based survey, and resistivity has been chosen as the best method due to its favourable depth of penetration and water detection properties.
- All five boreholes will be pump tested to determine the sustainable yield and aquifer parameters of the boreholes. The borehole will be subjected to a 24-hour constant discharge (CD) test and 12-hour recovery. A three hour step discharge test will precede the constant test to determine the optimum pump rate for the CD test.

- In addition, it is proposed that two exploration boreholes (fully penetrating the ore body) should be used for packer tests. The packer tests entail sealing the borehole at selected intervals with "packers" and conduct water infiltration tests on the selected section. This will provide valuable information on the variation of hydraulic conductivity with depth, and assist in calculation of required pumping tests as mining progress.
- Selected geological cores located at the core yard should be logged for RQD, where it is not available. RQD should allow the determination of fracturing with depth, and thus provide even more information to calculate predicted dewatering rates as mining progress to deeper levels.
- In order to determine the aquifer parameters from the boreholes used by the farmer on the north body, aquifer tests will have to be conducted here as well. It is envisaged that four of his boreholes will be subjected to a 24-hour constant discharge (CD) test and 12-hour recovery. A three hour step discharge test will precede the constant test to determine the optimum pump rate for the CD test.
- It will be important to determine the connectivity of the Nyl River with the groundwater. The river could be losing water to, or conversely gain water from the underlying aquifer. Surface water/groundwater interaction will be assessed by measuring and comparing the elevation of water in the river with water levels in three shallow boreholes (max. 20m deep) perpendicular with the river. These boreholes also need to be drilled, and the most cost effective method would be percussion. In this case, diameter is not an important consideration.
- These holes will also be pump tested, though a shorter duration of eight hours with recovery would suffice.

Further to what is outlined above, the geohydrological impact assessment has been expanded to include the following (taking into consideration comments from interested and affected parties, as groundwater has arisen as a major concern for the project):

- The hydrocensus of the entire area will be expanded to include additional boreholes in the surrounding area. This expansion of this hydrocensus will give a better idea of the aquifer characteristics over a larger area, and will provide additional information in order to further validate the model.
- It is proposed that flow meters (flow rate sensors) and water level indicators are installed on selected boreholes on the farm Volspruit. The flow rates will then be analysed, and the "real-time" data obtained can then be inputted into the model, which will evidently mean that the model accuracy increases.
- As a "scenario 2" to the groundwater modelling proposed (which is essentially a homogenous model), it is proposed that GPT then run a "heterogeneous" model, taking the faults into consideration, where each fault/structure is assigned a relatively higher conductivity, dependent on how large the fault is (i.e. conductivities assigned to each fracture will be determined by the size of the fractures). This heterogeneous modelling will give valuable output to determine what the impact of heavy dewatering will have on the fault system surrounding Volspruit. The heterogeneous modelling would assist in more accurately including the major fractures into the overall model.

9.1.6 HYDROLOGY

Surface and storm water management and water balance

A detailed study will be conducted and a report produced on the surface hydrology and water quality pertaining to the Volspruit mine. This study will include, but not necessarily be limited to, the following aspects:

1. Surface water quantities and flow patterns

    1.1. Description of the catchments, surface water flow patterns and water quantities. In this section all aspects pertaining to the catchment will be described. This will include statistics pertaining to the catchment and its rivers/impoundments, surface water flow patterns across and downstream from the proposed mine and average and projected peak flow quantities. The latter will include the 50- and 100-year flood discharge volumes and flood lines. These calculations have already been done as part of the pre-feasibility study and the data are available for inclusion into the hydrological report. Although the flood line modelling has already been done for this river, it will still be required to provide a detailed description of the current flow pattern across the proposed opencast pit as well as modelling of the average and projected peak rainfall volumes that would fall over the catchment of the mine. This aspect is required in designing the emergency pumping capacity required at the mine to protect the mining infrastructure inside the pit during a rainstorm.

    1.2. The mineral resource to be mined by the Volspruit mine locates in very close proximity to the Nyl River, a large river with a catchment of 2 294km² upstream from the proposed mining site. At the same time, the gradient of the river is *extremely* low in the vicinity of the mining site. To complicate the situation further, the bridge where the N1 freeway crosses the Nyl River has had a negative effect on the 50- and 100-year flood lines in that this bridge has artificially increased the elevation of these flood lines. Taking into account the above statistics pertaining to the Nyl River, the potential impact, which this mine will have on the surface flow regime and *vice versa*, will be discussed in detail in the document. The section will also include discussions on river diversions, alterations to the banks of the river and the construction of a flood barrier to protect the mine from floodwaters. In all instances the impact of the construction on the Nyl River must be documented in detail. The report will also include the calculations of the water "*made*", (i.e. rainwater into mining pit and groundwater seepage volumes obtained from the groundwater specialist) at the mine and will discuss and recommended water disposal options if it is identified that there would be surplus water. Once these balances have been done, the effect of the mine on the Nyl River itself and its catchment will be discussed and documented for the entire lifespan of the mine.

2. Surface water users hydrocensus: This section will comprise a census that will identify the downstream water users in Nyl River. Data relating to the uses of water from the river will be collected and reported on. Cut-off points for the census both up- and downstream from the mine will be defined and motivated.

3. Surface water quality

    3.1. Samples will be collected from various sampling points and will be analysed for the following determinants by a SANAS-accredited analytical laboratory: pH, EC, Total Alkalinity, Ca, Mg, K, Na, Mn, Fe, Cl, SO_4^{2-}, NO_3^-, NH_3/NH_4^+ and any other determinants that may be associated with the mining of the particular ore body to be exploited at Volspruit mine. The samples will also be subjected to an ICP-MS scan to determine the concentrations of other metals present in the sample not

covered in the above list. The sample results will be discussed in terms of the SA Water Quality Guidelines series (particularly in terms of domestic use and irrigation) published by DWAF, as well as the SA National Standard, SANS 241:2006 (drinking water standard). A Piper Diagram of the samples will be presented and the results discussed/explained in such a manner that it is clear if determinants, present in elevated concentrations, are from natural or man-made origin. The sample results will be documented for use as a baseline against which future water quality will be evaluated. Four samples will be collected at the following sampling points:

- One sample at or immediately downstream from the Ramsar site in the Nyl River (i.e. upstream from the study area).
- One sample closer to the study area, but still upstream from the site.
- One sample immediately downstream from the study area, i.e. as close as possible to the actual area where mining will occur but slightly downstream from the site.
- One sample to be collected some distance downstream from the mining site, preferably downstream from the N1 bridge.

3.2. At the same time of the surface water sampling exercise, the in-stream biological integrity of the same sampling points (where possible) must be carried out, based on the assessment of macro-invertebrate communities (commonly referred to as *river biomonitoring*) (this is also a requirement for the WULA). If possible, these monitoring points will attempt to coincide with the sampling points discussed above and will also be done at the same time as the above samples are collected. Where possible the protocols listed hereunder must be used to determine a ***Present Ecological State Class*** of the river at each of the sampling sites:

- **SASS 5** (South African Scoring System version 5)
- **IHAS** (Invertebrate Habitat Assessment)
- **IHIA** (Intermediate Habitat Integrity Assessment)
- **MIRAI** (Macro-invertebrate Response Assessment Index)

As with the above item, the results of these monitoring protocols will be discussed and documented for use as a baseline against which future water quality will be evaluated.

4. Water Balance. A water balance will be compiled in the form of a spread sheet or equivalent format, using available data and augmenting missing data through modelling. This water balance will also be projected into the future for the life of the mine. This water balance will take into account water ingress into the mine workings (supplied by groundwater consultant), rain water into the pit and onto areas that could be contaminated, any other water purchased from outside the area and water from any other water source that may be applicable to the mine. The aim of this water balance is to predict the water requirements versus the water usage/loss at the mine over the life of the mine.

5. General and additional items that may be required for the EMP and WULA. This section of the report will discuss any additional items that could be relevant to the EMP or WULA, but that do not fall into any of the categories above.

6. Recommendations and water management considerations:

   6.1. For each item listed above, impacts that the mine may have on the surface water environment will be identified and discussed, through all phases of the life of mine. This particular section will deal with these impacts one by one and wherever possible recommendations must be made to correct/ameliorate/manage these impacts.

   6.2. A sampling programme for all surface water monitoring pertaining to the mine will be compiled, based on the findings of the initial (baseline) sampling exercise.

9.1.7 EXTENT OF INTERCONNECTEDNESS BETWEEN SURFACE AND GROUNDWATER

One of the key factors that will need to be determined during the EIA phase is the potential interconnectedness between the surface water (hydrology of the Nyl River) and the ground water (regional geohydrology). There are a number of ways in which this is proposed to be done:

1. Drill three (3) deep boreholes in an east-west line in the dam wall area. This will help to determine the exact gradient of the groundwater flow. Combine these deeper holes with shallower hand auger holes to determine shallow and deep groundwater gradient.

2. Place piezometers for monitoring along the wetland edge, so as to monitor water level fluctuations. It is proposed that two piezometer transects in an east-west line be set up to monitor these fluctuations.

3. Geochemical analysis – A stable isotope study is proposed to be undertaken, which will give signatures of water inflow and outflow between the ground and surface water, thereby determining if interconnectedness exists.

4. Further to this, it is proposed to do one (1) additional resistivity traverse across the river from east-west just north of the current farm dam on Volspruit. This resistivity survey (geophysics traverse) will help to better understand the Nyl River bottom sub-surface. This resistivity traverse will also be done in conjunction with a few hand auger holes and soil test pits.

9.1.8 GROUTING FEASIBILITY STUDY

It is proposed that a desktop study on the feasibility of sub-surface grouting be undertaken. This is as a result of the proposed Volspruit mine being located in an area that is highly fractured and has a shallow water table. The following is proposed to be undertaken at a desktop level in order to inform the EIA. The study will be undertaken by AVS Engineering Geology and Geotechnical Consultant.

1. Literature study (internet and library of the University of Pretoria) to find local and international examples (case studies) of grouting works conducted for the purpose of groundwater control in mining. This will include a study of various grouts (e.g. cement, PFA, clay, chemical grouts (gels) and various admixtures) with particular

reference to their effectiveness in reducing permeability, their long-term durability and possible environmental impacts.
2. Review of available geological, geohydrological and geotechnical information from the Volspruit area.
3. Collection of information from recent local grouting contracts on drilling methods and drilling costs, typical grout consumption (per m^3 of treated rock) for various rock conditions, and unit cost costs for various grout mixes.
4. Provisional design of grout curtains around (and possibly also grout blankets below) the two proposed open cast pits. This will include spacing and number of holes, grouting methods and grout mixes.
5. Provisional cost estimates for construction of the grout curtains and blankets.

The accuracy of the above assessments will obviously depend on the availability of information from similar previous projects. Additional ground investigations, particularly Lugeon testing, will almost certainly be necessary before a final design can be done.

From Wikipedia, 2011: "*A Lugeon is a unit devised to quantify the water permeability of bedrock and the hydraulic conductivity resulting from fractures. More specifically, the Lugeon test is used to measure the amount of water injected into a segment of the bored hole under a steady pressure; the value (Lugeon value) is defined as the loss of water in litres per minute and per metre borehole at an over-pressure of 1 MPa.*"

9.1.9 FLOOD BARRIER WALL

As part of the pre-feasibility study that was undertaken in 2010 for Sylvania Platinum and Pan Palladium, the flood lines for the property were modelled by African Environmental Development (AED). A summary of the full flood line report is contained in Appendix 5.

As part of study done in 2010 (pre-EIA), the feasibility of a "flood barrier wall" was addressed, in order to determine the impact that such a structure would have on the western bank flood line, if it were to be built to divert floodwaters around the proposed North Pit, which as it stands now, protrudes into the current flood line area. It was further concluded by the modelling that was undertaken in 2010 that the flood elevations produced by the N1 bridge overrides all other features that were addressed in the report. These include the existing farm dam and the proposed flood barrier. The construction of the flood barrier or removal of the farm dam will not have any impact, whatsoever, on the elevation of the flood lines on the western bank of the Nyl River.

From Figure 9-2 below, it can be seen that if a flood barrier berm were to be built, that this berm would run on the western side of the North Pit, between the North Pit and the delineated wetland area. The engineering specifications and actual design of the flood barrier wall has not yet been done, and as such, no design specifications can be tabled. This is a conceptual plan that will be later developed and expanded on.

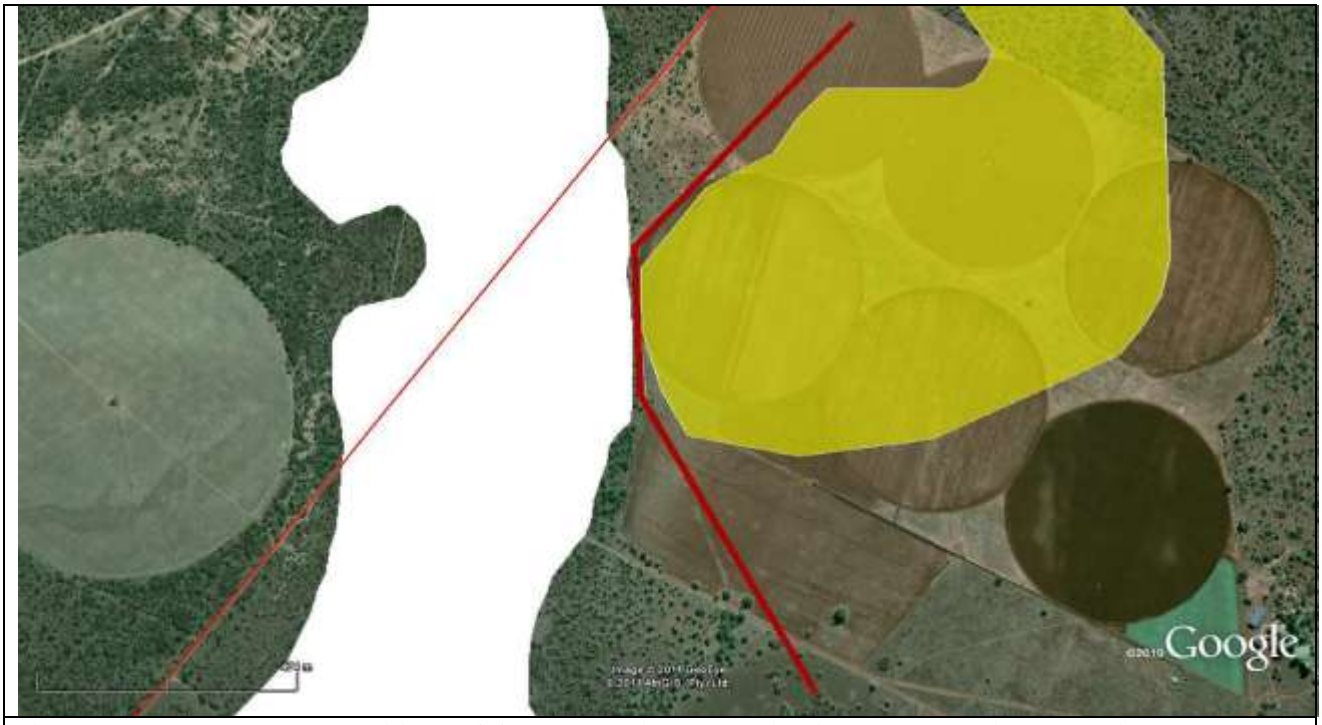


Figure 9-2: Proposed position of flood barrier wall (indicated as thick red line between North Pit (yellow) and wetland (white)).

9.1.10 TAILINGS STORAGE FACILITY SITE PLACEMENT AND DESIGN

A scoping level study will be conducted by SRK consulting engineers in Johannesburg, and a report produced on the site placement and preliminary design for the proposed tailings storage facility. More detailed studies of tailings design and pipe reticulation that may be needed to be undertaken during mine infrastructure design phase are not included in this study.

It is proposed that the study is to encompass the following aspects:

1. Site visit, data collection and initial investigations. This will include undertaking a hydrological and environmental hazards investigation
2. A full geochemical characterization of the tailings material derived from pilot plant test work, if possible, or from tailings derived from a similar ore body milled down to represent typical tailings and slimes from the proposed Volspruit plant. This will be undertaken in order to give an indication of what harmful substances could be released if a weakly acidic solution comes in contact with the waste material. Only static geochemical testing is considered necessary for this scoping level assessment and the results obtained from these tests would be used as indicators of what the properties of the tailings and slimes are likely to be.

The scope of work for the testing of the tailings material will therefore include:

- Tailings and slimes pH/EC sampling and testing based on the representative tailings samples received;
- Acid base accounting to assess the potential for acid mine drainage;
- The South African Acid Rain and TCLP tests to assess the impact on the material of weakly acidic solutions;

- A total head test (using ICP-MS analysis) to assess the potential for leachate
- Interpretation of the results and reporting.

3. Proper site selection: Potential tailings dam and waste rock sites will be identified. SRK propose to define a required footprint size and this footprint size will be used for the site selection study. Each site will be evaluated through the development of a site ranking matrix, as well as in terms of social and environmental requirements, engineering requirements and economic requirements.
4. On completion of the investigation phase, the detailed design of the tailing facility will commence. This phase will include the following:
    a. Impoundment layout: layout of the proposed tailings dam and waste rock dump will be optimised.
    b. Capacity assessment: evaluate the maximum permissible rate of rise and to determine the optimum deposition strategy based on the long term planning.
    c. Conceptual design: based on the optimised layout and will take into consideration the results of the hazard and risk assessment and findings of the capacity assessment.
    d. Hydraulic design: of water reticulation between storage dams and tailings facilities.
    e. High level water balance: for the overall slimes dam complex.

5. As part of this assessment, SRK also proposes to prepare a detailed schedule of quantities and cost estimates to an accuracy of 25%.
6. Reporting: A comprehensive report will be produced which will include a detailed description of the design and a list of assumptions, criteria and constraints which had a material impact on the design developed. Drawings of the general arrangement for each tailings storage facility and waste rock dump will be included.

9.1.11 AIR QUALITY IMPACT ASSESSMENT

The Plan of Study for EIA (PoSEIA) sets out the approach that will be undertaken to assess the impact of the operations (emissions source activities) at the proposed mine on ambient air quality, as well as development of an Air Quality Management Plan (AQMP) which will provide recommendations for implementing practicable mitigation measures, best practices for air quality management and formulation of a monitoring programme in order to minimise impacts to air quality associated with emissions sources from the propose OCMO.

The scoping process has identified all of the potentially significant emissions sources from which particulate matter (PM10) and TSP may be generated. The air quality impact assessment (AQIA) will include the following:

- Compilation of an emissions inventory from all potentially significant emissions sources associated with the proposed activity during the construction and operational phases;
- Prognostic as well a diagnostic meteorological modelling to generate boundary, site specific and gridded three-dimensional data for the area of interest (modelling domain);

- Development of a suitable geophysical data product including gridded terrain heights (DEM) and land use land cover (LULC) data at high resolution (300m), for the dispersion modelling;
- Dispersion scenario modelling to predict ambient concentrations for pollutants of interest (as well as dry deposition flux rates for PM10) during the construction and operational phases;
- The selection and parameterization of a suitable air dispersion model - it is anticipated that the (U.S. EPA approved) CALPUFF dispersion model (version 5.8) will be employed,
- Quantification, dispersion modelling and impact assessment of all potentially significant emissions sources associated with the proposed (emissions source) activities during both the construction and operational phases to inform baseline ambient air quality in the absence of measured data/APPA industrial sources within the AOI.
- Assessment of predicted impacts in relation to sensitive receptors during construction and operational phases as well as assessment of the contribution of individual source emitters (to determine the relative contribution to air quality impacts) and cumulative assessment of all emissions sources likely to be emitting at the same time;
- Evaluate predicted ambient pollutant concentrations and deposition rates for compliance against South African ambient air quality standards in terms of ambient air quality limits as specified in Government Notice No. 263:2009, as well as with reference to South African National Standards (SANS 1929, 2005) guidelines for ambient air quality criteria, where applicable;
- Provide the legislative and regulatory context for the study;
- Identify and contextualise knowledge gaps, assumptions, alternatives and limitations of the study.
- Recommendation of optimal positioning of air quality monitoring stations based on macro and micro scale citing criteria, where necessary;
- Compilation of a comprehensive AQIA report (including AQMP) which will document the impact assessment methodology, data inputs, study assumptions and limitations, and the study findings;
- Recommendations for the proposed development including mitigation measures and control options to manage air quality related impacts from all emissions sources where practicable.

Figure 9-3 illustrates the data requirements and flow of output data and information into the meteorological modelling and air pollution dispersion modelling. Emissivity from each individual and potentially significant source will be quantified and included as an individual emitter in a CALPUFF control file to be modelled. The ambient concentration from each of these sources will be presented in oder to assess its relative contribution to the overall impact. In addition, the predicted impact from all of these sources will be added (calsummed) so as to present a cumulative impact scenario.

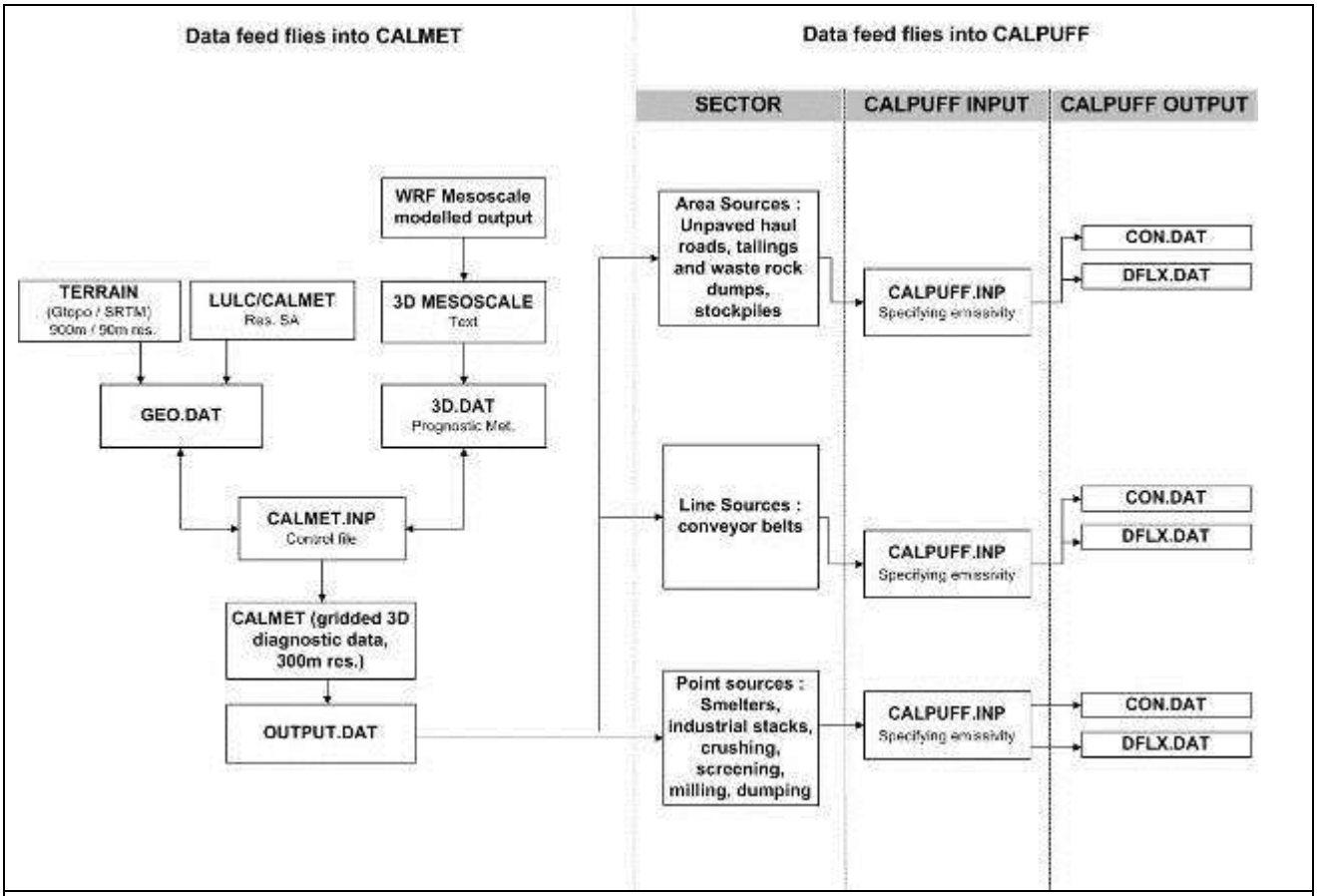


Figure 9-3: Data requirements and flow diagram for the meteorological and dispersion modelling system

9.1.11.1 AIR QUALITY IMPACT ASSESSMENT FOR PROPOSED SMELTER COMPLEX

Prediction of emissions arising from the mine and smelting operations will be achieved through emission inventorisation. Air pollution dispersion modelling of criteria pollutants emitted by the smelter will be undertaken to so as to assess the relative and cumulative impacts on air quality within the domain.

In the absence of readily available emissions data, emission factors will be based on internationally accepted resources such as the US-EPA AP42 and/or Australian NPI emission factor manuals. In addition, calculation of emissions rates for the proposed smelter will be undertaken using engineering specifications, and permissible emission rates as specified in the GN248:2010 emissions standards.

It is envisaged that the emissions inventory and data for the proposed smelter may also potentially be based on data from similar smelter plants currently in operation and according to the design specifications for the smelter in order to determine all potential emissions/ expected emissions rates and characteristics (based on the design parameters and mass flow rates obtained from similar operating plants).

In addition to the initially proposed PoSEIA for AQIA, the identification, construction and operation of the proposed smelter complex will include a specialist assessment of air quality related impacts(which require further detailed assessment), to include:

- Provision of the legislative and regulatory context for the listed activity in terms of its requirements for specialist study in terms of its current listing and adherence to minimum emissions standards in terms of NEMAQA (GN 248 : 2010).

- Detailed description of the smelter process and all pollutants associated with the proposed operation.
- Formulation of an emissions inventory and calculation of emissions to atmosphere emanating from to the proposed smelter operations.
- A specialist study to determine the potential impact of gaseous and particulate emissions, specifically from the proposed smelter at the proposed mining complex in terms of its impacts on ambient air quality and surrounding sensitive receptors.
- Stack height sensitivity analyses to ascertain optimal stack height dimension.
- A cumulative impact assessment scenario whereby the smelters emissions will be modelled and presented along with all other fugitive emissions so as to determine the overall impact from the proposed development.
- The following emissions from the proposed smelter complex have been identified as potentially significant in terms of the possible effect on ambient air quality and as will be assessed accordingly:
    I. Particulate matter with an aerodynamic diameter of less than 10 microns (PM10),
    II. Oxides of Nitrogen (NOx)
    III. Sulphur Dioxide (SO_2)
    IV. Carbon Monoxide (CO)
    V. Chlorine (Cl_2)
    VI. Hydrogen Chloride (HCl)
    VII. Hydrogen Fluoride (HF)
    VIII. Ammonia (NH_3)
- Compilation of isopleth maps indicating predicted ground level concentrations to illustrate the air quality impacts of the proposed activities.
- Comparison of modelled predictions from the smelter with several Air Quality Standards (National: SANS 1929 and gazetted ambient air quality standards (NEMAQA, GN 263:2009, International : WHO guidelines, USEPA NAAQS and or other relevant standards and guidelines) for the various (criteria) pollutants.
- Identify and contextualise knowledge gaps, assumptions, alternatives and limitations of the study with respect to emissions quantification and dispersion modelling.
- Recommendations for the proposed smelter development including mitigation measures and control options to manage air quality related impacts from all emissions sources where practicable.
- Atmospheric Emissions Licensing (AEL) application and supporting documentation for the proposed listing (smelter).

9.1.11.2 EMISSIONS INVENTORY

A comprehensive emission inventory of potentially significant pollutant compounds likely to be emitted (PM10, NO_x, SO_2 and CO) and associated with each activity/emissions source during the construction and operational phases of the proposed project will be compiled. The selection of pollutants may be further informed by the characterisation of the ore body and waste rock to be provided by the applicant. Each emissions source will be categorized in terms of its dispersion modelling characterisation, i.e. point, line or area source as illustrated in Figure 6 1.

In the absence of readily available emissions data, emission factors will be based on internationally accepted resources such as the US-EPA AP42 and or Australian NPI emission factor manuals.

9.1.11.3 AIR DISPERSION MODELLING

Air pollution dispersion modelling will be performed over a period of one (1) year. It is anticipated that 2009 will the year of interest for which the modelling will be undertaken. The dispersion modelling will provide an estimate of the ambient concentrations and deposition rates for PM10 and TSP in the vicinity of the proposed site based on modelled meteorological conditions. The CALPUFF model contains all necessary species parameterisations and deposition properties for particulates to be modelled.

The Air Quality Impact Assessment will include the emissions inventory along with meteorological data in the US-EPA approved CALPUFF suite of models to estimate ambient concentrations and deposition flux for all pollutants for the modelled scenarios, based on a detailed description of the mine construction and operation activities to be supplied by Pan Palladium, failing which, reasonable assumptions and guesstimates will be applied to derive activity rates and all other necessary data in order to construct the emissions inventory.

The meteorological parameters will include varying parameters which simulate/ characterise varying climatic conditions for different times of the day, and months throughout the year. Modelled predictions for various averaging periods will be used to determine the impact of pollutant emissions on receptors of interest.

Receptor identification will be based on:

a) Assessment of the current status of the geophysical landscape of the site and its nearby surroundings (this will include modelled land use categories and terrain height).
b) Prevailing meteorological conditions at the site and its surroundings.
c) A description of the receiving environment which includes identification of potential sensitive receptors including but not limited to nearby/surrounding communities and their sensitivity in terms of the proposed project.

The Weather Research and Forecasting (WRF ARW, version 3.2) mesoscale meteorological model will be used to model surface and upper air data. The CALMET diagnostic model will be used to model gridded three-dimensional and microscale meteorology, at high resolution (300m) for the AOI. High resolution geophysical data (land use and terrain heights) required for the modelling will be generated from the SA land use land cover (LULC) national land cover (NLC) GIS database and terrain heights will be generated from Shuttle Radar Topography Mission (SRTM) 90 metre digital elevation model (DEM) data, also a GIS raster based product available for South Africa.

Wind climatology data from the South African Weather Service (SAWS) stations in the vicinity of the proposed site will be used to assess the dispersion characteristics in the vicinity of the site. If site specific wind data are available for the period of interest, this may be used as a wind climatology data source to be included in the interpretation and validation of the meteorological modelling.

Dispersion of greenhouse gases will not be modelled. Methane, carbon dioxide and other greenhouse gases are not anticipated to be generated from the proposed activity. No ambient health-based guidelines exist for these pollutants. Impacts from these pollutants are associated and related more with hemispheric and global scale effects.

9.1.11.4 AIR EMISSION LICENCE

Further to the above Air Quality Impact Assessment which is proposed, an Air Emission Licence will be applied for, as the predicted emissions which will emanate from the proposed smelter complex are listed in terms of NEMAQA regulations.

9.1.12 ARCHAEOLOGICAL/HERITAGE IMPACT ASSESSMENT

The farms Volspruit and Zoetveld are characterised by farming practices (crops and grazing). Natural features include a stream that bisects the farm and a small knoll on the western boundary. The farm is located in an environment known to contain Stone Age artefacts and Iron Age artefacts and ruins (along streams and on slopes of hills).

Historical heritage features are typically graves, farmsteads and homesteads. The areas used for growing crops represent a transformed and disturbed environment and therefore it is doubtful that any significant heritage resources would have remained. Graves, farm structures and archaeological deposits may be scattered across other farm portions.

The presence of absence of such heritage features needs to be verified through a Heritage Impact Assessment (HIA).

Because the proposed mine is located in a Greenfields environment, it is proposed that the heritage investigation is divided into two phases.

Phase 1: To be undertaken during the scoping phase of the scoping and EIA process. A heritage scoping investigation and report will be formulated, which will focus on the identification, mapping, verification and significance assessment of heritage features and will recommend management measures aimed at minimising adverse impacts by the proposed development. The results of this report may inform the location of shafts/pits and infrastructure and (together with other specialist studies) will assist in the formation of the physical mine plan.

Phase 2: A full heritage impact assessment (HIA), which will assess the impacts of the mine plan on any heritage resources and recommend more detailed management measures aimed at minimising adverse impacts.

Such measures may involve the exhumation and relocation of human remains, sampling of significant archaeological finds and the documentation of historical structures older than 60 years that will be demolished. The implementation of these measures consists of separate, follow-up projects and involves specialists who must obtain the necessary permits from the heritage authorities.

The full HIA involves a thorough and focused assessment of mitigation and heritage impacts of the proposal including the identification of appropriate management actions. The study will make use of existing studies and information (including the heritage scoping investigation) but may also generate new information.

The HIA will fulfil the requirements of section 38 (3) of the National Heritage Resources Act, namely the identification and mapping of heritage resources and the assessment of the significance thereof, an assessment of the positive and negative impacts of the proposals, the results of consultation with IAPs, the consideration of alternatives and plans for the mitigation of any adverse impacts.

The purpose of the HIA report is to verify and assess the absence and/or presence of features of heritage significance that may be affected, to recommend mechanisms to manage impacts and thereby to enable the relevant heritage resources authorities to consider and approve the proposed project, based on the information contained in the report.

Heritage conservation and management in South Africa is governed by the National Heritage Resources Act (Act 25 of 1999) (NHRA) and falls under the overall jurisdiction of the South African Heritage Resources Agency (SAHRA) and its provincial counterparts.

Section 38 of the NHRA requires a Heritage Impact Assessment (HIA), to be conducted by an independent heritage management consultant, for the following development categories:

- Construction of a road, wall, power line, pipeline, canal or other linear form of development or barrier exceeding 300m in length
- Construction of bridge or similar structure exceeding 50m in length
- Development or other activity that will change the character of a site –
    - Exceeding 5000 sq m
    - Involving three or more existing erven or subdivisions
    - Involving three or more erven or divisions that have been consolidated within past five years
    - Rezoning of site exceeding 10 000 sq m
    - The costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- Any other development category, public open space, squares, parks, recreation grounds

The proposed development is a definite listed activity in terms of the NHRA since it involves a site larger than 5000 sq m.

Due to the location of the project, authorisation will be given, based on the final HIA report with accompanying documentation, by the Limpopo Provincial Heritage Resources Authority in terms of section 38 of the NHRA, with comments from the SAHRA Archaeology, Palaeontology and Meteorites Unit (Cape Town).

Should any graves be affected, the SAHRA Burial Grounds and Graves Unit (Pretoria) also may wish to comment. Should any built environment be affected, the SAHRA Built Environment Unit (Cape Town) also may wish to comment.

9.1.13 WASTE MANAGEMENT/WASTE PLAN

A waste management plan will be developed for all waste other than tailings, rock dumps and other mining specific waste that will be generated during the life of mine. The detailed waste management plan will focus on the management, storage, handling, treatment (if any), recycling, reuse and general disposal of all general and hazardous waste produced on-site.

Objectives and methodology

The waste management assessment will comprise the following activities:

- Review of literature,
- Tier 1 waste classification and hazard rating,
- Waste treatment alternatives, and

- Identification and evaluation of re-use and disposal alternatives

The Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, as well as the DEA's proposed waste Classification and Management Regulations, will further be used as a point of departure for discussion of storage, handling, treatment, and disposal procedures for hazardous waste.

Waste classification and hazard rating
Waste streams will be considered on a theoretical basis firstly, in terms of literature on waste streams arising from global PGM mining and beneficiation facilities that will be reviewed. The waste hazard characterisation process requires full chemical analysis of the by-products, which allows the risk assessment to focus on chemicals of potential concern. Slimes samples from comparable sources will be taken.

These samples will be subjected to compositional analyses as well as to Toxicity Characteristic Leach Potential (TCLP) and/or Acid Rain tests to empirically determine and quantify the nature of the hazardous components which may leach. The TCLP and Acid Rain leach tests will be conducted in accordance with the requirements of the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, but also relevant to the revised system currently being developed by the DEA.

Waste treatment/reuse alternatives
The results of compositional analyses, Toxicity Characteristic Leach Potential (TCLP) and Acid Rain tests, and literature review will be used to identify treatment strategies to reduce potentially harmful hazard components of the waste so as to minimise the potential impact of the waste on the environment, as far as practicably possible. Identification and evaluation of potential treatment methods will involve a generic gate process whereby wastes will be considered for re-use (Figure 9-4).

General landfill site
It is unknown at this point as to whether a general waste landfill site will be established on the property. It is predicted that general waste will be disposed of at the municipal landfill, and hazardous waste will be properly disposed of at a registered hazardous waste disposal site. During detailed design and planning, it will be further determined if a general landfill may be necessary. If it is deemed necessary, adequate engineering design and site placement will also be undertaken. The minimum requirement for waste disposal (as published by the Department of Water Affairs) will be strictly adhered to in this case.

Slag dump
There will be slag produced from the smelter complex, which will be disposed of on slag dumps. It is at this stage not known where the slag dump will be located, but this will be part of the overall mine design, and will be positioned at a locality that will be assessed in the EIA report.

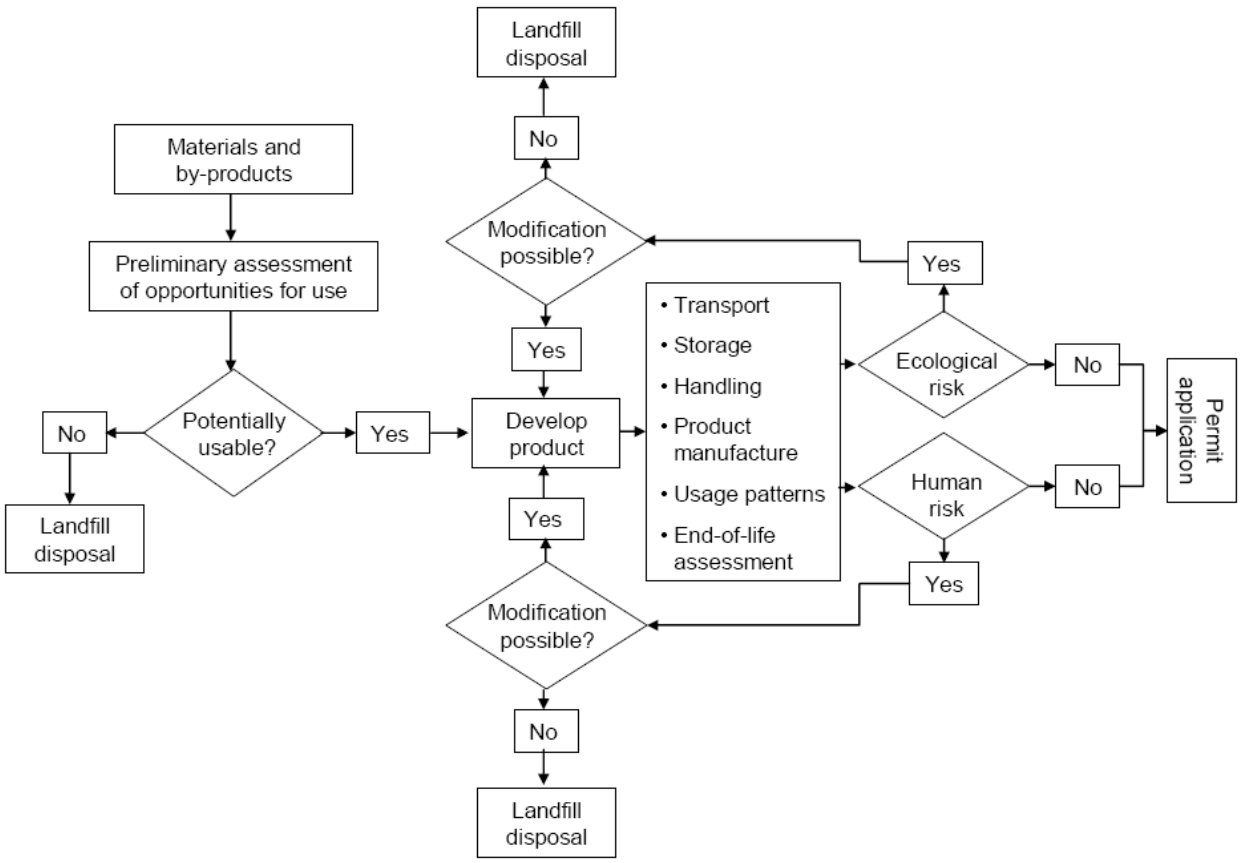


Figure 9-4: Waste management options evaluation process

Methodology applied to the collection of rock samples for acid mine drainage test work
Employing the 3D SURPAC geological modelling and resource estimate models of the Volspruit Northern ore body and imposing the provisional pit design; the boundaries of the resource model (designated at 0.34 g/t 3E) are used to determine the start points of sampling.

Originally each cyclic unit was to be modelled. Due to variable thicknesses and the fact that these units were only accurately defined on the bulk sampling and review logging boreholes, it was decided to model on a 10m bench height basis, emulating the proposed mining situation.

Ten (10) metre benches are modelled using the upper boundary of the resource model as the base and taking 10m cuts through to surface (hanging wall). Similarly, 10m cuts are taken downwards from the lower boundary of the resource model, to allow for sampling of the footwall, particularly where the pit design changes levels across the internal down-throw fault from north to south.

The 10m benches are projected to pit wall and the volume, tonnage and copper grade estimate of each 10m slice. Copper grades are taken to crudely emulate the sulphide content, and this was decided as the most representative way in which to get ore emulating sulphide content.

The 10m bench slices are projected through the borehole traces and the depth intervals determined in selected boreholes for the collection of samples. The analytical results from individual 1m samples, previously determined, will be known and acid mine drainage samples will be in accordance with those sample intervals.

Drill cores (currently half core reference material) are quartered with representative samples collected from each 1m interval through each 10m slice (this therefore results in approximately 10 samples per 10m slice). These samples are then composited to make up a single sample per 10m bench.

In the southern part of the Volspruit North ore body, approximately 6 x 10m benches are present, where as in the northern part of the Northern ore body, between 1 and 3 x 10m benches are present. There are 2 x 10m footwall slices in the intervening section. In order to provide a representative set of samples, four boreholes in the south and four boreholes in the north will be sampled.

Approximately 2kg of material is collected from each 10m slice in each borehole, resulting in:-

a) Southern area of North body: - 6 composite samples of 8kg each from the hanging-wall.
b) Northern area of the North body: - approximately 4 composite samples of 8kg each of hanging-wall.
c) N – S transition (fault area):- 2 composite samples of 8kg each from the foot-wall.

This methodology for Acid Mine Drainage (AMD) test work will allow for the opportunity to selectively mine particular benches (waste) that may have potential AMD characteristics that require specific storage criteria. In addition, opportunities may be realised for the processing of particular benches or portions of a bench, as the PGM, Cu and Ni grades can also be estimated.

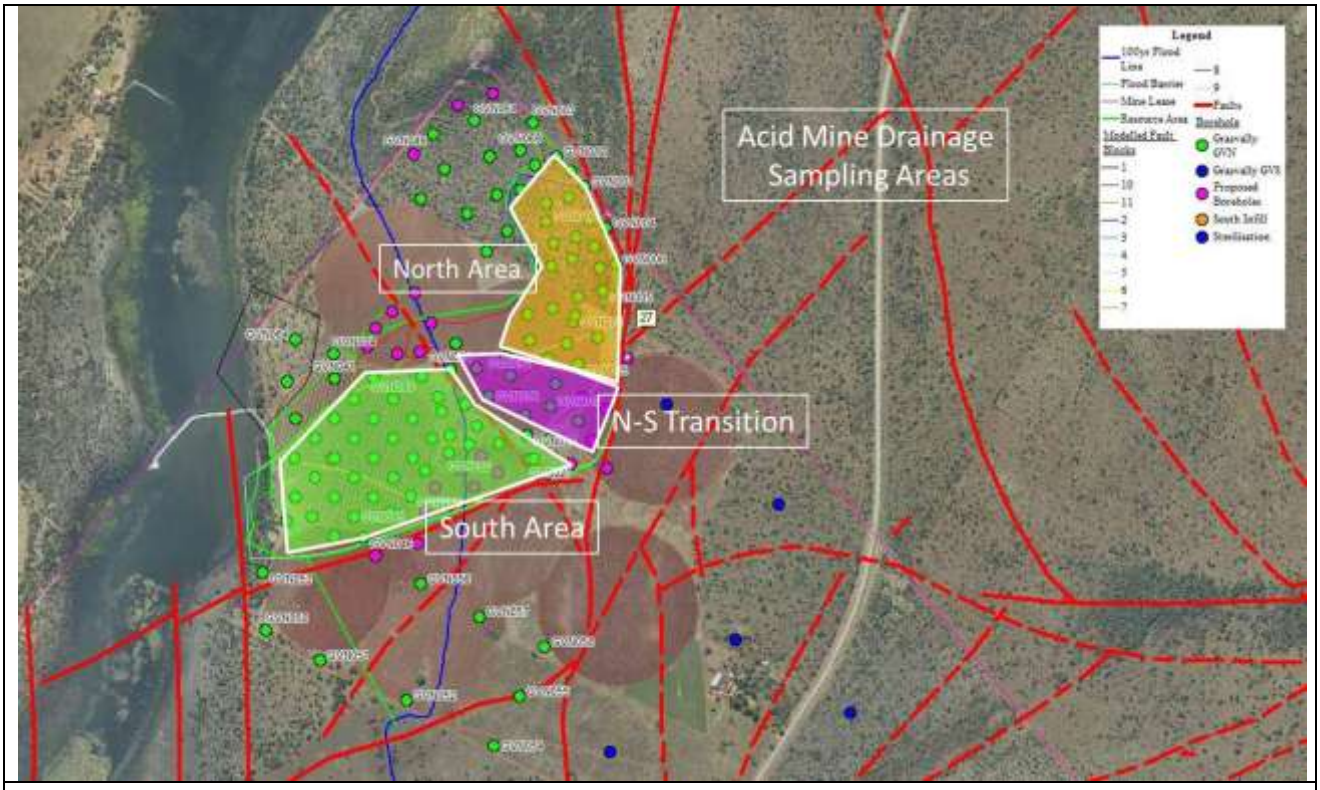


Figure 9-5: Map showing three regions/areas where the representative samples were taken from

Table 9-2: Acid mine drainage sampling: Volspruit Northern ore body

Sample Number	Depth Range (m) from bore holes		Area	Comopsite No	Position	Average Copper (Cu) ppm from Bh sampling	Comments
	From	To					
N0901	0	47	South	1	Hanging-wall	51	
N0902	35	52	South	2	Hanging-wall	48	
N0903	45	62	South	3	Hanging-wall	40	
N0904	55	72	South	4	Hanging-wall	103	Immediately above reef
N0905	103	158	South	5	Foot-wall	96	Immediately below reef
N0906	0	40	North	1	Hanging-wall	79	
N0907	23	80	North	2	Hanging-wall	92	
N0908	33	91	North	3	Hanging-wall	44	
N0909	0	101	North	4	Hanging-wall	175	Immediately above reef
N0910	72	132	North	5	Foot-wall	158	Immediately below reef
N0911	30	40	N to S	2	Hanging-wall	40	
N0912	40	58	N to S	3	Hanging-wall	80	
N0913	50	68	N to S	4	Hanging-wall	79	Immediately above reef
N0914	88	127	N to S	5	Foot-wall	56	Immediately below reef
N0915	104	141	N to S	6	Foot-wall	95	

Waste rock and tailing samples: Tests proposed to be undertaken
Tests for CHEMICAL characteristics of waste rock and residue:

Laboratory testing on representative tailing samples (obtained from Mintek) include the following:
a. XRF analysis – 1st tier risk assessment
b. Leach tests – deionised water leach – 2nd tier assessment
c. Acid: base accounting (ABA) to determine AMD formation

Waste rock sample testing (obtained as described above) will be tested as follows:
a. XRF analysis
b. Determination of Acid Potential using Hydrogen Peroxide oxidation
c. Neutralising potential using sulphuric acid adaptation of the Sobek method
d. Calculation of acid: base account (ABA)

9.1.14 NOISE AND VIBRATION IMPACT ASSESSMENT

A full noise and vibration impact assessment is proposed to be undertaken for the Volspruit mine, and mining activities are associated with noise and vibration generation in surrounding areas.

The study to determine the impact such a mine will have on the environment will be based on the following:

Noise policies and guidelines:

- SANS 10328 – Methods for environmental noise impact assessments and,
- SANS 10103:2008 – The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication and

- Guidelines for community noise impact assessments.
- Environmental Health and Safety Guidelines of the International Finance Corporation.

Vibration policies and guidelines:

- United States Bureau Vibration Standards, BMR 1-8507

This noise survey from an environmental noise point of view will have to be done during the daytime and the night-time in order to evaluate the recommended residual noise levels laid down by SANS 10103:2008 and to get a representative residual noise level for the study area.

A **noise impact assessment** will have to be done at the following areas in order to evaluate the existing baseline information and to use the information to create the noise contours:

- Boundary of the proposed mining area;
- Along the proposed conveyer system and/or haul routes to and from the sites;
- At the nearest noise sensitive areas.

This **vibration survey** from an environmental noise point of view will have to be done in and around areas where blasting is proposed to be taking place and more or less at the same measuring points as for the noise measurements. This will indicate the prevailing vibration levels during blasting and other mining activities.

It is proposed to make use of the following six-stage process approach for the two proposals in order to undertake adequate assessment and mitigation:

Step 1 - Define the project requirements and noise/vibration problem – gather technical support information

Step 2 – Agree on the assessment criteria, establish baseline noise and/or vibration environment and determine extent of the noise impact of initial proposal

Step 3 – Identify and agree on noise mitigation options

Step 4 – Assess noise impact against criteria of Step 2 and evaluate key considerations and significance for each mitigation option

Step 5 – Determine optimal noise control solution

Step 6 – Review, implement, monitor and audit

There will be two types of noise sources at the mining area, a point source which will be at the opencast mine area, the discard dump with its own noise sources which will have to be identified and addressed and the line source which will be the conveyer system and/or the new haul routes. These two categories of noise sources will determine how mitigation and the management thereof will be addressed.

The proposed noise and/or vibration survey will consist of the following:

- Preliminary survey and identification of measuring points;

- All measurements will be done on the boundary of the study area;
- Sound and/or vibration readings will also be done at the closest residential area;
- Noise and vibration survey at the identified measuring sites – ambient noise and vibration measurements;
- Calculation of noise propagation;
- Analysing of results;
- Results of the survey, report and recommendations and mapping of noise contours for the proposed site.

9.1.15 VISUAL IMPACT ASSESSMENT

It is the intent of the visual specialist, Mr Kotie Geldenhuys of Propaganda Studios, to execute the Visual Impact Assessment. Adequate explanations of the processes and their subsidiary components will be presented, accompanied by clear and palatable graphs for stakeholders who might be less familiar with the methodology of Visual Impact Assessment (VIA).

It is proposed that two (2) sets of guidelines will be used for undertaking the VIA, namely:

- Department of Environmental Affairs' Environmental Management Guidelines in 2010 (DEA, 2010), and,
- "*Guideline for involving visual & aesthetic specialists in EIA processes: Edition 1*", published for the CSIR, particularly pertaining to sensitive areas in the Western Cape Province, but also applicable throughout (and not limited to) the Republic of South Africa.

It is the intent of the visual specialist to focus on the following principles, requirements and evaluation criteria in the execution of a comprehensive Visual Impact Assessment**:**

- An awareness that 'visual' implies the full range of visual, aesthetic, cultural and spiritual aspects of the environment that contribute to the area's sense of place;
- The consideration of both the natural and the cultural landscape, and their inter-relatedness;
- The identification of all scenic resources, protected areas and sites of special interest, together with their relative importance in the region;
- The nature and location of any cultural heritage sites, and areas of special or historical interest;
- An understanding of the landscape processes, including geological, vegetation and settlement patterns, which give the landscape its particular character or scenic attributes;
- The need to include both quantitative criteria, such as 'visibility', and qualitative criteria, such as landscape or townscape 'character';
- The need to include visual input as an integral part of the project planning and design process, so that the findings and recommended mitigation measures can inform the final design, and hopefully the quality of the project.

It is proposed that the following evaluation criteria will be employed to evaluate the Visual Impact Assessment process:

- Provision of a full description of the environment and the project;
- Consideration of the project within its wider context;
- Provision of a clear methodology using accepted conventions for visual assessment;
- Presentation of all sources of information and references;
- Clear presentation of graphics, including maps and visual simulations;
- Inclusion of both quantitative and qualitative criteria;
- Consideration of cumulative visual impacts;
- Determination of the relative compatibility or conflict of the project with the surroundings;
- Evaluation and consideration of alternatives;
- Explanation of significance ratings, related to bench-marks;
- Inclusion of long term sustainable development objectives;
- Practical and sensible recommendations for visual mitigation;
- Identification and description of monitoring programme recommendations;
- Consideration of the best practicable environmental options;
- The addressing of all the visual issues raised in the scoping;
- Provision of a clear summary of mitigation measures, including essential and optional measures.

In addition to the above, a cumulative impact assessment will be done, as well as mitigation measures suggested with regards to layout of surface structures and suggestions with regards to rehabilitation and possible redevelopment of the area post-mining.

The full VIA will encompass the following components:

- Background research and quantification modelling: This includes an on-site photographic audit;
- Identification of landscape types, landscape character and sense of place, generally based on geology, landforms, vegetation cover and land use;
- Identification of view sheds and view catchment areas (based on the degree to which topography will impact on rendering the proposed development visible or invisible);
- Identification of important view points and view corridors within the affected environment (including sensitive receptors, high traffic areas and places of interest);
- Indication of distance radii from the proposed project to the various view points and receptors;
- Determination of the visual absorption capacity (VAC) of the landscape, usually based on vegetation cover or urban fabric in the area;
- Determination of the relative visibility, or visual intrusion, of the proposed project;
- Determination of the relative compatibility or conflict of the project with the surroundings;
- Three-dimensional modelling and texturing of surface infrastructures (including stockpiles, plant, offices etc.)
- View simulations of potential visual impacts, including rendering elevations and three (3) vantage points in both day and night (night-time lighting impacts).

- Immersed Imagery. This aspect of the VIA will include:
    - 360 degree, 10 second rotational animation of the mine area
    - Animated 5 second "camera pan"
    - Animated 5 second "camera zoom"
    - Interactive panoramic visualization
    - 3-D stereo visualization
- Reporting on the visual impacts predicted will include:
    - A summary impact assessment table, using the defined impact assessment and significance rating criteria;
    - Indications of whether impacts are irreversible or result in an irreplaceable loss to the environment and/or society;
    - Statement of impact significance for each issue specifying whether a level of acceptable change has been exceeded and whether the impact presents a potential fatal flaw;
    - Identification of beneficiaries and losers of the proposed development;
    - Summary of key management actions that fundamentally affect impact significance;
    - Identification of the best practicable environmental option, providing reasons;
    - Identification of viable development alternatives not previously considered;
    - Landscape end use planning (alternative options) and rehabilitation proposal.

9.1.16 SOCIO-ECONOMIC IMPACT ASSESSMENT

A full socio-economic impact assessment (SEIA) will be undertaken by Urban-Econ Development economists in Pretoria. The overall objectives of the socio-economic impact assessment are as follows:

- understanding the spatial context of the area and mine surroundings;
- becoming aware of the on-mine constraints and opportunities;
- developing a baseline socio-economic profile of the primary, secondary and tertiary study areas;
- determining positive and negative socio-economic impacts of the proposed project on the local, regional and national economies, as well as during construction, operation and decommissioning phases;
- proposing mitigation measures to reduce the expected negative effects and enhance positive impacts;
- ranking potential socio-economic impacts according to the predefined criteria and for both cases - before and after mitigations measures.

The SEIA study approach is proposed to be the following**:**

Step 1: Orientation and scoping: This is the initial step in the process, and involves information gathering and collating

Step 2: Socio-economic profile development: Compile a profile of the study area's socio-economic environment to serve as a baseline for modelling and particularly interpretation of impact in the local context. The following elements of the study area's socio-economic environment will be addressed:

- demographic characteristics of communities (obtained from a social specialist)
- employment creation opportunities as well as skills base and needs
- economic sectorial structure and trends
- supporting economic infrastructure and services inclusive of housing
- perspective on strategic initiatives and institutional issues related to economic identification of future trends

Step 3: Project description and interpretation: A concise description and interpretation of the project in terms of economic quantities for modelling purposes will be given. This step in the process will comprise of the following activities:

- Obtaining the description of components of the project, whether of a short or long-term, direct or related nature.
- Interpretation of the project in terms of socio-economic variables for modelling purposes.
- Collecting from the client cost estimates for the establishment of the project, running the mine during its operational period and projected expenditure during the closure/decommissioning phase.
- The project will be interpreted in terms of economic elements such as:
    - employment creation
    - income generation
    - construction activities
    - secondary projects (settlement development, business, etc.)
    - skills requirements.

Step 4: Economic modelling: This will include undertaking a modelling exercise to determine the types of impacts that could be expected once the project is implemented and, importantly, the extent of these impacts. The following approach will be followed:

The econometric model developed on the basis of the Limpopo Social Accounting Matrix will be utilised to determine direct, indirect and induced economic impacts.

The project information will be used as an input to the modelling exercise.

Households will be prominently included as a system of account.

Impact assessment will be undertaken for the various phases of the project development, namely construction and operation, and possibly closure.

Different types of impacts will be examined, including:

- impact on production
- impact on employment
- impact on skills
- impact on income
- other economic impacts identified throughout the study

Step 5: Interpretation: This step will identify the implications of the proposed project on the affected economies and communities. The results of the impact analysis and investigation of the implications of the project from the social perspective will be interpreted and

unpacked to create a comprehensive description of potential socio-economic impacts of the project throughout its lifecycle.

Step 6: Ranking and recommendations: Once the impacts are identified they will be described in terms of their duration, extent, significance and other criteria specified in the Environmental Impact Assessment Regulations (R543). The study will also provide recommendations on the possible mitigation measures that could be implemented to reduce the negative socio-economic impacts and expand the positive socio-economic impacts.

9.1.17 BIRD IMPACT ASSESSMENT

The following methodology is proposed for a full Bird Impact Assessment:

- The study area will be inspected to gain a first-hand impression of the bird habitat both on the site itself as well as the surrounding floodplain area.
- The existing environment will be described and the bird communities currently existing within the zone of influence of the proposed mine will be identified and described.
- Different bird micro-habitats will be described as well as the species associated with those habitats.
- Trends and conditions in the environment that affects the avifauna as it currently exist within the zone of influence will be identified and analysed
- Gaps in baseline data will be highlighted and discussed. An indication of the confidence levels will be given. The best available data sources (both published and unpublished literature) will be used to establish the baseline conditions, and extensive use will be made of local knowledge if available (e.g. local bird clubs/amateur ornithologists/existing studies) and who are familiar with the study area.
- Bird sensitive areas will be mapped in a sensitivity map for easy reference, and particular emphasis will be placed on habitat for red data and endemic species.
- A full description of potential impacts (direct, indirect and cumulative) will be provided, relative to these specific activities and developments.
- The potential impact on the birds will be assessed and evaluated according to the criteria that are required by the EIA.
- Practical mitigation measures will be recommended and discussed.
- If a need for the implementation of a monitoring programme in the EMP phase is evident, it will be highlighted and a programme proposed.

9.1.18 COMPILATION OF AN IWWMP

An Integrated Water and Waste Management Plan (IWWMP) is compiled in order to promote the environmentally sustainable and equitable use of water in relation to the proposed mining operations. The IWWMP is intended to be a simple, feasible, implementable plan for the mine based on site specific programmes, also taking into account the National Water Resource Strategy (NWRS), relevant Catchment Management Strategy (CS), Resource Quality Objectives (RQO) and the sensitivity of the receiving water resources and down-stream water users in the vicinity of the mine (Figure 9-6).

This plan would consolidate a number of so-called 'sectorial' water and waste management programmes, relating to specific mine water and waste management

aspects, into a single standalone document for ease of implementation by the mandated parties at the Mine (Figure 3-4). The 'sectorial' programmes referred to above cover, *inter alia*, the following aspects:

- Pollution prevention;
- Water re-use and reclamation;
- Water treatment;
- Storm water management; and
- Water balances.

The consolidation of the above has been done taking cognisance of the resource quality objectives of the National Water Resource Strategy, as well as the relevant Catchment Management Strategy. The formulation of the IWWMP is, furthermore, based on an understanding of the above objectives in conjunction with an impact assessment for all those on-site activities that have the potential to impact upon receiving water resources and users in the vicinity of the mine.

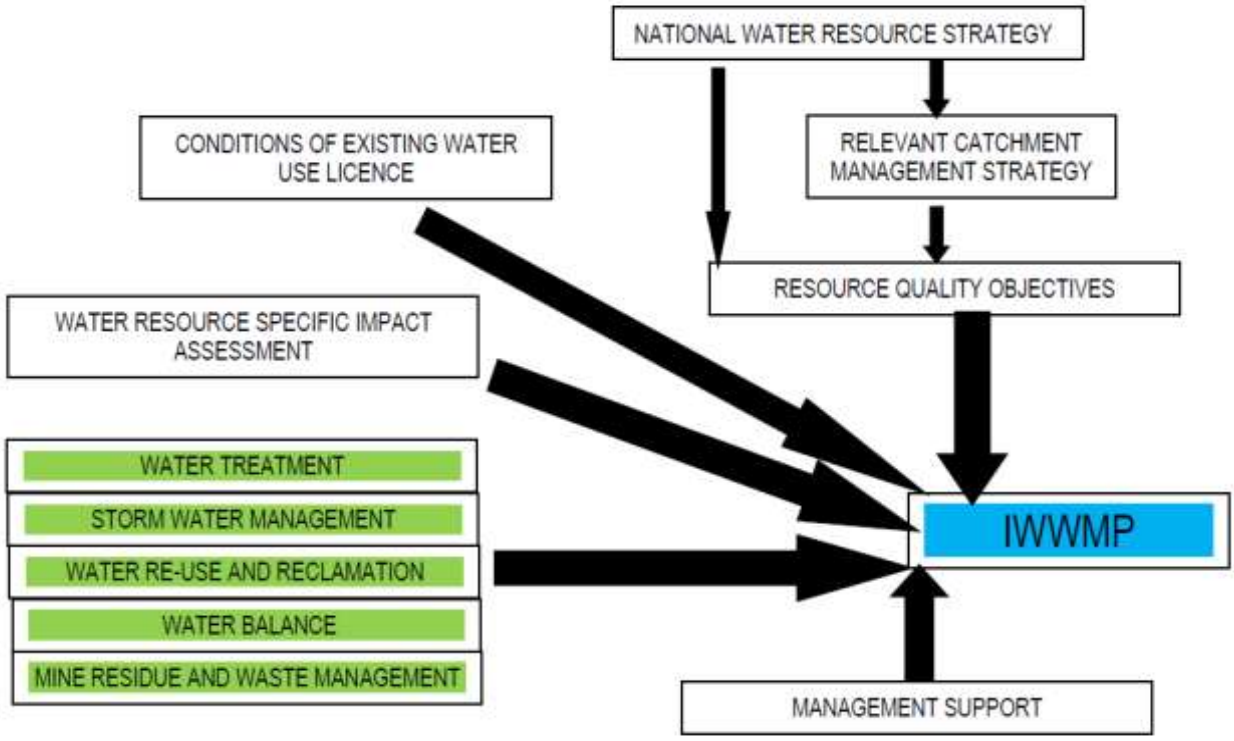


Figure 9-6: Approach to Integrated Waste and Water Management Planning (Adapted from DWAF IWWMP Operational Guidelines, 2008).

The objective of an IWWMP is not to merely compile all existing site knowledge from prior EIA processes or EMPRs into a single unmanageable document (DWA, 2008). It applies the principles of the hierarchy for Water Quality Management (WQM) to focus mine management's attention on dealing expressly with those site activities that impact either directly, or indirectly, on water resources and sets clear action plans for the control of water (containing waste) and waste as sources of pollution (Figure 3-5). The hierarchy makes use of precautionary principles and sets an order of priority for mine water and waste management decisions and actions

9.1.19 CLOSURE COSTING AND REHABILITATION PLAN

Regulation 37(1) promulgated under the Minerals and Petroleum Development Act of 2002 requires that the quantum of the financial provision must be based on the requirements of the approved EMP or plan and shall include a detailed itemisation of all actual costs required for:

- premature closure regarding:
  - the rehabilitation of the surface of the area;
  - the prevention and management of pollution to the atmosphere;
  - the prevention and management of pollution of water and the soil;
  - decommissioning and final closure of the operation; and
  - post-closure management of residual and latent environmental impacts.

A review of closure cost estimates will be undertaken including:

- Review and redefine closure cost objectives and closure methodology (to ensure that they are objective and measurable.
- Development of closure alternatives and cost models, in terms of Regulation 37(1) promulgated under the MPRDA and in cognisance of the duty to care (in terms of NEMA S28), including:

1. Dismantling plant and buildings, re-enforced concrete, buildings and structures
2. Rehabilitation of access roads
3. Demolition of housing facilities
4. Opencast rehabilitation of final voids and dumps
5. Rehabilitation of over-burden and spoils
6. Rehabilitation of processing waste
7. Rehabilitation of subsided areas
8. General surface rehabilitation of disturbed areas
9. Stream diversions
10. Erection of fencing
11. Water management
12. Long-term end use planning for open pits
13. Aftercare maintenance and management cost
14. Financial costs of closure plan development
15. Formulation of top soil and residue management and conservation management plans to optimise future recovery and optimal utilisation.

9.1.20 END USE ALTERNATIVES

It is proposed that the end use alternatives for the mining area also be thoroughly assessed and dealt with in the EIA, so that ideas and scenarios can be shared with respect to the rehabilitation of the area and proposed post-mining land uses.

Some alternative options that will be assessed include, but not limited to:

- The details and extent of rehabilitation and landscaping of the "flood berm" that is proposed between the North Pit and the Nyl River;
- The reshaping of the rock dump areas and storage of stockpiled topsoil so that it can potentially be used for agriculture post-mining;
- The establishment of a resort type development, on the areas surrounding the North Pit, which is proposed to be flooded with water post mining, in order to create a man-made dam, and extended bird and wildlife habitat within the Nyl River system.

This section of the EIA will show that the entire life of mine, as well as post-mining operation and developments are being considered even before mining commences, and that rehabilitation recommendations will be complied with.

End use alternative planning can be achieved by relocating the farmer to land that has been cleared, is of similar agricultural potential and use of mine abstraction water for irrigation, no loss of sensitive vegetation through diligent mine planning. Forward looking mine closure planning will result in no visible waste rock dumps as a result of proposed flood barrier fill to create area ideal for a possible resort type development around the North Pit, which will fill with water after decommissioning. The site will be rehabilitated accordingly, and the area could once again be used for agricultural and recreational purposes.

9.2 CUMULATIVE IMPACT ASSESSMENT STUDY

9.2.1 LEGAL REQUIREMENT

NEMA 2010 Regulations, R543 states: "cumulative impact", in relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

9.2.2 INTERPRETATION

A cumulative impact is an instance where that occurs as a result of the addition of many similar smaller impacts. These smaller impacts may occur from similar or very different developments and individually they may each be within the assimilative capacity of the environment, but together they reach a threshold that then cause serious damage.

9.2.3 METHODS

Cumulative impacts will be explicitly assessed in instances where additional burden/ impact will be caused by the proposed development.

Several considerations apply to CEA and some of these are discussed below:

- Cumulative effects are not only calculated from those currently occurring, but also past impacts that still have an effect. An area that is already degraded must not be evaluated from that degraded state, but must be evaluated from its pristine state, even if that was centuries ago.
- Cumulative effects are both direct and indirect impacts – anything that will add to the effect being considered. However, the number of effects being considered will generally have to be limited. For example, every species in a given area cannot be assessed for the effect that the impact will have on it. A decision must be taken to select perhaps a few species including the most likely to be affected species, the rarest species, iconic species or those that are well understood for which baseline or dose-response data exist.
- Cumulative effects may occur across political and ownership boundaries. The assessment must not stop at those boundaries and should rather use natural boundaries, such as catchments or changes in vegetation type.
- Cumulative effects can be of many types. Every attempt must be made to incorporate and, if possible, synthesize these impacts and effects where they may occur.
- Cumulative effects must be forecast as far as possible into the future to try and sense the possibility of severe effects that may only occur in the long term.

Cumulative Environmental Assessment can be done using various methods, some of which are explained in table below.

Cumulative Effects Assessment	
Analysis method	Description
Checklist	Common projects with easily anticipated impacts can be assessed using a checklist
Questionnaire	Systematic interviewing with experts or locals with good knowledge

	of the area and environment
Network	Diagrams illustrating flows and other relationships between components; good for illustrating cause and effect
Interactive analysis	Assessment of additive and synergistic effects of various configurations of multiple projects
Biogeographical analysis	Ecosystem analysis at landscape and larger levels, emphasizing patterns, processes and structure of the ecosystem
Carrying capacity analysis	Determination of the total resource base that can be used by humans whilst maintaining a sustainable natural environment in the long term
Ecological modelling	Mathematical modelling using computers, where areas are data rich and ecosystems are well understood
GIS (geographic information system)	Computerized mapping system for spatial data allowing sophisticated spatially related querying and presentation

The outputs of a CEA can be the identified sources of cumulative impacts, the sequence of events from source to effect, or the resultant effects. Ideally all three of these should be mentioned, but in some cases it may not be necessary for the aim of the study to investigate all three aspects in detail. For instance, if it is known that air quality in a certain area is dangerous to human and environmental health, it is probably more important to quantify the sources and try and limit these, than to doing a detailed study of the exact health effects and environmental risks from the poor air quality. The latter may be interesting, but will not really address the cause of the problem.

9.3 COMPILATION OF EMP(R)

9.3.1 EIA AND EMP

It is our opinion that should one EIA report be used as basis for applications for both mining as well as other EIA listed activities, such a process must comply with relevant applicable EIA legislation as follows:

1) the EIA regulations of the Mineral and Petroleum Resources Development Act, Regulations GN R 527 (GG26275 of 23 April 2004 hereafter called the MPRDA 2004 EIA Regulations); and
2) the National Environmental Management Act 107 of 1998, NEMA EIA Regulations GG R 385 (GG 28753 Of 21.04.2006) hereafter called the NEMA 2006 EIA Regulations.

As stated in section 3.1.3 of this report, an EMPR is necessary for the mining licence submission, and as a standard document to be used for construction, operation, decommissioning and rehabilitation of the mine.

According to section 39 (6) (a) of the MPRDA, "*The Minister may at any time after he or she has approved an environmental management programme or environmental management plan and after consultation with the holder of the reconnaissance permission, prospecting right, mining right or mining permit concerned, approve an amended environmental management plan or environmental management programme*". The EMPR is thus required to ensure that the potential impacts of all foreseen operations are understood and appropriately quantified (where possible) and appropriate mitigation measures put in place to abate or avoid those impacts identified.

This EMPR will therefore be further compiled to comply with the provisions of section 39 of the Mineral and Petroleum Resources Act, 2002 (Act No 28 of 2002) [MPRDA] and the Mineral and Petroleum Resources Development Amendment Act, 2008 (Act No 49 of 2008) [MPRDA], as amended. The document will also be compiled to comply with those conditions set out in Regulation 51 of the aforementioned Act.

Furthermore, in accordance with section 51 of the MPRDA 2004 EIA regulations, the EMPR will include the following aspects:

(a) A description of the environmental objectives and specific goals for –
  (i) Mine closure
  (ii) The management of identified environmental impacts emanating from the proposed mining operation
  (iii) The socio-economic conditions as identified in the social and labour plan, and
  (iv) Historical and cultural aspects, if applicable

(b) An outline of the implementation programme which must include
  (i) A description of the appropriate technical and management options chosen for each environmental impact....
  (ii) Action plans to achieve the objectives and specific goals contemplated in paragraph (a)…
  (iii) Procedures for environmentally related emergencies and remediation;
  (iv) Planned monitoring and environmental management programme performance assessment;
  (v) Financial provision in relation to the execution of the environmental management programme….
  (vi) An environmental awareness plan…
  (vii) All supporting information and specialist reports…
  (viii) An undertaking by the applicant to comply with the provisions of the act and regulations thereto.

9.4 IMPACT ASSESSMENT METHODOLOGY

The following criteria and methodology is proposed to determine the significance of environmental impacts caused by the proposed project.

9.4.1 TYPE OF IMPACTS

Potential environmental impacts may either have a positive or negative effect on the environment, and can in general be categorised as follows:

a) Direct/primary impacts

Primary impacts are caused directly due to the activity and generally occur at the same time and at the place of the activity.

b) Indirect/secondary impacts

Secondary impacts induce changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken.

c) Cumulative impacts

Cumulative impacts are those that result from the incremental impact of the proposed activity on common resources when added to the impacts of the other past, present or reasonably foreseeable future activities. Cumulative impacts can result from the collective

impacts of individual minor actions over a period of time, and can include both direct and indirect impacts.

9.4.2 DETERMINING SIGNIFICANCE

The following criteria will be used to determine the significance of an impact. The scores associated with each of the levels within each criterion are indicated in brackets after each description [like this].

Nature

Nature (N) considers whether the impact is:

- positive [- ¼]
- negative [+1].

Extent

Extent (E) considers whether the impact will occur:

- on site [1]
- locally: within the vicinity of the site [2]
- regionally: within the local municipality [3]
- provincially: across the province [4]
- nationally or internationally [5].

Duration

Duration (D) considers whether the impact will be:

- very short term: a matter of days or less [1]
- short term: a matter of weeks to months [2]
- medium term: up to a year or two [3]
- long-term: up to 10 years [4]
- very long-term: 10 years or longer [5].

Intensity

Intensity (I) considers whether the impact will be:

- negligible: there is an impact on the environment, but it is negligible, having no discernable effect [1]
- minor: the impact alters the environment in such a way that the natural processes or functions are hardly affected; the system does however, become more sensitive to other impacts [2]
- moderate: the environment is altered, but function and process continue, albeit in a modified way; the system is stressed but manages to continue, although not with the same strength as before [3]
- major: the disturbance to the environment is enough to disrupt functions or processes, resulting in reduced diversity; the system has been damaged and is no longer what it used to be, but there are still remaining functions; the system will probably decline further without positive intervention [4]
- severe: the disturbance to the environment destroys certain aspects and damages all others; the system is totally out of balance and will collapse without major intervention or rehabilitation [5].

Probability

Probability (P) considers whether the impact will be:

- unlikely: the possibility of the impact occurring is very low, due either to the circumstances, design or experience [1]

- likely: there is a possibility that the impact will occur, to the extent that provisions must be made for it [2]
- very likely: the impact will probably occur, but it is not certain [3]
- definite: the impact will occur regardless of any prevention plans, and only mitigation can be used to manage the impact [4].

Mitigation or enhancement

Mitigation (M) is about eliminating, minimising or compensating for negative impacts, whereas enhancement (H) magnifies project benefits. This factor considers whether –

- A negative impact can be mitigated:
  - unmitigated: no mitigation is possible or planned [1]
  - slightly mitigated: a small reduction in the impact is likely [2]
  - moderately mitigated: the impact can be substantially mitigated, but the residual impact is still noticeable or significant (relative to the original impact) [3]
  - well mitigated: the impact can be mostly mitigated and the residual impact is negligible or minor [4]
- A positive impact can be enhanced:
  - un-enhanced: no enhancement is possible or planned [1]
  - slightly enhanced: a small enhancement in the benefit is possible [2]
  - moderately enhanced: a noticeable enhancement is possible, which will increase the quantity or quality of the benefit in a significant way [3]
  - well-enhanced: the benefit can be substantially enhanced to reach a far greater number of receptors or recipients and/or be of a much higher quality than the original benefit [4].

Reversibility

Reversibility (R) considers whether an impact is:

- irreversible: no amount of time or money will allow the impact to be substantially reversed [1]
- slightly reversible: the impact is not easy to reverse and will require much effort, taken immediately after the impact and even then, the final result will not match the original environment prior to the impact [2]
- moderately reversible: much of the impact can be reversed, but action will have to be taken within a certain time and the amount of effort will be significant in order to achieve a fair degree of rehabilitation [3]
- mostly reversible: the impact can mostly be reversed, although if the duration of the impact is too long, it may make the rehabilitation less successful, but otherwise a satisfactory degree of rehabilitation can generally be achieved quite easily [4].

9.4.3 CALCULATING IMPACT SIGNIFICANCE

The table below summarises the scoring for all the criteria.

Table 9-3: Scoring for Significance Criteria

CRITERION	SCORES					
	- ¼	**1**	**2**	**3**	**4**	**5**
N-nature	positive	negative	-	-	-	-
E-extent	-	site	local	regional	provincial	national
D-duration	-	very short	short	moderate	long	very long
I-intensity	-	negligible	minor	moderate	major	severe
P-probability	-	very unlikely	unlikely	likely	very likely	-

M-mitigation	-	none	slight	moderate	good	-
H-enhancement	-	none	slight	moderate	good	-
R-reversibility	-	none	slight	moderate	good	-

Impact significance is a net result of all the above criteria. The formula proposed to calculate impact significance (S) is:

- For a negative impact: S = N x (E+D) x I x P ÷ ½(M+R); and
- For a positive impact: S = N x (E+D) x I x P x (H).

Negative impacts score from 2 to 200. Positive impacts score from – ½ to -200.

9.4.4 UNDERSTANDING IMPACT SIGNIFICANCE

The following is a guide to interpreting the final scores of an impact (for negative impacts):

Table 9-4: Final significance scoring

Final score (S)	Impact significance	
0 – 10	Negligible	the impact should cause no real damage to the environment, except where it has the opportunity to contribute to cumulative impacts
10 – 20	Low	the impact will be noticeable but should be localized or occur over a limited time period and not cause permanent or unacceptable changes; it should be addressed in an EMP and managed appropriately
20 – 50	Moderate	the impact is significant and will affect the integrity of the environment; effort must be made to mitigate and reverse this impact; in addition the project benefits must be shown to outweigh the impact
50 – 100	High	the impact will affect the environment to such an extent that permanent damage is likely and recovery will be slow and difficult; the impact is unacceptable without real mitigation or reversal plans; project benefits must be proven to be very substantial; the approval of the project will be in jeopardy if this impact cannot be addressed
100 – 200	Severe	the impact will result in large, permanent and severe impacts, such as local species extinctions, minor human migrations or local economic collapses; even projects with major benefits may not go ahead with this level of impact; project alternatives that are substantially different should be looked at, otherwise the project should not be approved

Two examples will help illustrate this system:

SCENARIO 1 – An industrial facility proposes discharging effluent containing a high salt content into a nearby stream. These salts will cause temporary problems for the ecosystem, but are washed downstream, diluted and will have no long term effects. The short term damage to the stream can be reversed fairly easily, but only if the ecosystem has not been seriously damaged by the salts over a long time. A mitigation measure is also proposed whereby during low flow periods (dry season) a pulse of clean water is discharged into the stream after the saline effluent, diluting the salts and pushing them downstream faster, so that the salts become so dilute as to have little or no effect.

From this scenario, the criteria are:
nature = negative = 1
extent = local = 2
duration = medium = 3
intensity = moderate = 3
probability = very likely = 4
mitigation = moderate = 3
reversibility = moderate = 3,

and therefore impact significance is:
S = N x (E+D) x I x P ÷ ½(M+R)
= 1 x (2+3) x 3 x 4 ÷ ½(3+3)
= 60 ÷ 3
= 20.

Note that the impact prior to mitigation is major, but that due to the mitigation and the fact that the ecosystem can recover easily from the effects of salt (high reversibility), the residual impact becomes minor/moderate.

SCENARIO 2 – The above scenario applies, except that the effluent contains metals. These metals become adsorbed into clay and organic matter in the stream bed and are accumulative toxins within the ecosystem, getting into the food chain and concentrating upwards into predator species. Fresh water flushing will only very slightly mitigate this and ecosystem recovery will not be easy or fast.

From this scenario, the criteria are:
nature = negative = 1
extent = local = 2
duration = very long = 5
intensity = moderate = 3
probability = very likely = 4
mitigation = slight = 2
reversibility = slight = 2,

and therefore impact significance is:
S = N x (E+D) x I x P ÷ ½(M+R)
= 1 x (2+5) x 3 x 4 ÷ ½(2+2)
= 84 ÷ 2
= 42.

Note that in this case, the original impact (of the metals) is more serious than the salt, but it is the limited mitigation and reversibility that also act on the residual score and result in this score being moderate.

9.5 PROPOSED SCOPING AND EIA TIMELINE INCLUDING KEY AUTHORITY CONSULTATION (LEDET AND DMR)

As per EScience discussions at the meeting on 2 June 2011 with LEDET it is proposed that the following course of action is followed:

1) Submit five (5) copies of draft scoping report to LEDET (one (1) for LEDET and the other four (4) for LEDET to distribute to other government departments for a 40 day comment period).
2) One (1) week after submission of the scoping report to LEDET EScience will distribute the scoping report for public review for a period of 40 days (as per regulations, EScience will submit to LEDET prior to distribution of scoping report to public).
3) During this 40 day public review period, it is proposed to have a public meeting and discuss the scoping report and PoSEIA with stakeholders, as well as meet with LEDET and other government departments.
4) Comments will then be collated from the public and from LEDET (and other government departments), whereafter a final scoping report will be submitted to LEDET and the public (as per the regulations requirement).
5) If there are SUBSTANTIVE changes that need to be made to the report, then the process will again start from point 1 (as above).
6) If no substantive changes are needed, the reports should be processed accordingly – a meeting on the need for these "substantive changes" may be required.

Please refer to Figure 9-7: Scoping phase flow diagram.

Table 9-5: Anticipated key dates

Process Phase	Details	Estimated Date
Application	Lodge application and declaration of interest to LEDET	Completed March 2011 and submitted on 11 March 2011.
	Receive confirmation of application from LEDET	Received on 30 March 2011.
Scoping phase	Finalise draft scoping report and send back to LEDET and send to I&APs	June 2011
	Submit draft scoping report to LEDET and to public for review	July 2011
	Consideration by LEDET of draft scoping report and PoSEIA, as well as review of scoping by public	July/August 2011
	Submit final scoping report to LEDET and DMR (as well as mining right application to DMR)	Early October 2011
EIA phase	Review of draft Environmental Impact Assessment Report (EIR) by LEDET and Public	February/March 2012
	Lodge final EIR with LEDET and DMR	End April 2012
	Lodge water use licence application and IWWMP with DWA	End April 2012
	Decision on application from DMR and LEDET	October 2012 (assuming submission of mining right application to DMR in August 2011)

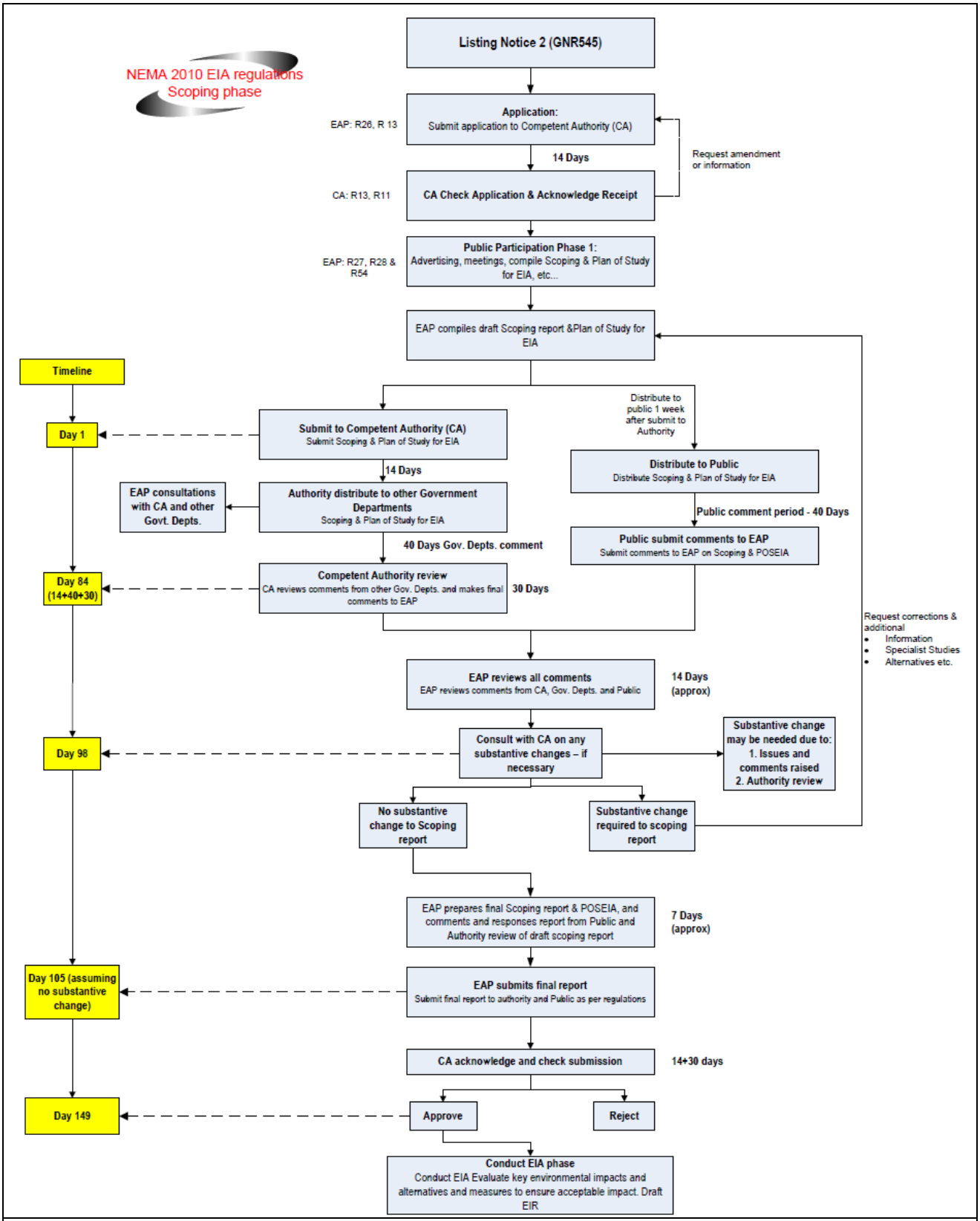


Figure 9-7: Scoping phase flow diagram

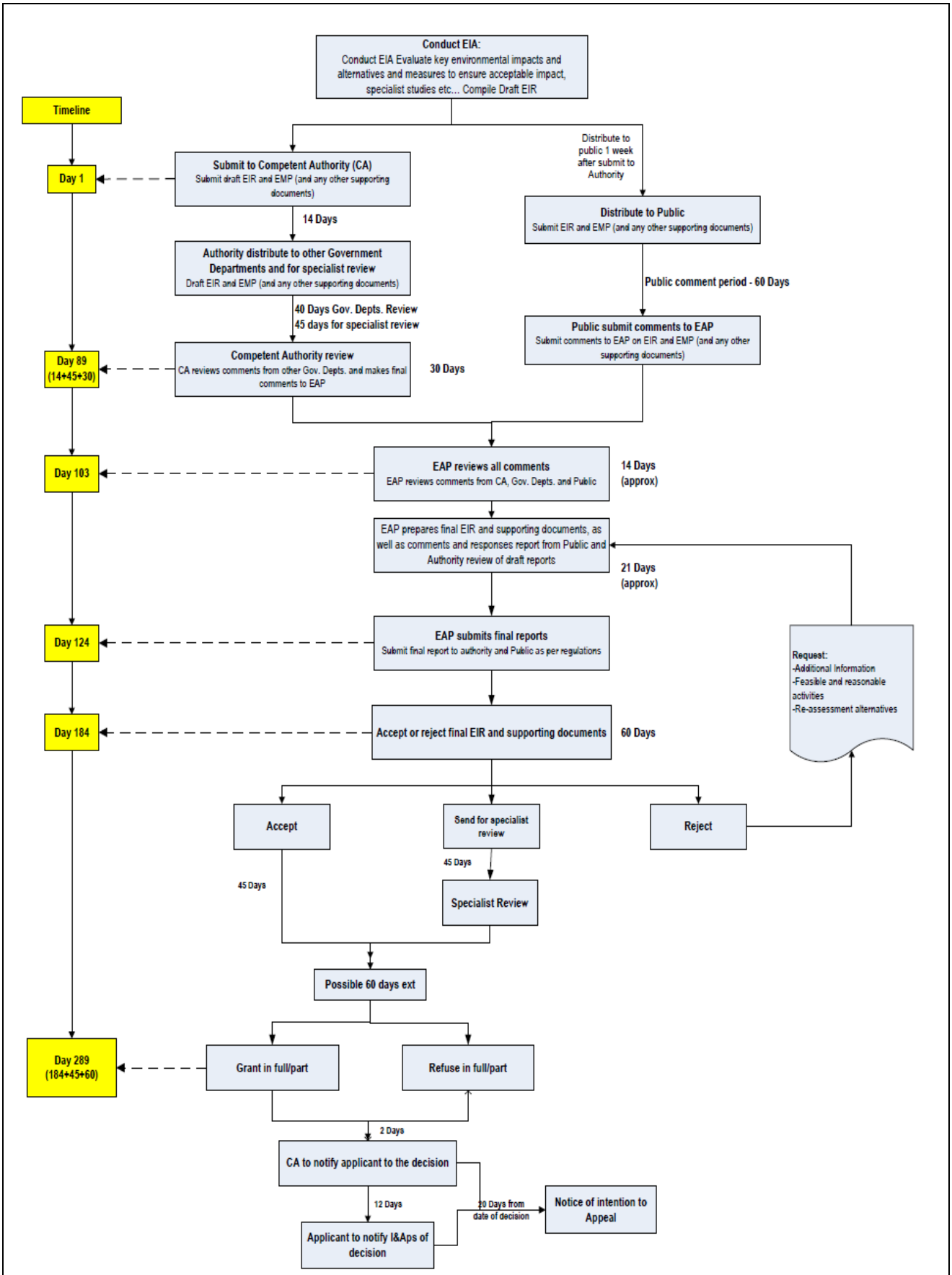


Figure 9-8: EIA phase flow diagram

9.6 PUBLIC PARTICIPATION PROCESS FOR EIA PHASE

The proposed public participation process for the remainder of the Environmental Impact Assessment will consist of:

9.6.1 ADVERTISING AND REPORT COMMENT PERIODS

- Advertise the process as per the EIA regulations (GNR 543 of 18 June 2010).
- Present all registered Interested and Affected Parties, stakeholders and government departments with the opportunity to read and comment on environmental impact assessment reports, including all specialist reports.
- Present registered Interested and Affected Parties, stakeholders and government departments with the opportunity to read and comment on draft environmental management plans and EMPR compiled in terms of regulations.
- Present registered Interested and Affected Parties and stakeholders with the opportunity to read and comment on the IWWMP.
- Present registered Interested and Affected Parties and stakeholders with the opportunity to read and comment on the final reports submitted to LEDET, DEA and DMR.

9.6.2 PUBLIC MEETINGS AND OPEN DAYS

- Hold a public meeting to present and discuss the findings of the Environmental Impact Assessment and related specialist reports.
- Hold a public open day to present and discuss the findings of the EIA and related specialist studies. This open day will give stakeholders and any public the opportunity to come and read reports, discuss the project with specialists and EIA consultants, and have access to photos and reports during the day.
- Undertake various focus group meetings with selected focus groups. These meetings should include meetings with NGOs (i.e. WESSA, EWT, SANBI) as well as focus group meetings with farmers in the area.

10. CONCLUSIONS

Based on the independent evaluation and assessment of the proposed project during the scoping phase by the Environmental Assessment Practitioner (EAP), a Plan of Study for Environmental Impact Assessment (PoSEIA) has been developed. The PoSEIA includes the scope of further specialist studies to be conducted, which would inform the accurate assessment and mitigation of potential environmental impacts that may arise from the proposed project. This would result in the compilation of a detailed EIA Report, EMPR document and IWWMP that would allow the competent authorities (LEDET, DMR, DWA and DEA) to make an informed decision regarding the various authorisations needed for the proposed Volspruit mine project, or components thereof.

In conclusion, it is felt that the scoping study has highlighted numerous areas that will need to be properly evaluated during the EIA phase due to the sensitivity of the site, and the proximity to the Nyl River, as well as various guidelines and policies (i.e. Waterberg EMF) that will need to be addressed. It is felt that the scoping study has been undertaken thoroughly and that authorization be granted to continue with the full Environmental Impact Assessment to adequately quantify and assess the impacts of the proposed Volspruit Mine on the receiving environment.

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12. APPENDIX 1: LOCALITY PLANS AND MAPS

13. APPENDIX 2: LEDET ACKNOWLEDGMENT OF RECEIPT OF EIA APPLICATION AND ACCEPTANCE OF DRAFT SCOPING REPORT

14. APPENDIX 3: DEA ACKNOWLEDGMENT OF RECEIPT OF WASTE LICENCE APPLICATION FORM

15. APPENDIX 4: PUBLIC PARTICIPATION REPORT

16. APPENDIX 5: PREVIOUS STUDIES UNDERTAKEN ON THE FARM VOLSPRUIT

Included in this section is the final summary report - Volspruit hydrogeological survey undertaken in June/July 2010, which includes the summary of findings for three separate studies.

The three studies that were undertaken were:

- Hydrogeological
- Flood lines
- Desktop wetland assessment

17. APPENDIX 6: SOCIO-ECONOMIC SCOPING STUDY

18. APPENDIX 7: BASIC HERITAGE SCOPING REPORT

19. APPENDIX 8: CVS OF LEAD ENVIRONMENTAL CONSULTANTS

20. APPENDIX 9: SPECIALIST'S DECLARATIONS

21. APPENDIX 10: SPECIALIST REVIEW OF DRAFT SCOPING REPORT BY SE SOLUTIONS