November 2016

DRAFT SCOPING REPORT

SMARTY (SOUTH AFRICA) MINERALS INVESTMENT (PTY) LTD

Draft Scoping Report - Application for Mining Right, EA, WML and WUL for Copper Mine near Musina

Submitted to:
Smarty (South Africa) Minerals Investment (Pty) Ltd
Department of Mineral Resources

Please note: due to lack of access to private land, this report is largely based on literature. Pre-project baseline environmental information generated by field investigations after access is obtained will be included in the EIA report to follow

Project Number: 1655245-306398-2

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Executive Summary

Smarty (South Africa) Minerals Investment (Pty) Ltd (Smarty), a company with offices in Sandton, South Africa, have acquired prospecting rights for copper on seven farms near Musina in Limpopo Province. Sufficient ore reserves to support a copper mine and ore beneficiation plant have been demonstrated.

Smarty has submitted applications for a mining right and environmental authorisation to the Department of Mineral Resources and has appointed Golder Associates Africa (Pty) Ltd (Golder) to undertake the required environmental authorisation processes.

The information on pre-project baseline environmental conditions within the area that would be directly affected by the proposed project, as presented in this report, is based on literature, because landowners refused to grant access to the land to enable the environmental scientists to undertake field studies. The necessary fieldwork will be done once access has been granted, and the updated baseline information will be incorporated in the environmental impact assessment report.

The currently available baseline information can be summarised as follows:

Climate

The area has a hot, semi-arid climate with summer temperatures ranging from 22°C to 34°C and winter temperatures from 9°C to 26°C. Mean annual evaporation (2248 mm) far exceeds mean annual precipitation (324 mm). The predominant wind direction is from the east. Wind speeds are generally low to moderate (3 m/s) but strong winds occur briefly during thunderstorms.

Air quality

The proposed project area is located about 5 km to the south-west of the industrial area of Musina, which does not comprise significant heavy industry. Air quality at the project area is typical of an undeveloped rural area, with atmospheric emissions being caused mostly by agriculture, wood being burned for domestic fuel and veld fires towards the end of the winter.

A number of schools and medical treatment facilities occur within 10 km from the proposed project area.

Soil, land use and land capability

Sandy and loam-sand soils of the Hutton, Mispah and Gelenrosa types occur within the proposed project area. The land is non-arable and is only suitable for limited pastoral or forestry use. It is generally not suitable for rain-fed cultivation.

Land uses in the area include game breeding and hunting farms, with some areas being used for grazing. There is an airstrip to the north-west of the project area, a rock crushing operation on the south-eastern perimeter and small cultivated areas less than 1.5 km to the south-west and the south.

Ecology

The study area is located within the Musina Mopane Bushveld and Limpopo Ridge Bushveld vegetation types of the savanna biome. The Limpopo Conservation Plan recognises parcels of land in the eastern portion of the study area as Critical Biodiversity Areas, with remaining portions either uncategorised or considered Ecological Support Areas.

The Musina Nature Reserve is located immediately south of the study area, the Maremani Nature Reserve to the north and the Soutpansberg Important Bird Area (IBA) approximately 30 km south. Several protected species of fauna and flora that occur in these nature reserves may also be present within the project area, which is currently considered to have moderate to high ecological integrity. However, the same vegetation types occur widely over a large area in the vicinity of the proposed project area and the conservation importance of the vegetation on the site is regarded as low.

Surface water

A tributary runs through the proposed project area in a south-easterly direction for about 14 km until it joins the Sand River, which flows in a north-easterly direction until it meets the Limpopo River. There are several non-perennial watercourses within the proposed project area. The Department of Water and Sanitation undertakes river flow and water quality monitoring in the area.

Groundwater

The hydrogeological map series published by the DWS classifies the regional aquifer system as intergranular and fractured, with an average borehole yield between 0.5l/s and 2.0l/s. The maps indicate the water level to be between 20 to 40 metres below ground level (mbgl) with an average of 22.54 mbgl.

No detailed groundwater quality information is available from literature sources, but measured EC values recorded on the groundwater database range from 110 to 770 mS/m with an average of 211mS/m, which represents Class 2 drinking water.

The maps show the average recharge for the study area as being between 1 and 5 mm per annum.

Noise

The primary noise sources in the area are existing farming activities, roads (gravel and tarred) and the distant N1 National Road.

Visual

The features that contribute to the visual character of the project area and its surroundings occurring within a 10 km radius around the site include rocky outcrops and flat to slightly undulating terrain covered in dense bushveld, with the iconic baobab contributing significantly to the “sense of place” of the area. Man-made features within 10 km include the Musina aerodrome, the town of Musina, the railway line, a crusher plant, and construction on the new N1 by-pass and interchange.

There are no prominent water bodies or watercourses present within viewing distance of the project area, but views of the Limpopo River and Sandrivier have strong visual appeal.

Cultural and Heritage

The project area falls within a regional cultural landscape which is host to settlements dating from the Stone Age and Iron Age, historical farmsteads, many graves, and the remains of pre-historic copper mines founded by the Musina and Thsope people that are thought to have continued over a period of more than a thousand years, from AD700 to AD1850.

The copper deposits in the area were investigated in 1903 by Colonel John P Grenfell, who subsequently established the Messina (Transvaal) Development Company Limited in 1904. Mining commenced in 1906 and continued until the closure of the mine in 1991. The town of Messina (renamed Musina in 2002) was founded in 1904 on the farm Berkenrode.

Traffic

A traffic study undertaken during August 2016 found the existing main roads to be adequate for current traffic volumes and the level of service at all intersections in the vicinity of the project site to b excellent.

Socio-economics

The project area spans Wards 2,3,4,5 and 6 in the Musina Local Municipality (MLM) within the Vhembe District Municipality, which covers an area of some 2 140 700 ha and consists of the four local municipalities of Makhado, Musina, Thulamela and Mutale. The total number of households was recorded as 20 042 in 2011 which is a 57.8% increase on the 2001 total of 11 577.

Bulk raw water is purchased from the Department of Water and Sanitation, processed and distributed. There is no backlog on electricity in municipal urban areas. There is however a 1 013 household backlog on electricity supply in the rural villages.

The economy in the VDM is dominated by mining, agriculture and tourism. MLM has been identified as a provincial growth point with significant potential to accelerate the industrialisation process in the province.

The unemployment rate stands at 25% with the highest percentage among the youth aged between 15 to 19 years.

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1.0 INTRODUCTION AND BACKGROUND

Smarty (South Africa) Minerals Investment (Pty) Ltd (Smarty), a company with offices in Sandton, South Africa, have acquired prospecting rights for copper on seven farms near Musina in Limpopo Province. Sufficient ore reserves to support a copper mine and ore beneficiation plant have been demonstrated. As indicated in Table 1-1, the prospecting rights will expire in November 2016 and Smarty have applied for a mining right (MR), environmental authorisation (EA), a waste management licence (WML) and a water use licence (WUL), all of which must be obtained before mining may commence.

Table 1-1: Prospecting rights held by Smarty

Number	Farm	Portions	Minerals	Expiry date
LP/5/1/2/5/1/1/2/930	Plaatje 200 MS Tralee 204 MS Papenbril 205 MS	Portion 2 Remaining Extent	Copper Ore, Iron Ore and Associated Base Minerals	26 November 2016
LP/5/1/2/5/1/1/2/957	Uitenpas 2 MT Messina 4MT	Remaining Extent Portion 40	Not stated on PR	26 November 2016
LP30/5/1/2/5/1/1/2/958	Tralee 204 MS	Remaining Extent	Copper Ore, Iron Ore and Associated Base Minerals	26 November 2016
LP 30/5/1/1/2/1608	Antonvilla 7 MT	Portion 1	Not stated on PR	19 November 2016
LPJ0/5/1/1/2/1610	Hereward 203 MS Vogelenzang 3 MT	Portion 9 and Remaining Extent	Copper	19 November 2016
LP 30/5/1/1/2/1999	Vogelenzang 3 MT Messina 4 MT	Portion 10, 11 and Remaining Extent Portion 30, 49, 50 and Remaining Extent	Copper	Applied for renewal on 19 March 2014, secured not executed, expires 18 March 2017

In terms of the Mineral and Petroleum Resources Development (Act 28 of 2002) (MPRDA), a mining right application (MRA) must be accompanied by a Mining Work Programme (MWP) and a Social and Labour Plan (SLP). These documents were submitted together with the MRA on XX October 2016. The application was accepted by the Department of Mineral Resources (DMR) on XXX 2016.

2.0 PROPONENT AND PRACTITIONER DETAILS

2.1 Details of the proponent

For purposes of this EIA, the following person may be contacted at Smarty:

Table 2-1: Proponent's contact details

Contact Person	Lazarus Nephembani
Address	Block 2, 29 Impala Road, Chislehurston, Sandton, Johannesburg
Telephone	011 059 2888
Fax	011 050 2828
E-mail	lazarus@intl-resource.com

2.2 Details of Environmental Assessment Practitioner

Smarty has appointed Golder Associates Africa (Pty) Ltd (GAA) as the independent Environmental Assessment Practitioner (EAP) to undertake the Environmental Impact Assessment (EIA) that is required to support the application for a MR, WML and WUL.

Golder Associates Africa is a member of the world-wide Golder Associates group of companies, offering a variety of specialised engineering and environmental services. Employee owned since its formation in 1960, the Golder Associates group employs more than 6 000 people who operate from more than 160 offices located throughout Africa, Asia, Australasia, Europe, North America and South America. GAA has offices in Midrand, Pretoria, Florida, Durban, Rustenburg, Cape Town, Maputo and Accra. GAA has more than 300 skilled employees and is able to source additional professional skills and inputs from other Golder offices around the world.

GAA has no vested interest in the proposed project and hereby declares its independence as required by the EIA Regulations.

For purposes of this EIA, the following persons may be contacted at Golder:

Contact Persons	Etienne Roux		Antoinette Pietersen
Purpose	Technical		Public Participation
Address	P O Box 6002 Halfway House 1685		P O Box 6002 Halfway House 1685
Telephone	011 254 4970		011 254 4805
Fax	011 315 0317		011 315 0317
Cell phone	082 774 2045		083 280 5024
E-mail	Eroux@golder.co.za		Apietersen@golder.co.za

2.2.1 Expertise of environmental assessment practitioners

2.2.1.1 Qualifications

Etienne Roux holds an MSc degree in physical chemistry from the University of Pretoria (1966) and an MBL degree from the University of South Africa (1974). He also completed a Development Programme in Labour Relations at the University of South Africa (1984). He has 53 years' experience in mining and industry, the last 22 years being in environmental impact assessment and auditing processes.

Antoinette Pietersen holds a BA (Hons) in psychology from the Potchefstroom University for Christian Higher Education. She has more than 18 years' experience in the design, facilitation and management of public participation processes to local and international standards. She is a past President of the Southern African

Affiliate of the International Association for Public Participation (IAP2) and an internationally certified trainer in public participation processes.

2.2.1.2 Summary of past experience

2.2.1.2.1 Etienne Roux

1962-1966: African Explosives and Chemical Industries Ltd, Modderfontein – research and development work on industrial electrochemical processes;

1967-1993: Foskor Ltd, Phalaborwa – analytical chemistry, systems analysis, research and development, geological exploration, mining, production, tailings storage, environmental management, strategic corporate planning;

1993-2005: Industrial Development Corporation: Responsible for developing corporate environmental, health and safety policy and capability, managing environmental aspects of IDC's larger industrial, mining and agricultural projects, managing remediation programs on polluted sites, designing and implementing an EHS risk assessment methodology specifically for a financial institution and overseeing its application. Participated in more than 50 EIAs within South Africa and seven other African countries, several with involvement from World Bank, IFC, European Investment Bank, African Development Bank, Kreditanstalt für Wiederaufbau, provided environmental guidance on IDC's investment decisions and served as director on boards of two IDC subsidiaries.

2006 – Present: Golder Associates Africa (Pty) Ltd – Has undertaken more than 20 complete EIAs, 5 environmental audits and several environmental due diligence investigations.

2.2.1.2.2 Antoinette Pietersen

1995-1996: Department of Water Affairs and Forestry –Communications Officer responsible for internal and external newsletters, preparation of media releases and radio interviews and event coordination, including press conferences and ministerial functions.

1996 – Present: Public participation practitioner at environmental consultancies Strategic Environmental Focus, Ferret Mining and Environmental Services, and Golder Associates Africa (Pty) Ltd.

2.3 Description of the property

Smarty has applied for a mining right on the farm portions listed in Table 1-1, where Smarty holds prospecting rights. The surveyor general codes, surface right owners and surface areas of these farm portions are listed in Table 2-2.

Table 2-2: Details of area applied for

Farm	Prospecting Right	Surveyor General Codes	Area (hectare)	Surface Right Owner
Vogelenzang 3 MT	1610PR	T0MT00000000000300000	1526.431727	Musina Local Municipality
	1610PR	T0MT00000000000300009	71.103752	Messina Investments Ltd
	1999PR	T0MT00000000000300010	0.112753	Jacobus Daniel Venter Jennifer Lynette Venter
	1999PR	T0MT00000000000300011	0.170743	Jacobus Daniel Venter
Messina 4 MT	1999PR	T0MT00000000000400000	278.592251	Musina Local Municipality
	1999PR	T0MT00000000000400030	11.740779	De Beers Consolidated Mines Ltd
	957PR	T0MT00000000000400040	39.983736	Central Africa Crushers CC
Tralee 204 MS	930PR	T0MS00000000020400002	518.144266	Nathaniel Vos
	958PR	T0MS00000000020400006	344.909899	Plaatjie Game Farm CC

Farm	Prospecting Right	Surveyor General Codes	Area (hectare)	Surface Right Owner
Hereward 203 MS	1610PR	T0MS00000000020300000	750.333993	Nari Danga Safaris CC
Papenbril 205 MS	930PR	T0MS00000000020500000	677.261639	Nari Danga Safaris CC
Plaatje 200 MS	930PR	T0MS00000000020300000	993.829525	Plaatjie Game Farm CC
Uitenpas 2 MT	957PR	T0MT00000000000200000	2407.6431	H Schoeman Investments CC
Antonvilla 7 MT	1608PR	T0MT00000000000700001	3122.101182	Republiek van Suid-Afrika

2.4 Locality map

The mining right being applied for is located in the Magisterial District of Musina in the Limpopo Province. See Figure 2-1.

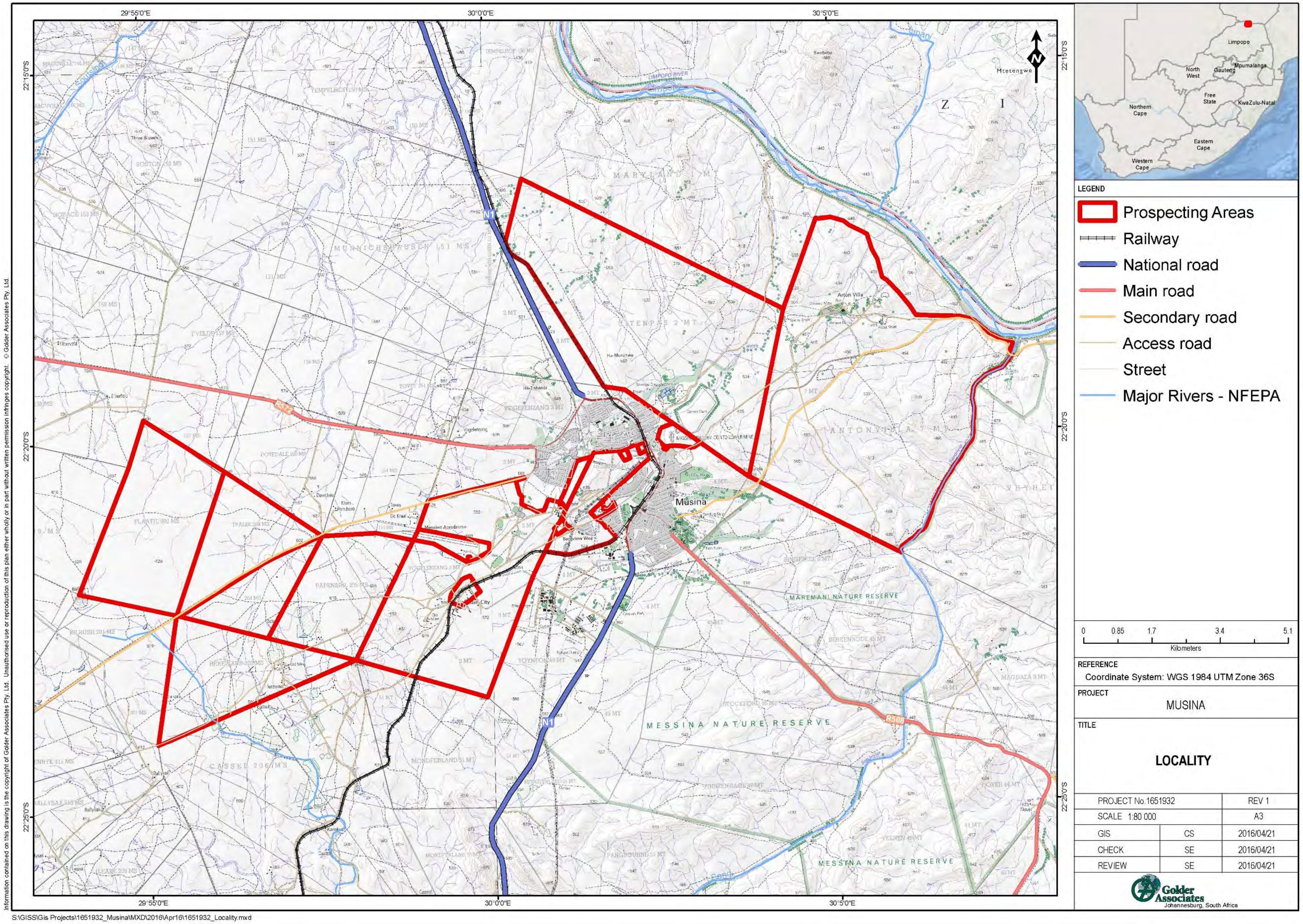

Figure 2-1: Location of Smarty mining right application areas

2.4.1 Magisterial District and relevant Local Authority

The mining right area applied for falls within the Musina Magisterial District and the Musina Local Municipality, which are located in the Vhembe District Municipality of the Limpopo province.

2.4.2 Landowners and use of immediately adjacent land

The proposed mining area is surrounded mainly by game farms. The surface right owners of the various farm portions are indicated in Table 2-2.

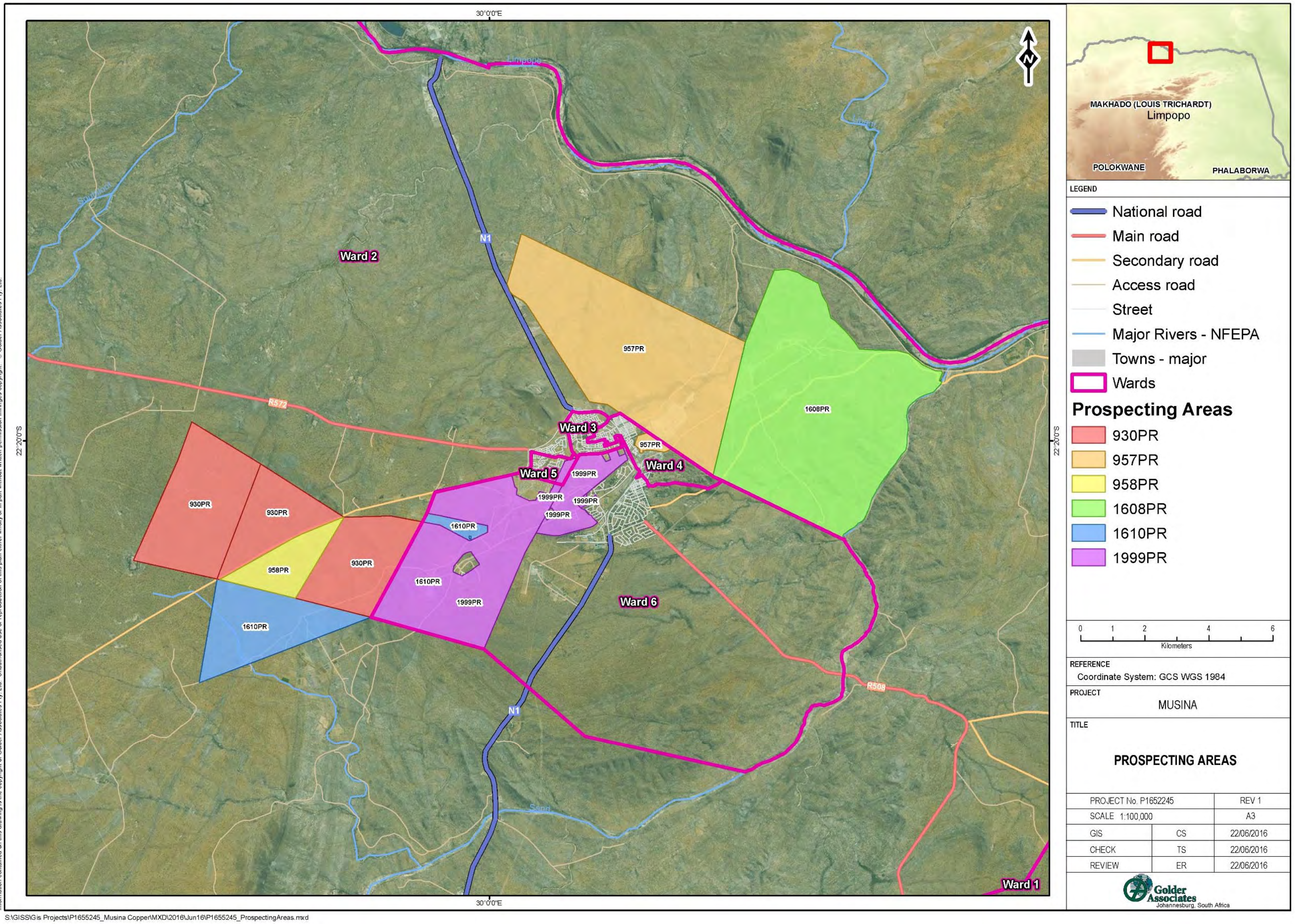

Figure 2-2: Prospecting rights owned by Smarty

2.5 Description and Scope of the Proposed Overall Activity

Smarty (South Africa) Minerals Investment (Pty) Ltd (Smarty) acquired the prospecting rights listed in Table 2-2 and shown in outline on Figure 2-1 from BSC Resources Limited during 2015. Smarty commissioned Golder and Ukwazi Mining Solutions (Pty) Ltd (Ukwazi) in March 2016 to conduct a mining study on a scoping level of confidence and to compile a Mining Work Programme (MWP) as a requirement of the Mining Right Application (MRA) (Eckstein, S;, April 2016). Ukwazi sub-contracted ATEC Project Management and Consulting (Pty) Ltd (ATEC PMC) to provide assistance with the plant and infrastructure aspects of the study (Jacobs, A;, May 2016).

The project components will include an opencast mine, an ore beneficiation plant comprising crushing, screening, flotation and/or heap leaching, possibly electro-winning and/or solvent extraction, tailings disposal and supporting infrastructure.

2.5.1 Mining operations

Geophysical survey work was undertaken on the LP1610PR prospecting right in the southwestern portion of the project area by Remote Exploration Services (RES) in late 2014 (Eckstein, S;, April 2016).

The ground magnetic survey consisted of a total of 118 km of line data collected as northwest-southeast lines spaced 50m apart. The induced polarisation (IP) survey consisted of a gradient array survey on a 100m spacing. East-west trending lines were surveyed at a station spacing of 25m utilising current injection points spaced 3 km apart. Pole-Dipole IP was undertaken along two approximately 800m lines at a station spacing of 25m.

MSA drilled five diamond holes totalling 2 220 metres on the LP1610PR prospecting right. The five holes intersected several sulphide mineralization zones with an average true thickness of 6m to 50m, and average copper content of 0.5 to 0.8% Cu, from vertical 165m to 470m. The drillholes formed part of the database used in the resource estimation.

Sufficient resources were proven to support a conventional drill and blast, truck and shovel opencast mining operation at projected mining and production costs and copper prices for about 20 years. The mining operations will take place in two areas known as Molly Too and 67 Area. The locations of these two areas and the layout of the supporting infrastructure are shown schematically on Figure 2-3. The infrastructure footprint sizes are listed in Table 2-3.

Table 2-3: Footprint sizes of mining areas and associated infrastructure

Item	Footprint (hectare)
67 Area opencast	32.9
Contractor laydown area	27.4
Heap leach pads	19.7
Molly Too opencast	88.9
Plant footprint	99.9
Tailings storage facility	180.4
Topsoil stockpile	9.2
Topsoil stockpile	36.0
Waste rock – 67 Area	104.3
Waste Rock – Molly Too area	358.6
Total	**957.5**

Mining will commence with the removal and separate stockpiling of topsoil and subsoil and the establishment of an access ramp for the removal of overburden, ore and waste rock from each opencast mine. The placement and layout of the processing plant and other infrastructure will be designed to minimise hauling distances from the mines to the plant, overburden stockpiles and waste rock dumps.

The topsoil, subsoil, overburden and waste rock will be stored in temporary stockpiles and backfilled into the opencast voids in reverse sequence, i.e. waste rock first and topsoil last.

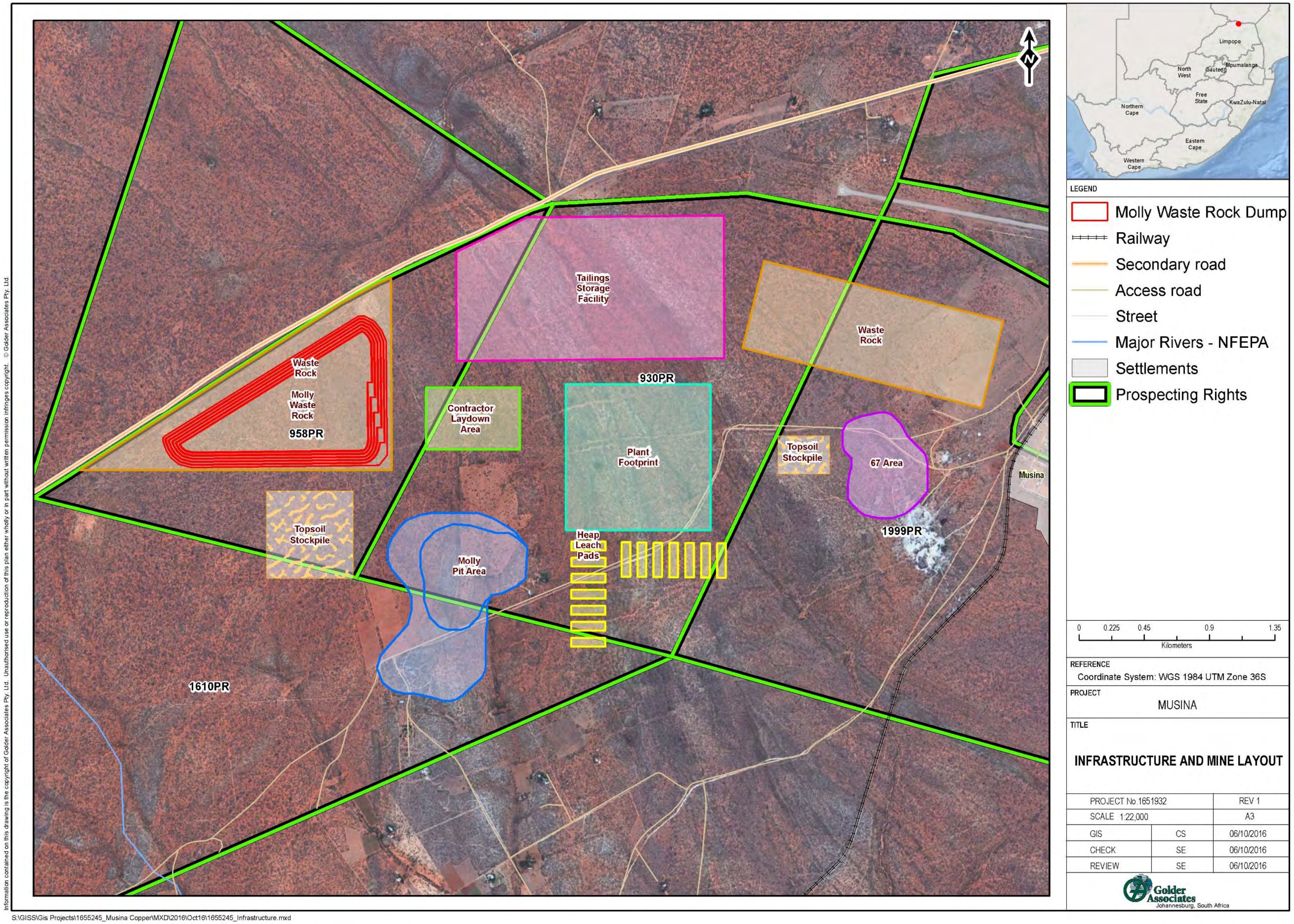

Figure 2-3: Location of opencast mining areas and mining infrastructure

The 67 Area opencast mine will be about 400 m in width and 700 m in length. The mine design for the opencast operation involves two pushbacks and is illustrated in Figure 2-4.

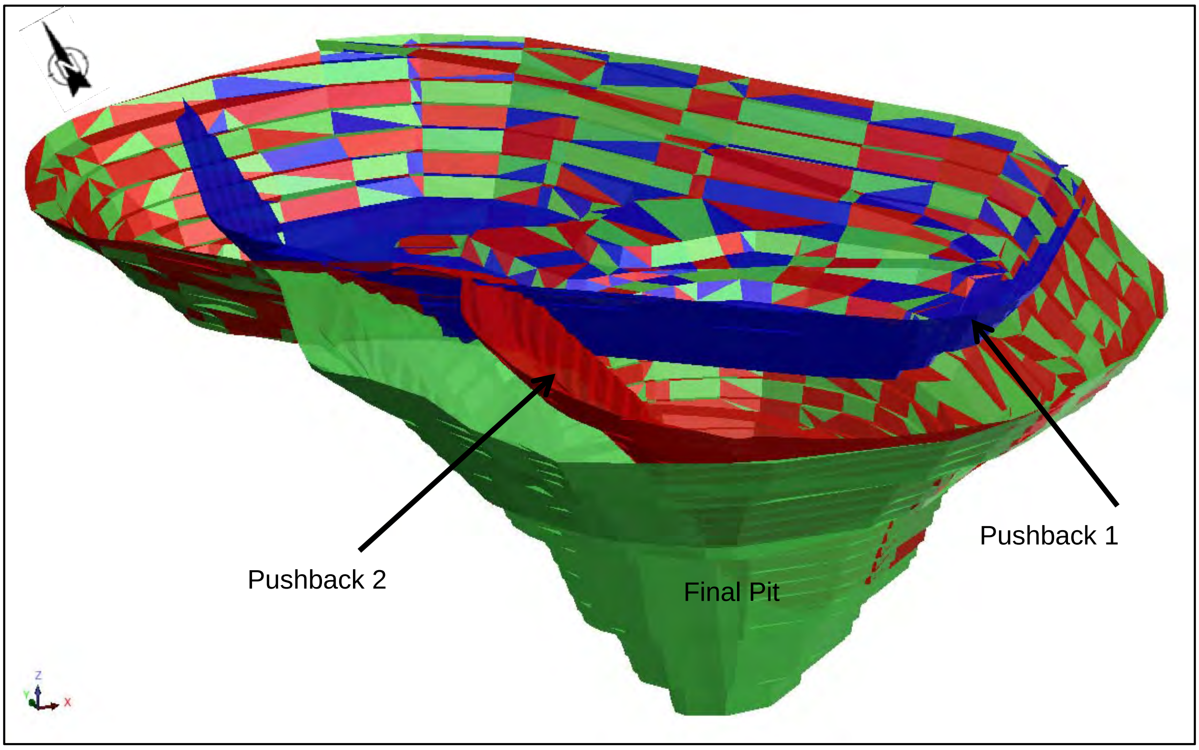

Figure 2-4: Opencast mine design for 67 Area

The average width and length of the Molly Too pit will be about 500 and 700 metres respectively. The pit design, involving only one pushback, is illustrated in Figure 2-5.

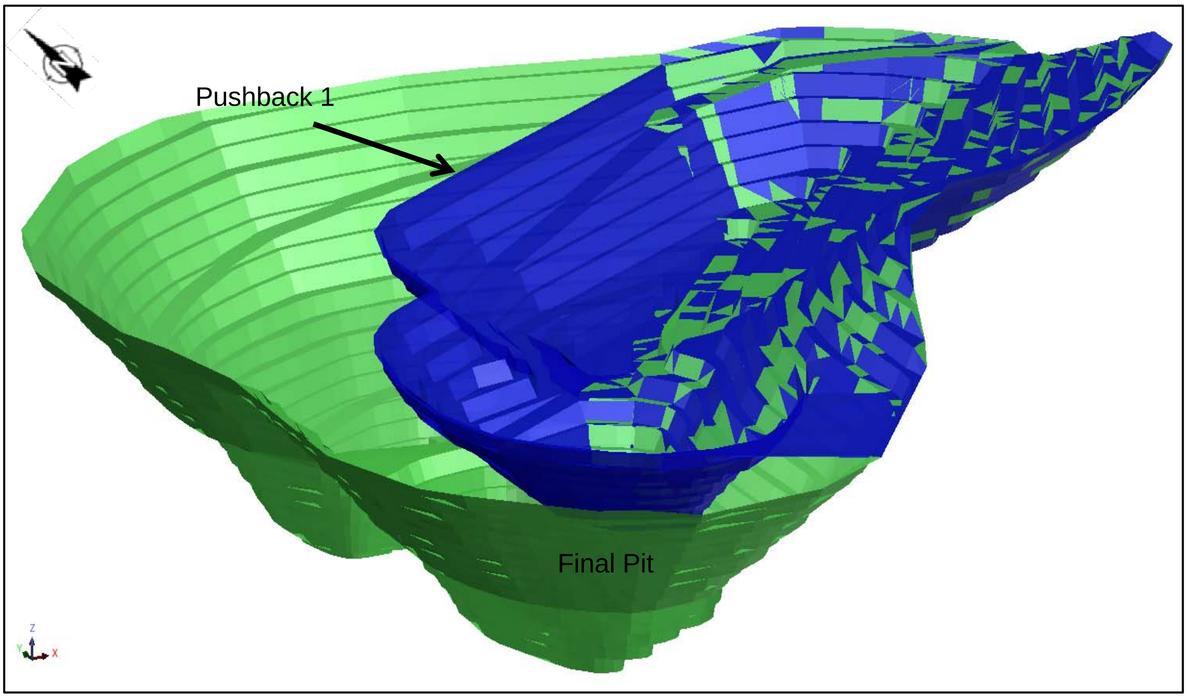

Figure 2-5: Mine design for Molly Too opencast

2.5.2 Ore processing and copper recovery

Copper occurs in the form of oxide copper minerals such as malachite in the weathered layers near the surface. The deeper ore contains copper sulphides such as chalcocite, chalcopyrite bornite. Different processes in separate processing plant circuits will be applied to recover the oxide and sulphide copper minerals.

The initial ore processing circuit will operate on the shallow ore containing copper oxide minerals and will comprise heap leaching, solvent extraction and electro-winning to produce copper cathodes. The heap leaching process takes from 150 to 300 days, which will result in a time delay before copper cathodes are available for sale. Heap leaching is a batch process that requires a number of active heap leach pads to enable the production of copper metal on a semi-continuous basis.

As the mining operations progress, sulphide ore will become available and a flotation circuit will be added to the processing plant to recover the sulphide copper minerals. Oxidic and sulphidic copper ores will be treated separately. This requires the crushing circuit to be operated in batch mode, first crushing oxidic ore, followed sulphidic ore later in the life of the mine. The two ore types will be stockpiled separately.

2.5.2.1 Crushing and screening

The liberation size for heap leaching is 15 to 25mm. The liberation size for sulphide flotation is typically in the range of 75 to 150 microns.

The run of mine (RoM) ore will be crushed to <150 mm by a primary jaw crusher and passed over a scalping screen. The oversize will be fed to a cone crusher. The cone crusher product and scalping screen undersize, both typically <50 mm, will be combined and passed over a second stage scalping screen. The oversize will be fed to a second stage cone crusher. This cone crusher product and scalping screen undersize, both typically <15 mm, will be combined.

When crushing mixed ore, the oversize from the second stage scalping screen will be stockpiled for heap leaching. The combined product will fed to a third stage scalping screen, the oversize of which will be fed to a third stage cone crusher. The cone crusher product will be recycled to the third stage scalping screen. The scalping screen undersize is the final crushed product, typically typically minus 4 mm and containing the copper sulphides.

2.5.2.2 Oxide copper recovery circuit

The oxide copper recovery circuit comprises heap leaching, solvent extraction and electro-winning as illustrated in Figure 2-6.

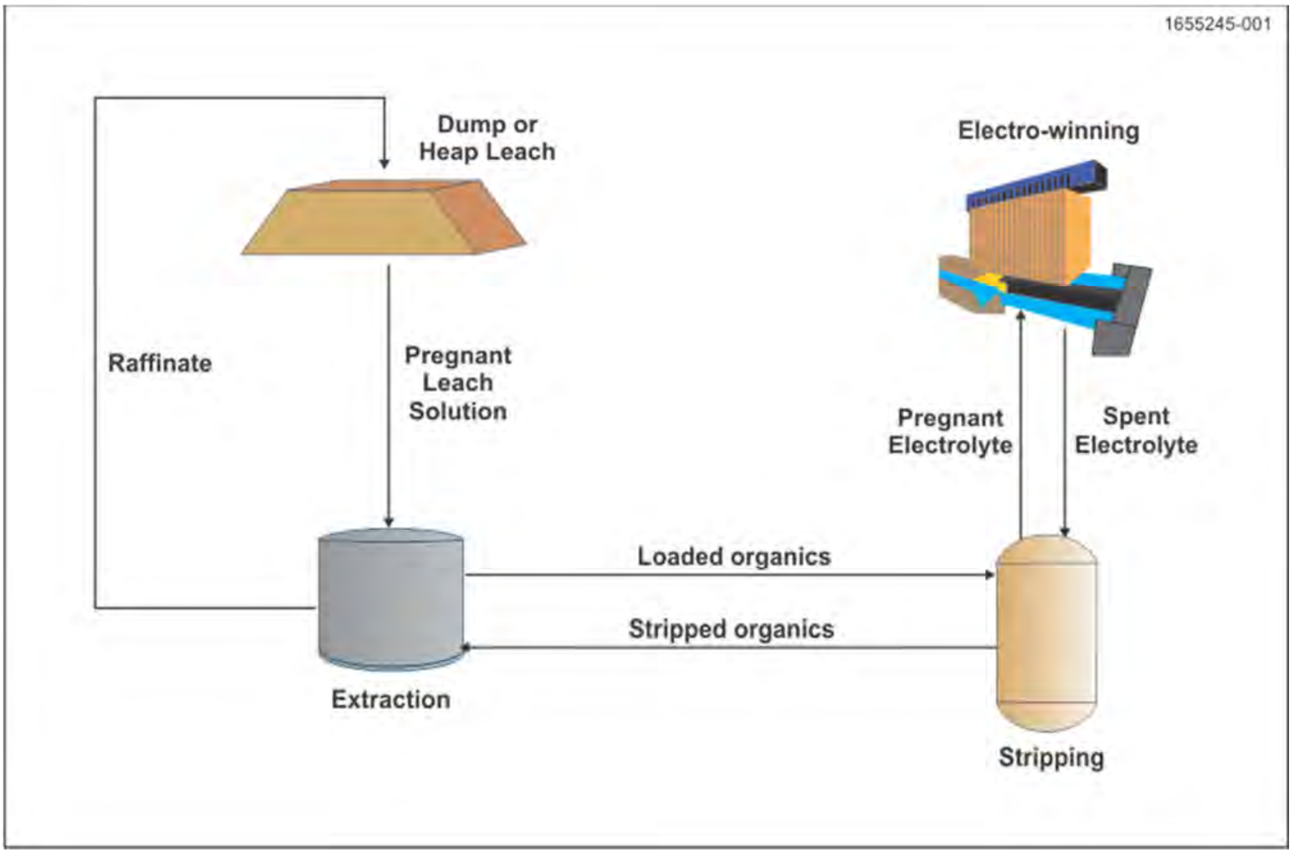

Figure 2-6: Simplified flow diagram for oxide copper recovery by leaching, solvent extraction and electro-winning

A leach pad is built by levelling a suitable area and laying down a protective layer of clay followed by an impermeable, acid proof plastic liner such as poly-ethylene. The crushed ore is deposited on several leach pads in heaps and weak sulphuric acid is added to the top of the heap using either sprays or drip irrigation to dissolve the acid soluble oxide coper minerals and form a pregnant liquor solution (PLS). The heaps are divided into cells which allow for sequential leaching of specific areas within a heap. The PLS is drained into a pond. At the end of each completed cycle, the remaining acid solution is rinsed from the heap, which is left in situ.

The copper is extracted from the PLS with an organic solvent (extractant), sulphuric acid is added to the aqueous phase or raffinate to restore its original acidity and it is recycled back to the heap.

The copper bearing organic phase is then stripped of its copper by counter-current contact with a strong acid solution. The copper bearing acid solution is sent to the electro-winning plant while the stripped organic phase is recycled back to the extraction plant and dissolved copper is recovered as metallic copper by electrochemical reduction at the cathodes of the electro-winning cells. The spent electrolyte is recycled to the copper stripping circuit.

2.5.2.3 Milling

Only the copper sulphide ore will be milled. The <4 mm crushed ore will be fed from the stockpile to a ball mill. Water will be added to the ball mill product to produce a slurry containing 35 to 40% solids, which will be pumped to cyclones sized to cause particles below the sulphide mineral liberation size (as determined by microscopic examination) to report to the cyclone overflow. The cyclone underflow will be returned to the ball mill feed to close the circuit.

2.5.2.4 Flotation

The sulphide copper minerals are recovered in a standard flotation circuit comprising a conditioner, where lime, collectors and frothers are added followed by banks of flotation cells configured as roughers, scavengers and cleaners. The cleaner concentrate is dewatered by thickening and filtration and the scavenger tails are sent to the oxide flotation circuit.

The scavenger tails are conditioned with a sulphiding agent is added to sulphidize the oxide copper minerals and make them amenable to conventional flotation. Collectors and frothers are added and a rougher/scavenger/cleaner flotation circuit, similar to that for sulphide flotation, is used.

The cleaner product (oxide copper) is sent to the dewatering circuit. The scavenger tails are thickened and pumped to a tailings storage facility (TSF). The water recovered as thickener overflow is recycled to the sulphide flotation plant.

The planned production rate of flotation concentrate is too low to justify the high capital cost of installing a copper smelter and the concentrate will be sold as is.

2.5.3 Listed Activities

Smarty has applied for a mining right on the farm portions where it holds prospecting rights (see Figure 2-2), and environmental authorisation for the development of supporting infrastructure. The listed activities that require environmental authorisation in terms of the EIA Regulations GN R. 983, 984 and 985 that commenced on 8 December 2014 and the waste management Regulations GN R.632 and R.633 that commenced on 24 July 2015 are indicated in Table 2-4.

Table 2-4: Listed activities requiring environmental authorisation

Listing Notice	Activity No	Description
GN R.983 Basic Assessment	9	Pipelines and supporting infrastructure will be developed to transport industrial water and stormwater
	10	Transport of tailings from the flotation plant to the tailings storage facility (TSF) and water from the TSF back to the plant will take place in pipelines. There will also be stormwater conveyances and sewage lines.
	11	The mine and plant will require a power line of more than 33 but less than 275 kilovolts
	12	The infrastructure development will include: ■ Canals or channels exceeding 100 square metres in size; ■ Pollution control dams exceeding 100 square metres in size; ■ Bulk storm water outlet structures exceeding 100 square metres in size; ■ Buildings exceeding 100 square metres in size; and ■ Infrastructure or structures with a physical footprint of 100 square metres or more within 32 metres of a watercourse, measured from the edge of a watercourse.
	13	Facilities and infrastructure for the off-stream storage of water in dams and reservoirs, with a combined capacity of 50 000 cubic metres or more will be developed.

Listing Notice	Activity No	Description
	14	Diesel storage tanks with a combined capacity of about 450 cubic metres will be installed.
	19	The opencast mining will result in the removal of more than 5 cubic metres of soil, sand, grit, pebbles and rock from a watercourse.
	24	Access roads and haul roads wider than 8 metres will be developed.
GN R.984 Scoping and Impact Assessment	6	Smarty will need a Water Use Licence for the impoundment of mine-affected water in a pollution control dam and a Waste Management Licence for the deposition of mining residues such as waste rock and tailings.
	15	More than 20 ha of indigenous vegetation will be cleared during mining and infrastructure development
	16	"The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 metres or higher or where the high-water mark of the dam covers an area of 10 hectares or more."
	17	Smarty has applied for a mining right, which it will require in order to undertake the contemplated mining activities and to develop the associated infrastructure, structures and earthworks directly related to the extraction of the mineral resource.
	21	Smarty will undertake activities associated with the primary processing of a mineral resource including winning, reduction, extraction, classifying, concentrating, crushing, screening and washing but will not undertake smelting, beneficiation, refining, calcining or gasification of the mineral resource.
GN R.632 and R.633, 24 July 2015	Category B (11)	The mine will require a waste management licence for the storage/disposal of mine residues (waste rock and tailings)

Please note:

- *With reference to activity 11 of GN R.983, Eskom will be responsible for establishing the infrastructure to supply the power requirements to the site;*

  While Eskom would normally also be responsible for obtaining the required environmental authorisation, there have been instances where the site owner has assumed this responsibility. Smarty will finalise this aspect in consultation with Eskom during the EIA process;

- *GN R.983, activity 14 or GN R.984 activity 4 will apply, depending on the combined storage capacity for diesel fuel; and*
- *GN R.983, activity 30 will apply only if the site falls within a listed ecosystem and one or more of the activities to be undertaken has been gazetted as a "threatening process".*

Application for Environmental Authorisation (EA) must be made to the Department of Mineral Resources (DMR). The role of the DMR will be to evaluate the Scoping and EIA Reports and the draft EMPr, and, if the documents are acceptable, to issue a Mining Right, an Environmental Authorisation and a Waste Management Licence for the undertaking of the listed activities applied for.

2.5.4 Specific activities to be undertaken

The specific activities that will be undertaken during the life of the project will include:

- Drilling of infill boreholes for detailed mine planning as and when necessary;
- Stripping and stockpiling of topsoil in front of the advancing opencast mining front, with bulldozers and front end loaders;
- Drilling and charging of blast holes, followed by blasting, where necessary. Vibration levels and fly rock occurrence will be recorded during each blast and used to plan subsequent blasts.
- Excavation, loading, hauling and transport of overburden and ore. Bench heights will be 10 metres. Haul trucks will transport the ore to the beneficiation plant and the overburden and waste rock to temporary stockpiles alongside the opencast;
- Stockpiling of overburden, waste rock and copper concentrate from the flotation plant. The overburden will be stockpiled separately from the topsoil and the waste rock;
- Backfilling the opencast voids with waste rock, overburden and topsoil, in that order, followed by fertilisation and re-vegetation with locally indigenous species of grass, shrubs and trees.
- Constructing and operating a storm water control system comprising diversion berms, collection channels, and a pollution control dam;
- Constructing and operating a water supply dam and boreholes for monitoring, mine dewatering and water supply purposes;
- Constructing and operating the oxide and sulphide ore beneficiation plants;
- Crushing, screening and milling the ore to appropriate size ranges as described in sections 2.5.2.1 and 2.5.2.3;
- Construction of new heap leach pads as and when needed;
- Recovery of copper cathodes from the oxide copper minerals by heap leaching, solvent extraction and electro-winning as described in section 2.5.2.2;
- Recovery of copper as a concentrate of sulphide minerals by flotation as described in section 2.5.2.4; and
- Transporting the copper products from the mine to market;
- Decommissioning and removing all equipment, removing infrastructure, backfilling the opencast voids, making the ex-operating areas safe, shaping them to be free draining and rehabilitating them to a condition fit for grazing or game farming.

3.0 POLICY AND LEGISLATIVE CONTEXT

This section provides a brief overview of the legal requirements that must be met by this project.

3.1 Mineral and Petroleum Resources Development Act

In terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) and the MPRDA Regulations GN R. 527, an application for a mining right must be supported by an EIA process. In terms of Regulation 3 of GN R. 527, consultation must take place with interested and affected parties (I&APs). In terms of the latest EIA Regulations (see section 3.2) a scoping report conforming to Appendix 2 of GN R.982 must be submitted to the DMR, followed by an environmental impact assessment report conforming to Appendix 3 of GN R.982 and an environmental management programme conforming to Appendix 4 of GN R.982. These documents must also be aligned with the templates prescribed by the DMR.

In terms of Section 41 of the MPRDA and Regulations 53 and 54, the holder of a mining right must make financial provision, in a manner acceptable to the DMR, for the rehabilitation of negative environmental impacts, both for a planned closure at the end of the life of the mine, and for an unplanned closure during the life of the mine.

3.2 National Environmental Management Act

In terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as amended, and the EIA Regulations, an application for environmental authorisation for certain listed activities must be submitted to the provincial environmental authority, the national authority (Department of Environmental Affairs, DEA), depending on the types of activities being applied for or, when mining and mineral processing activities are involved, the Department of Mineral Resources (DMR) - see section 3.1 above.

The current EIA regulations, GN R.982, GN R.983, GN R.984 and GN R.985, promulgated in terms of Sections 24(5), 24M and 44 of the NEMA and subsequent amendments, commenced on 8 December 2014. GN R.983 lists those activities for which a Basic Assessment is required, GN R.984 lists the activities requiring a full EIA (Scoping and Impact Assessment phases) and GN R.985 lists certain activities and competent authorities in specific identified geographical areas. GN R.982 defines the EIA processes that must be undertaken to apply for Environmental Authorisation.

The activities requiring environmental authorisation and/or licensing in terms of the NEMA and NEMWA are included in Table 2-4. The EIA process has been undertaken in accordance with the requirements stipulated in GN R.982 and the DEA's guidelines on public participation, published as GN 657 in May 2006.

3.3 National Water Act

The National Water Act, 1998 (Act No. 36 of 1998) (NWA) is the primary legislation regulating both the use of water and the pollution of water resources. It is applied and enforced by the Department of Water and Sanitation (DWS).

Section 19 of the National Water Act regulates pollution, which is defined as "the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it:

- less fit for any beneficial purpose for which it may reasonably be expected to be used; or
- harmful or potentially harmful to -
  - the welfare, health or safety of human beings;
  - any aquatic or non-aquatic organisms;
  - the resource quality; or
  - property."

The persons held responsible for taking measures to prevent pollution from occurring, recurring or continuing include persons who own, control, occupy or use the land. This obligation or duty of care is initiated where there is any activity or process performed on the land (either presently or in the past) or any other situation which could lead or has led to the pollution of water.

The following measures are prescribed in the section 19(2) of the NWA to prevent pollution:

- cease, modify or control any act or process causing the pollution;
- comply with any prescribed standard or management practice;
- contain or prevent the movement of pollutants;
- eliminate any source of the pollution;
- remedy the effects of pollution; and
- remedy the effects of any disturbance to the bed or banks of a watercourse.

The NWA states in Section 22 (1) that a person may only use water:

- without a licence –
  - (i) if that water use is permissible under Schedule 1;
  - (ii) if that water use is permissible as a continuation of an existing lawful use; or
  - (iii) if that water use is permissible in terms of a general authorisation issued under section 39;
- if the water use is authorised by a licence under this Act; or
- if the responsible authority has dispensed with a licence requirement under subsection (3).

Water use is defined in Section 21 of the NWA. Smarty's proposed mining operations at Musina may involve the following water uses:

a) taking water from a water resource;

b) storing water;

c) impeding or diverting the flow of water in a watercourse;

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; and

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.

Regulation 704 of 4 June 1999 defines the manner in which rainwater falling or flowing onto a mining area or an industrial site must be managed and requires *inter alia* the following:

a) Separation of clean (unpolluted) water from dirty water;

b) Collection and confinement of the water arising within any dirty area into a dirty water system;

c) Design, construction, maintenance and operation of the clean water and dirty water management systems so that it is not likely for either system to spill into the other more than once in 50 years;

d) Design, construction, maintenance and operation of any dam that forms part of a dirty water system to have a minimum freeboard of 0.8 metres above full supply level, unless otherwise specified in terms of Chapter 12 of the Act; and

e) Design, construction, and maintenance of all water systems in such a manner as to guarantee the serviceability of such conveyances for flows up to and including those arising as a result of the maximum flood with an average period of recurrence of once in 50 years.

3.4 National Environmental Management: Waste Act

The National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEMWA) commenced on 1 July 2009. In terms of this Act, all listed waste management activities must be licensed and in terms of Section 44 of the Act, the licensing procedure must be integrated with the environmental impact assessment process.

Government Notice 921, which commenced on 29 November 2013, lists the waste management activities that require licensing in terms of the NEMWA. Licence applications for activities involving hazardous waste must be submitted to the national authority, the Department of Environmental Affairs (DEA) and those for general waste to the provincial authority, in this case the LDEDET.

One of the major amendments effected by the National Environmental Management Amendment Act 2014 is the insertion of section 24S, as a result of which the NEMWA became applicable to mining residue deposits and residue stockpiles, as follows:

''Management of residue stockpiles and residue deposits

24S. *Residue stockpiles and residue deposits must be deposited and managed in accordance with the provisions of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), on any site demarcated for that purpose in the environmental management plan or environmental management programme in question.''*

Mining residues were classified as hazardous wastes by default In terms section 18, Schedule 3 of the National Environmental Management: Waste Amendment Act, 2014 (Act No. 26 of 2014) (NEMWAA), which commenced on 2 June 2014. In terms of Regulations GN R.632 and R.633, which commenced on 24 July 2015, mining residues must be characterised and classified, and the design and management of residue stockpiles and deposits must be based on an assessment of the potential impacts and risks.

3.5 National Environmental Management: Air Quality Act

The main objectives of the National Environmental Management: Air Quality Act 2004 (Act no. 39 of 2004) (NEM: AQA) are to protect the environment by providing reasonable legislative and other measures to:

- Prevent air pollution and ecological degradation;
- Promote conservation; and
- Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development in alignment with Sections 24a and 24b of the Constitution of the Republic of South Africa.

The Act has devolved the responsibility for air quality management from the national sphere of government to local spheres of government (district and local municipal authorities), who are tasked with baseline characterisation, management and operation of ambient monitoring networks, licensing of listed activities, and development of emissions reduction strategies.

The National Ambient Air Quality Standards (NAAQS) for common pollutants, as set in terms of the NEM:AQA, are reproduced in Table 3-1.

Table 3-1: South African Ambient Air Quality Standards for Criteria Pollutants

Pollutant	Averaging Period	Limit Value (µg/m^3)	Limit Value (ppb)	Frequency of Exceedance	Compliance Date
Sulphur dioxide (SO_2)[(a)]	10 minute	500	191	526	Immediate
	1 hour	350	134	88	Immediate
	24 hours	125	48	4	Immediate
	1 year	50	19	0	Immediate
Nitrogen dioxide (NO_2)[(b)]	1 hour	200	106	88	Immediate
	1 year	40	21	0	Immediate
Particulate matter <10 micrometres in diameter (PM_{10})[(c)]	24 hour	75	-	4	Immediate
	1 year	40	-	0	Immediate
Particulate matter <2.5 micrometres in diameter ($PM_{2.5}$)[(d)]	24 hours	65	-	4	Immediate
	24 hours	40	-	4	01/01/2016 – 31/12/2029
	24 hours	25	-	4	01/01/2030

Pollutant	Averaging Period	Limit Value (µg/m³)	Limit Value (ppb)	Frequency of Exceedance	Compliance Date
	1 year	25	-	0	Immediate
	1 year	20	-	0	01/01/2016 – 31/12/2029
	1 year	15	-	0	01/01/2030
Ozone (O_3)(e)	8 hours	120	61	11	Immediate
Lead (Pb) (f)	1 year	0.5	-	0	Immediate
Carbon monoxide (CO)(g)	1 hour	30,000	26,000	88	Immediate
	8 hour (1 hour averages)	10,000	8,700	11	Immediate
Benzene (C_6H_6) (h)	1 year	5	1.6	0	01/01/2015

a. *The reference method for the analysis of SO_2 shall be ISO 6767*
b. *The reference method for the analysis of NO_2 shall be ISO 7996*
c. *The reference method for the determination of the particulate matter fraction of suspended particulate matter shall be EN 12341*
d. *The reference method for the analysis of $PM_{2.5}$ shall be EN14907*
e. *The reference method for the analysis of ozone shall be the UV photometric method as described in ISO 13964*
f. *The reference method for the analysis of lead shall be ISO 9855*
g. *The reference method for analysis of CO shall be ISO 4224*
h. *The reference methods for benzene sampling and analysis shall be either EPA compendium method TO-14 A or method TO-17*

The National Dust Control Regulations (GN R.827), which were promulgated on 1 November 2013, define acceptable dust fall rates for residential and non-residential areas as listed in Table 3-2.

Table 3-2: Acceptable dust fall rates

Defined areas	Dust fall rate (mg/m²/day over a 30 day average)	Permitted frequency of exceedance
Residential areas	Dust fall < 600	Two per annum (not in sequential months)
Non-residential areas	600 < Dust fall < 1200	Two per annum (not in sequential months)

Smarty will not undertake copper smelting or roasting or any other of the activities listed in GN 893 of 22 November 2013 that would require an atmospheric emission licence (AEL), but it will have to operate within the NAAQS and the National Dust Control Regulations.

3.6 Need and Desirability of Proposed Activities

Copper occurs in metallic form nature, and was used in this form since about 8 000 BC. It was the first metal to be smelted from ore, *ca*. 5 000 BC, the first metal to be cast into a shape in a mold, *ca.* 4 000 BC and the first metal to be purposefully alloyed with another metal, (tin) to make bronze, *ca*. 3 500 BC.

Copper is indispensable to modern civilisation. It is the third-most consumed industrial metal in the world, after iron and aluminium. Its major applications are electrical wire (60%), roofing and plumbing (20%), and industrial machinery (15%). Copper paint copper paint has been used on boat hulls to control the growth of barnacles for more than two centuries. A small part of the copper supply is used to manufacture fungicides for agricultural use and nutritional supplements for humans.

Copper mining and smelting in the Musina area was undertaken several centuries ago by indigenous peoples. Their ancient smelting sites are still to be found on some high ridges in the area. Modern mining commenced in 1906 when the Messina Development Company started mining the copper ore at the Campbell, Harper, Artonvilla, Messina and Spence mines. When mining ceased in 1992, more than 40 million tons of ore had been mined and some 700 000 tons of copper metal had been produced

(Mundalamo, H R; Ogola, J S;, June 2012). At peak production these mining operations provided employment for more than 4 000 people (Malunga, May 2006).

Smarty's prospecting programme and subsequent feasibility studies have demonstrated that a viable mining operation can be established that would provide significant benefits to the local economy and about 55 employment opportunities for at least 20 years. It is anticipated that the copper produced by the Musina copper project will be sold on international markets supported by the high demand created mostly by China as the leading global consumer of copper.

3.7 Period for which environmental authorisation is required

The planned life of the mine, based on the proven copper reserves, is estimated to be about 20 years, but continued prospecting may demonstrate additional reserves. To accommodate the time needed for construction, mine development, production ramp up, closure and rehabilitation, the authorisation is required for a period of 30 years.

3.8 Process followed to reach preferred site

Mining can take place only within the area for which a mining right is obtained and no alternative site for mining is possible. Several alternative sites and layouts for the supporting infrastructure are possible and will be explored, taking into consideration economic viability, practicality and environmental characteristics.

3.8.1 Project Alternatives

In terms of Regulation 50 (d) of the MPRDA Regulations R. 527 under the Mineral and Petroleum Resources Development Act, Act 28 of 2002, an environmental impact assessment report must include *inter alia* the following:

> *"(d) A comparative assessment of the identified land use and development alternatives and their potential environmental, social and cultural impacts."*

Alternatives considered for the proposed project are as follows:

3.8.1.1 Opencast mining

There are a number of alternative methods of opencast mining, e.g.:

- Removal of topsoil, overburden and even ore can sometimes be done by means of draglines, bucket wheel excavators or bowl scrapers.
- In some opencast operations, the ore is crushed in the pit and transported to a processing plant by means of conveyor belts or trains.
- Blast designs can vary widely, but are always tailored to the particular pit design and materials handling system.
- Sometimes opencast mines are not backfilled. Instead, the void is allowed to fill with water, while the overburden and waste rock dumps and the tailings dams are re-vegetated.

The description provided in section 2.5.1 reflects the most suitable opencast mining approach for this particular orebody.

3.8.1.2 Underground mining

Underground mining was undertaken at the Artonvilla, Harper and Campbell mines between 1967 and 1979, eventually reaching a depth of 1 400 metres, but Smarty are not at this stage planning any underground mining operations.

If Smarty should decide to undertake underground mining at a later stage, there are several alternative methods that could be considered, e.g.:

- Sinking one or more vertical shafts into or adjacent to the ore seam and driving horizontal drifts into the ore seam at various levels;
- Constructing one or more incline shafts or decline shafts from the surface, through the host rock and into the ore seam;
- Applying the bord and pillar method of ore extraction, leaving behind adequate pillars of ore to support the roof of the mine and prevent surface subsidence;
- Practising high extraction by removing the pillars of ore and accepting the risk of various degrees of surface subsidence;
- Transporting the ore to surface by means of cocopans or trains running on rails from the underground workings to the surface, by trackless load-haul-dump (LHD) electric or diesel vehicles, or by means of conveyor belts.

3.8.1.3 Location of infrastructure

The preferred location and layout of the supporting infrastructure on the farms, as shown on Figure 2-3, was chosen with practical, economic, environmental and logistics considerations in mind, as set out in section 6.4 of this report.

3.8.1.4 Postponement of mining project

The copper reserves within the mining right area could be left in the ground to be mined at a later date, but if Smarty, who has applied for a mining right, does not pursue this project, Smarty's rights will lapse and other parties would be free to pursue the right to mine these copper reserves. Such postponement would result in Smarty losing a business opportunity and allow other parties to apply for a mining right on the same farms.

3.8.1.5 No-Project Option

If the copper ore reserves on the prospecting area shown on Figure 2-1 are not mined, Smarty and the local communities will forego the benefits of the associated additional employment opportunities and revenue streams and the limited agricultural and game hunting activities currently being undertaken will continue.

3.8.2 Public Participation Process

This section provides an overview of the public participation process undertaken to date in this EIA.

3.8.2.1 Objectives of Public Participation

The principles that determine communication with society at large are included in the principles of the National Environmental Management Act (NEMA) (Act 107of 1998, as amended) and are elaborated upon in General Notice 657, titled *"Guideline 4: Public Participation"* (Department of Environmental Affairs and Tourism, 19 May, 2006), which states that: *"Public participation process means a process in which potential interested and affected parties (I&APs) are given an opportunity to comment on, or raise issues relevant to, specific matters."*

> **Opportunities for Comment**
>
> Documents will be available at various stages during the EIA process to provide stakeholders with information, further opportunities to identify issues of concern and suggestions for enhanced benefits and to verify that the issues raised have been considered.

Public participation is an essential and regulatory requirement for an environmental authorisation process, and must be undertaken in terms of Regulations 39 to 44 of the Environmental Impact Assessment (EIA) Regulations GN R.982 (December 2014). Public participation is a process that is intended to lead to a joint effort by stakeholders, technical specialists, the authorities and the proponent/developer who work together to produce better decisions than if they had acted independently.

The public participation process is designed to provide sufficient and accessible information to Interested and Affected Parties (I&APs) in an objective manner and:

During the Scoping Phase to enable them to:

- raise issues of concern and suggestions for enhanced benefits;
- verify that their issues have been recorded;
- assist in identifying reasonable alternatives;
- comment on the plan of study of specialist studies to be undertaken during the impact assessment phase; and
- contribute relevant local information and traditional knowledge to the environmental assessment.

During the impact assessment phase to assist them to:

- contribute relevant information and local and traditional knowledge to the environmental assessment;
- verify that their issues have been considered in the environmental investigations; and
- comment on the findings of the environmental assessments.

During the decision-making phase:

- to advise I&APs of the outcome, i.e. the authority decision, and how the decision can be appealed.

3.8.2.2 Identification of I&APs

I&APs were initially identified through a process of networking and referral, obtaining information from Golder's existing stakeholder database, liaison with potentially affected parties in the study area, newspaper advertisements and a registration process involving completion of a registration and comment sheet. The registration sheet encouraged I&APs to indicate the names of their colleagues and friends who may also be interested in participating in the public participation process.

The initial stakeholder database used to announce Smarty's proposed project for the mining of copper ore on the farms Hereward 203MS, Tralee 204MS, Papenbril 205MS and Vogelenzang 3MT near Musina comprised a total of approximately 255 I&APs (See APPENDIX A) representing the various sectors of society listed below:

- Government (national, provincial and local);
- Environmental NGOs;
- Conservation Agencies;
- Agricultural Bodies;
- Community Representatives and CBOs;
- Business and Commerce; and
- Other.

3.8.2.3 Register of I&APs

The NEMA Regulations (GN R.982) distinguish between I&APs and registered I&APs. I&APs, as contemplated in Section 24(4)(d) of the NEMA include: "*(a) any person, group of persons or organisation interested in or affected by an activity; and (b) any organ of state that may have jurisdiction over any aspect of the activity".*

In terms of the Regulations:

"An EAP managing an application must open and maintain a register which contains the names, contact details and addresses of:

(a) All persons who; have submitted written comments or attended meetings with the applicant or EAP;
(b) All persons who; have requested the applicant or EAP managing the application, in writing, for their names to be placed on the register; and
(c) All organs of state which have jurisdiction in respect of the activity to which the application relates.

> **Please register as an I&AP!**
> Stakeholders are encouraged to register as I&APs and participate in the consultation processes by completing the Registration and Comment sheet and returning it to the Public Participation Office. The Registration and Comment Sheet can also be completed on-line via Golder's website: www.golder.com/public. Contact details are provided on page iii of this report.

As per the EIA Regulations, future consultation during the Impact Assessment phase will take place with **registered I&APs**. Stakeholders who were involved in the initial consultation and who attended the public open house during the Scoping Phase will be added to the register. The I&AP register will be updated throughout the EIA process.

3.8.2.4 Public participation during Scoping

This section provides a summary of the public participation process followed during the Scoping Phase of the EIA.

3.8.2.4.1 Announcement of the proposed project

Draft Scoping Report

The Draft Scoping Report was available for public review for 30 days from ***Friday 04 November 2016 until Monday 05 December 2016.***

The proposed project was announced on 20 October 2016 and stakeholders were invited to participate in the EIA and public participation process and to pass on the information to friends/colleagues/neighbours who may be interested and to register as interested and affected parties (I&APs).

The proposed project was announced as follows:

- Distribution of a letter of invitation to participate to all I&APs on the database, accompanied by a registration, comment and reply sheet that was mailed/emailed to the entire stakeholder database. The letter also provided information on the public places where the Draft Scoping Report could be viewed. Stakeholders were invited to download electronic copies of the Draft Scoping Report from the Golder website or to request electronic copies from the Public Participation Office. Copies of the announcement documents are attached as APPENDIX B.
- The abovementioned documents were made available at the public places listed on page ii of this report and posted to the Golder website**: http://www.golder.com/public;**
- An advertisement was published in the Limpopo Mirror Newspaper, on the 4th November 2015 (APPENDIX C**);**
- Convening small group meetings with representatives at the Local Municipality; and
- Site notices were placed at all entrances to the proposed project site and at visible places at the boundaries of the properties.

Copies of the Draft Scoping Report have been sent to the Limpopo Department of Economic Development, Environment, and Tourism (LEDET), the Department of Water and Sanitation (DWS), the South African Heritage Resources Agency (SAHRA) and the Department of Agriculture (DOA) for comment.

Final Scoping Report

The Draft Scoping Report will be updated after the expiry of the public review period and submitted to the Department of Mineral Resources (DMR).

3.8.2.5 Public participation during the Impact Assessment Phase

Public participation during the impact assessment phase of the EIA will entail a review of the findings of the EIA, presented in the Draft EIA Report and Environmental Management Programme (EMPr), and the volume of specialist studies. These reports will be made available for public comment during April 2017.

I&APs will be advised timeously of the availability of these reports and how to obtain them. They will be encouraged to comment either in writing (mail or email), or by telephone. Ample notification of due dates will be provided.

All the issues, comments and suggestions raised during the comment period on the Draft EIA Report/EMPr will be added to the Comment and Response Report that will accompany the Final EIA Report/EMPr. The Final EIA Report/EMPr will be submitted to the Department of Mineral Resources (DMR) for a decision about the proposed project.

On submission of the Final EIA Report/EMPr to the DMR, a personalised letter will be sent to every registered I&AP to inform them of the submission and the opportunity to request copies of the final reports.

3.9 Lead Authority’s decision

Once the DMR has taken a decision about the proposed project, the Public Participation Office will immediately notify I&APs of this decision and of the opportunity to appeal. This notification will be provided as follows:

- A letter will be sent, personally addressed to all registered I&APs, summarising the authority’s decision and explaining how to lodge an appeal should they wish to; and
- An advertisement to announce the Lead Authority’s decision will be published in the Limpopo Mirror Newspaper and other newspapers, if so required by the authorities.

4.0 ENVIRONMENTAL ATTRIBUTES AND DESCRIPTION OF THE BASELINE RECEIVING ENVIRONMENT

This section of the Draft Scoping Report provides a description of the receiving environment and existing conditions on and in the vicinity of the proposed project components.

Please note: due to lack of access to private land, the information on soil, land use, land capability, ecology, surface water, groundwater, noise and archaeology is based on literature. The other specialists do not require access to the land. Pre-project baseline environmental information generated by field investigations after access is obtained will be included in the EIA report to follow.

4.1 Geology

The geology in the vicinity of the project area is illustrated in

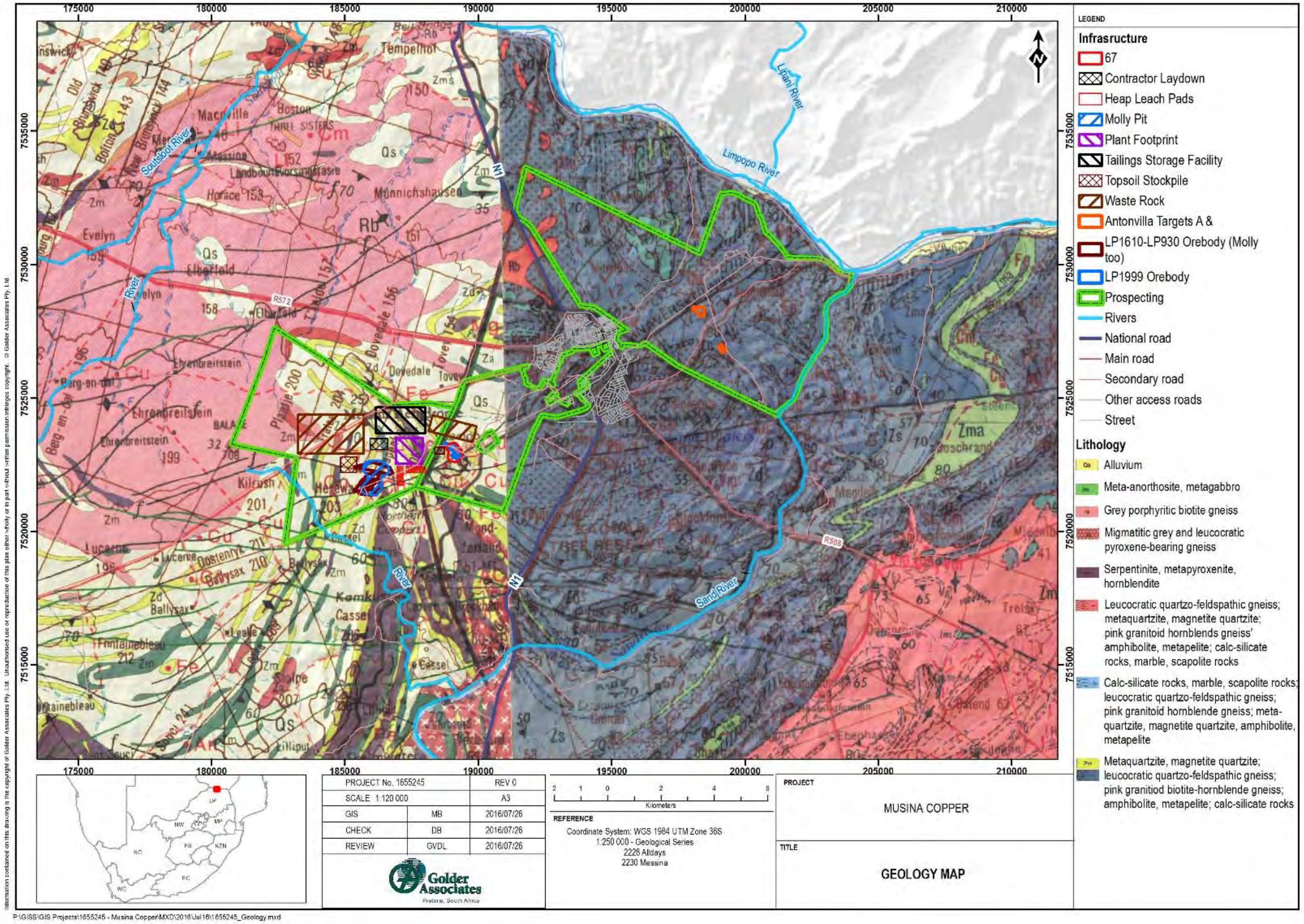

Figure 4-1: Geological features in the vicinity of the project area

4.1.1 Regional Geology

The Messina Formation of Metasedimentary rocks in the Central Zone of the Limpopo Belt were formed approximately 3.2 billion to 2.9 billion years ago The succession is believed to have been metamorphosed and ductily deformed during at least one period of high grade, Archaean tectonism or orogeny, resulting in the formation of numerous, steeply dipping, sheath folds throughout the Central Zone. A period of high grade tectonism has been shown to have occurred during the Proterozoic about 2.04 billion years ago.

4.1.2 Local Geology

The copper-bearing deposits in the Messina area occur in a more or less linear configuration in close association with the north-east striking Messina fault, which itself parallels the main trend of the mobile belt. The deposits are of three morphological types, breccia columns, tabular veinlike bodies and inclined elliptical replacement bodies, which are normally controlled by south-west striking sub-faults and/or fissures associated with the north-east striking Messina faults.

The breccia columns occur over a vertical extent of 1 250m, and are not exposed on surface. They are circular to polygonal in plan, outlined as a result of joint controls. Hydrothermal alteration of wallrock gneiss mantles the breccia columns and does not extend to surface. The outermost are characterized by sericitized gneiss, grading to an albitite, and finally to zoisite-quartz rock around the immediate brecciated contacts, and within the pipes. The interfragmental fill consists largely of quartz and sulphides, and grades downwards to albite and sulphides in the West Lode pipe. Sulphide mineral distribution is zoned, pyrite dominating in the apex of the pipes, grading downwards to chalcopyrite-bornite and then bornite-chalcocite at deeper levels. The nature of the fragmentation precludes normal stoping collapse mechanisms for brecciation and suggests a single implosive event. Chemical reaction induced shrinkage of fragments probably created the bulk of the interfragmental volume.

The breccia-pipe mineralized bodies apparently formed by collapse after dissolution of quartz-rich silicate host rocks. The settling of breccia fragments with respect to their source is minimal in the upper levels of the pipes but tends to increase in magnitude progressively downward. The spaces between the breccia fragments have been subsequently in-filled with quartz and lesser copper sulphides. The volume relations between breccia fragments and later quartz infilling suggest that at least 20% of the original volume of country rock now occupied by breccia must have been removed in each case by the passage of hydrothermal solutions. The breccia pipes appear to have been propagated upward by collapse of wall rock with the major part of the solution of country rock taking place toward their base. Some secondary brecciation of large collapse fragments is associated with quartz deposition and appears to be the result of chemical brecciation.

During the earliest stages of hydrothermal activity large-scale dissolution of quartz occurred accompanied or closely followed by strong albitization of the adjacent country rocks. Subsequent to this, deposition of copper sulphides occurred together with in-filling of quartz in the voids between breccia fragments in the breccia-pipe orebodies. In the replacement orebodies, copper sulphide deposition occurred largely as a replacement of mafic minerals in mafic metamorphic units, and in these orebodies quartz deposition is more or less restricted to the vug stage. The alteration mineral assemblages that appear to be most closely associated with the main metallization stage are albite, clinozoisite, epidote and chlorite, developed in that order. During vug-stage deposition quartz was the major phase to form, and in a number of instances was followed by deposition of calcite. Larger quartz crystals in many cases exhibit a well-defined zoning and some contain occluded epidote crystals toward their outer extremities. In some instances a dusting of specularite coats the later growth zones of the outer surfaces of the crystals.

4.2 Climate

The baseline characteristics of the climate, wind field and air quality in the project area were determined from literature sources (Allan, C; Bennett, A;, August 2016)

Musina experiences a hot, semi-arid climate with high temperatures during most of the year. Air temperature is important, both for determining plume buoyancy and the development of mixing and inversion layers.

Average summer temperatures in Musina range from 22°C to 34°C, while winter temperatures range from 9°C to 26°C (Table 4-1) (www.worldclimateguide.co.uk, accessed August 2016).

Table 4-1: Average temperatures for Musina

	Jan	Feb	March	April	May	June	July	August	September	October	November	December	Year
Average maximum temperature (°C)	33	32	31	30	28	25	25	27	29	31	32	32	29.6
Average minimum temperature (°C)	21	21	19	16	12	8	8	10	14	17	19	20	15.4

(From: http://www.worldclimateguide.co.uk/climateguides/southafrica/messina.php, accessed August, 2016)

The mean annual rainfall at Musina ranges from 300 mm to 400 mm, but the figure varies considerably from year to year as a result of frequent dry spells. Rainfall occurs almost exclusively in the form of thundershowers during the summer months between October and March, with maximum rainfall occurring between November and January (Table 4-2) (www.worldclimateguide.co.uk, accessed August 2016).

Table 4-2: Average rainfall for Musina

	Jan	Feb	March	April	May	June	July	August	September	October	November	December	Year
Average rainfall (mm)	61	65	42	26	12	4	1	2	15	33	55	56	372
Number of rain days	8	8	5	4	2	2	2	1	3	5	7	9	55

(From: http://www.worldclimateguide.co.uk/climateguides/southafrica/messina.php, accessed August, 2016)

The proposed mining operation near Musina is located in the subtropical high-pressure belt. The mean circulation of the atmosphere over the subcontinent is anticyclonic throughout the year, excepting near the surface. The synoptic patterns affecting the typical weather experienced in the region owe their origins to the subtropical, tropical and temperate features of the general atmospheric circulation over Southern Africa.

The subtropical features are controlled by the semi-permanent presence of the South Indian Anticyclone (high pressure cell), Continental High (high pressure cell) and the South Atlantic Anticyclone (low pressure cell) in the high pressure belt located approximately 30° south of the equator. The tropical controls are brought about via tropical easterly flows (low pressure cells) from the equator to the southern mid-latitudes and the occurrence of the easterly wave and lows. The temperature control is ascribed to perturbations in the westerly wave, leading to the development of low pressure cells or cold fronts from the polar region moving into the mid-latitudes.

Seasonal variations in the positioning and intensity of the high pressure cells determine the extent to which the westerly waves and lows impact the atmosphere over the region. In winter, the high pressure belt intensifies and moves northwards while the westerly waves in the form of a succession of cyclones or ridging anticyclones move eastwards around the South African coast or across the country. The positioning and intensity of these systems have significant impacts on the region. In summer, the anticyclonic high pressure belt weakens and shifts southwards and the influence of the westerly wave and lows weakens.

Anticyclones (high pressure cells) are associated with convergence in the upper levels of the troposphere, strong subsidence throughout the troposphere, and divergence near the surface of the earth. Air parcel subsidence, inversions, fine conditions and little to no rainfall occur as a result of such airflow circulation patterns (i.e. relatively stable atmospheric conditions). These conditions are not favourable for air pollutant dispersion, especially with regard to contaminants emitted close to the ground.

Westerly waves and lows (low pressure cells) are characterised by surface convergence and upper-level divergence that produce sustained uplift, cloud formation and the potential for precipitation. Cold fronts, which are associated with the westerly waves, occur predominantly during winter. The passage of a cold front is characterised by pronounced variations in wind direction and speed, temperature, humidity, pressure and distinctive cloud bands (i.e. unstable atmospheric conditions). These unstable atmospheric conditions bring about atmospheric turbulence which creates favourable conditions for air pollutant dispersion.

The tropical easterlies and the occurrence of easterly waves and lows affect Southern Africa mainly during the summer months. These systems are largely responsible for the summer rainfall pattern and the north easterly wind component that occurs over the region.

In summary, the convective activity associated with the easterly and westerly waves disturbs the persistent inversion which sits over Southern Africa. This allows for the upward movement of air pollutants through the atmosphere, leading to improved dispersion and dilution of accumulated atmospheric pollution.

4.3 Wind Field

Wind roses summarize the characteristics of the wind field at a specified location by representing their strength, direction and frequency. Calm conditions (wind speeds of less than 1 m/s) are represented as a percentage of the total winds in the central circle. Each directional branch on a wind rose represents wind originating from that specific cardinal direction (there are 16 cardinal directions). Each directional branch is divided into segments of different colours which represent different wind speed classes. Each circle in the wind rose represents a percentage frequency of occurrence.

Wind roses for the proposed Smarty copper mine were generated from an analysis of MM5[1] modelled meteorological data for 2013 - 2015[2]. The wind rose based MM5 modelled data Figure 4-2 was compared to a wind rose generated by Royal Haskoning DHV (2013) using local meteorological data obtained from the South African Weather Services station located in Mopane approximately 35 km south east of Musina for the monitoring period of 1 January 2008 to 31 December 2012 Figure 4-3.

Easterly winds are expected to be dominant at the proposed Smarty mine, with wind speeds being low to moderate, averaging 3 m/s with about 14 % calm conditions (<1 m/s) on average.

[1] The MM5 (short for Fifth-Generation Penn State/NCAR Meso-scale Model) is a regional meso-scale model used for creating weather forecasts and climate projections. It is a community model maintained by Penn State University and the National Centre for Atmospheric Research

[2] The analysis of the data is assumed and expected to be representative of the actual experienced meteorological conditions on site.

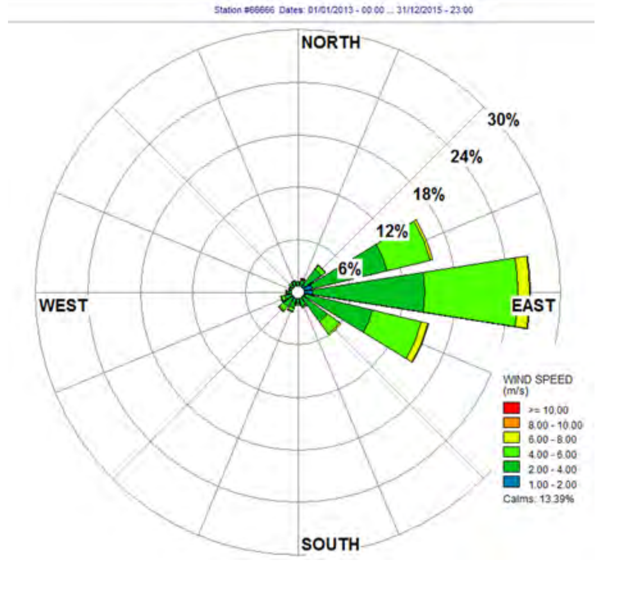	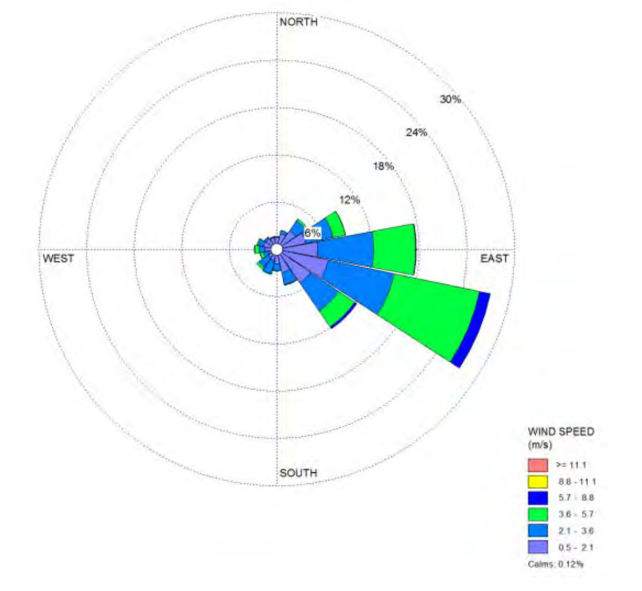
Figure 4-2: Modelled period wind rose for 2013 – 2015	*Figure 4-3: Measured period wind rose for Mopane 01/01/2008 – 31/12/2012 (source: RHDVH, 2013)*

It is clear that, while there are minor variations, the outputs are consistent and display a dominance of wind direction from the easterly sector. Similar consistencies are also present in the diurnal and seasonal wind roses. A high confidence is thus placed in the MM5 modelled meteorological data.

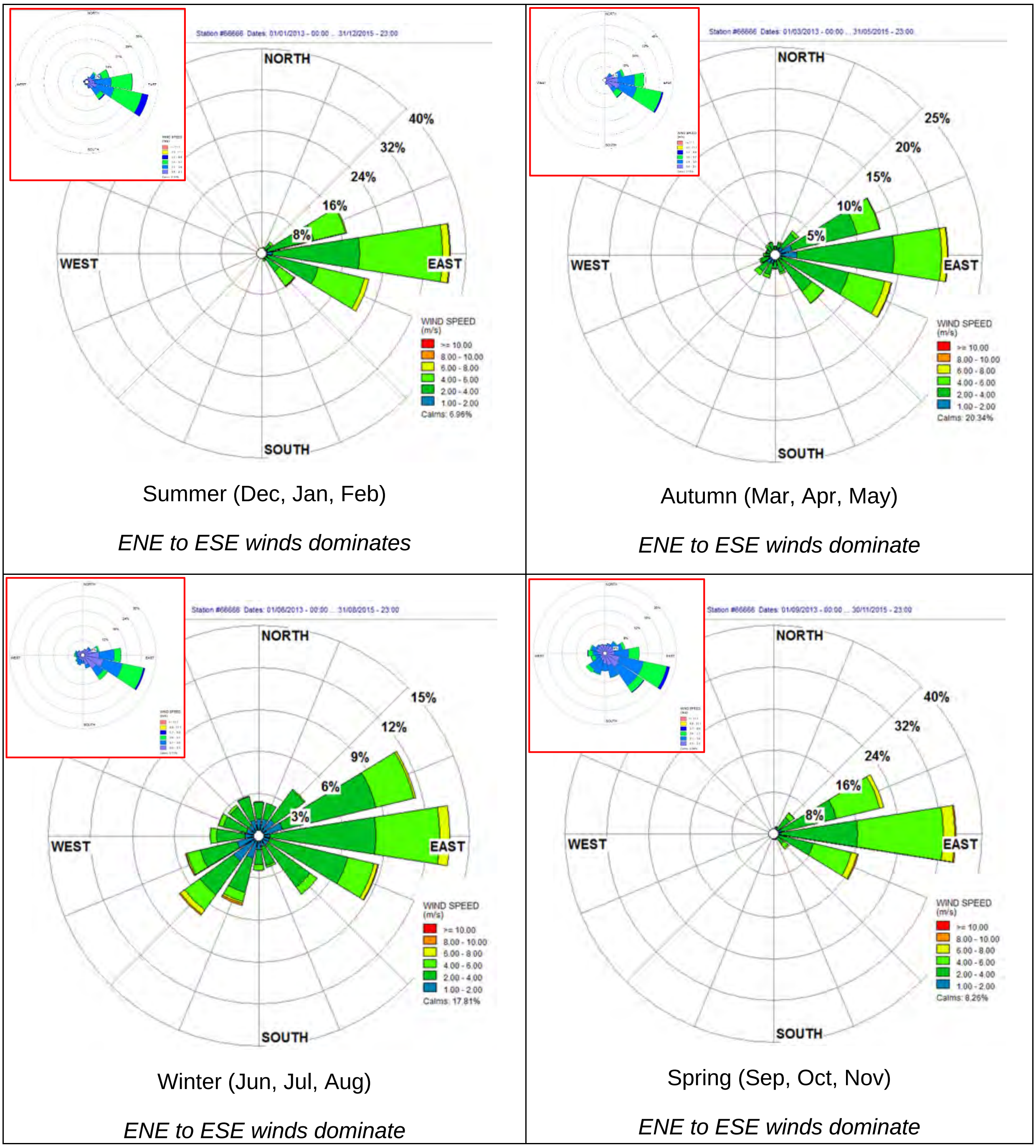

Figure 4-4: Modelled seasonal wind roses (2013 - 2015). Seasonal measured wind roses for Mopane from RHDVH, 2013 (01/01/2008 – 31/12/2012) are provided as overlay insets for comparison

4.4 Air Quality

Limited monitored ambient air quality data exists for the Limpopo Province and for the Musina area in particular. A qualitative characterisation of the baseline ambient air quality was based on literature sources and the typical emissions from primary sources identified in the area. Based on the National Land Cover Dataset (2013/14), and Limpopo Provincial Air Quality Monitoring Plan (AQMP) (2013), primary emission sources are likely to include the following: agricultural activities, domestic fuel burning, veld fires and vehicles travelling on unpaved roads.

- Agricultural activities that lead to particulate emissions due to:
  - Tilling and harvesting;
  - Wind erosion from exposed areas;
  - Vehicles travelling on paved and unpaved roads;
- Gaseous and particulate emissions due to:
  - Burning of residue crops and vegetation; and
  - The use of fertilizers and crop protectionchemicals treatment;
- Veld fires and domestic fuel burning (coal, wood and paraffin) for space heating and cooking purposes, leading to emissions of particulates, SO_2, NO_2, CO, polycyclic aromatic hydrocarbons (PAHs), benzo(a)pyrene and formaldehyde;

The potential health effects associated with exposure to elevated concentrations of the key pollutants identified above are summarised in Table 4-3.

Table 4-3: Key pollutants and associated health effects

Pollutant	Description	Health effects
Carbon monoxide	One of the most common and widely distributed air pollutants (WHO, 2000). CO is an odourless, colourless and tasteless gas which has a low solubility in water.	■ Severe hypoxia ■ Headaches, nausea & vomiting ■ Muscular weakness & shortness of breath ■ Long term exposure can lead to Neurological deficits and damage
Nitrogen dioxide	Formed though the oxidation of nitric oxide in the atmosphere, it is a primary pollutant emitted from the combustion of stationary point sources and from motor vehicles. It is toxic by inhalation. However, as the compound is acrid and easily detectable by smell at low concentrations, inhalation exposure can generally be avoided.	■ Effects on pulmonary function, especially in asthmatics ■ Increase in airway allergic inflammatory reactions
Particulate matter (TSP, PM_{10} and $PM_{2.5}$)	Can be classified by their aerodynamic properties into coarse particles, PM_{10} (particulate matter with an aerodynamic diameter of less than 10 µm) and fine particles, $PM_{2.5}$ (particulate matter with an aerodynamic diameter of less than 2.5 µm). The fine particles contain the secondarily formed aerosols such as combustion particles, sulphates, nitrates, and re-condensed organic and metal vapours. The coarse particles contain earth crust materials and fugitive dusts from roads and industries (Fenger, 2002).	■ Airway allergic inflammatory reactions & a wide range of respiratory problems ■ Increase in medication usage related to asthma, nasal congestion and sinuses problems ■ Adverse effects on the cardiovascular system

Pollutant	Description	Health effects
Sulphur dioxide (SO_2)	One of a group of highly reactive gasses known as "oxides of sulphur." Anthropogenic sources include; fossil fuel combustion (particularly coal burning power plants) industrial processes such as wood pulping, paper manufacture, petroleum and metal refining, metal smelting (particularly from sulphide containing ores, e.g. lead, silver and zinc ores) and vehicle tailpipe emissions.	■ Reduction in lung function ■ Respiratory symptoms (wheeze and cough)
Volatile organic compounds (benzene, toluene, ethyl benzene and xylene)	Organic compounds that easily vaporise at room temperature and are colourless. VOCs are released from vehicle exhaust gases either as unburned fuels or as combustion products, and are also emitted by the evaporation of solvents and motor fuels.	■ Adverse effects on the cardiovascular system and central nervous system ■ Long term exposure can lead to Neurological and cardiovascular system damage and Increased prevalence of carcinomas in the community

4.4.1 Land use and sensitive receptors

Land use within 10 km of the proposed Smarty mine-related infrastructure and activities primarily comprises:

- Grassland, open bush and thicket (97%);
- Urban built-up commercial, industrial and residential areas (±2%); and
- Cultivated land (±1%).

Schools and healthcare facilities within 10 km radius of the proposed Smarty mining and ore beneficiation activities are listed in Table 4-4 The closest sensitive receptor is St. Martin de Porres Primary School, located about 2 km to the north-east.

Table 4-4: Sensitive receptors within 10 km of the proposed Smarty operating area

Receptor	Latitude	Longitude
Eric Louw High School	-22.35839	30.04660
Rixile/ Bonwa UDI Primary	-22.33112	30.03264
St. Martin de Porres Primary	-22.35540	30.00615
Makushu Primary	-22.33135	30.03027
Laerskool Messina Primary	-22.35260	30.04524
Musina Secondary	-22.33042	30.02590
Doreen Bridge	-22.34580	30.04110
Madavhila Primary	-22.40430	30.03011
Nancefield Community Health Centre	-22.35533	30.02326
Messina Clinic and Emergency Services	-22.34616	30.04220
Messina Hospital	-22.34183	30.04302

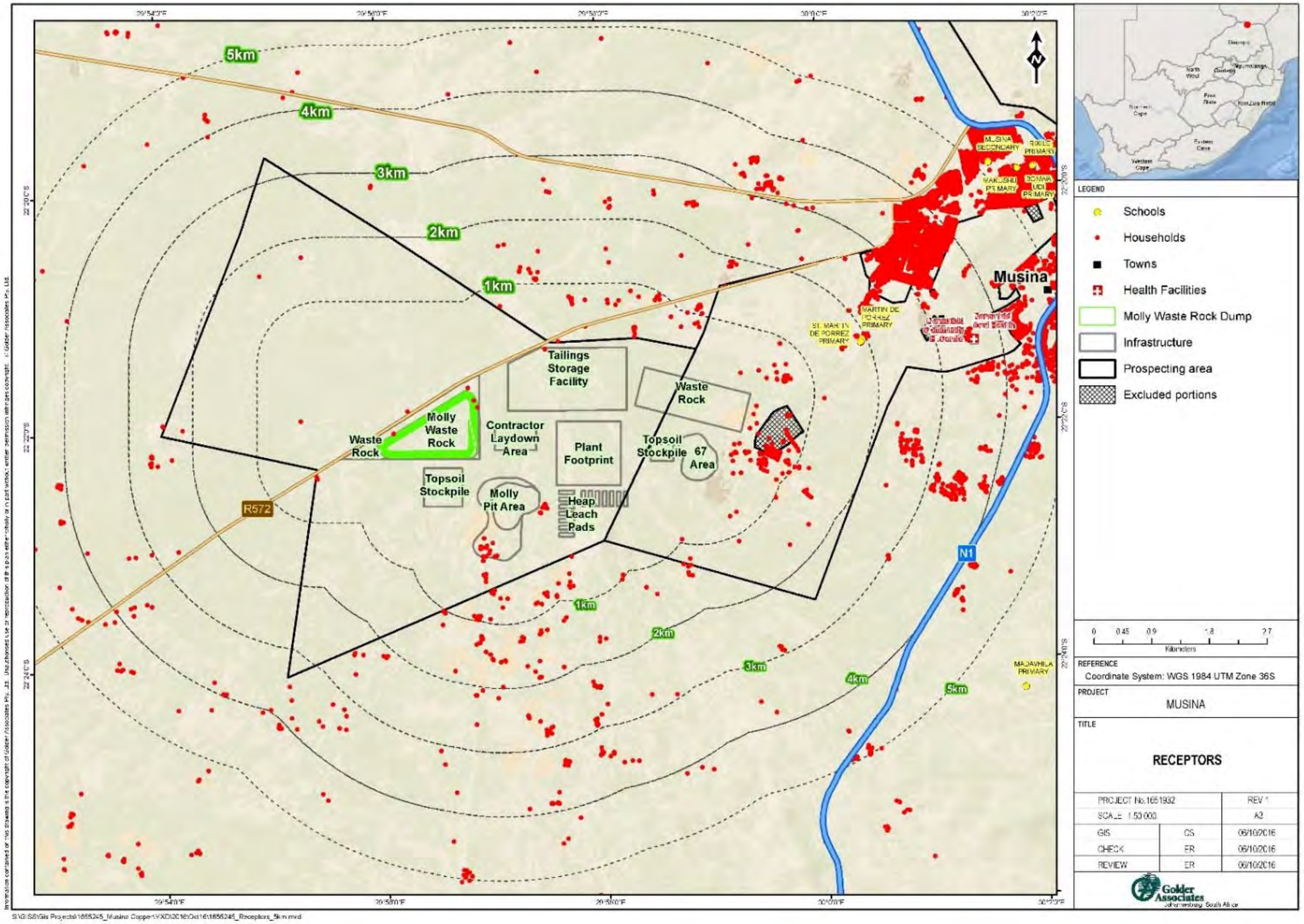

Figure 4-5: Sensitive receptors within 5 km of mining and ore beneficiation activities

4.5 Topography

The area where Smarty proposes to establish its mining operation and supporting infrastructure is flat, lies at an average elevation of 610 mamsl and slopes very gently from west to east at a rate of 1:155 and from south to north at a rate of 1:330. The area is on a water divide, with drainage lines running northwards and south-south-eastwards from the perimeter of the area.

The topography of the wider area within which Smarty holds prospecting rights is shown on Figure 4-6

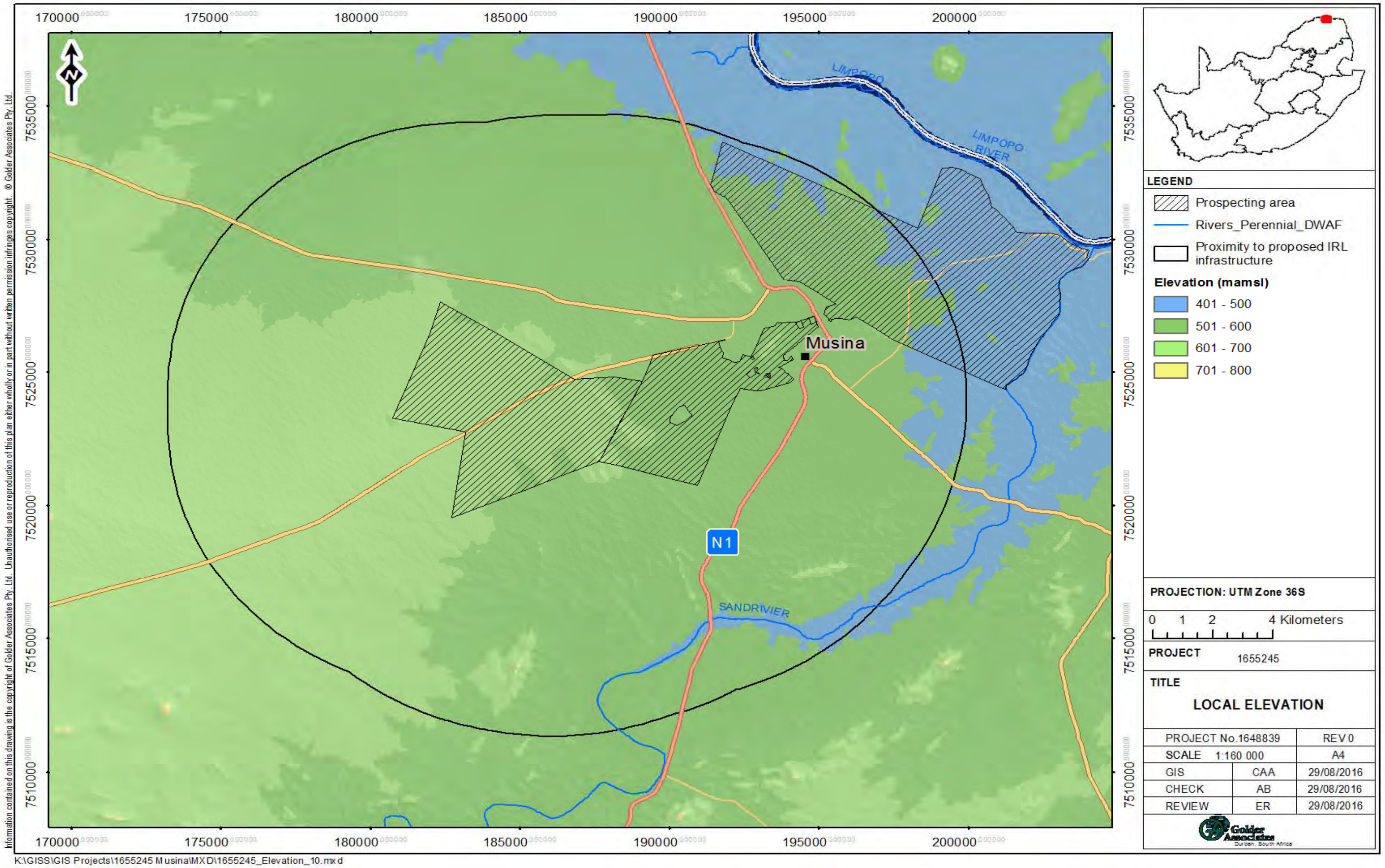

Figure 4-6: Topography in the vicinity of the project area

4.6 Soils and Land Capability

Lacking access to the land, the soil specialist undertook a literature study to produce an overview of the soil, land use and land capability within the project area. (Snyman, Brink, & Lupankwa, September 2016). Information based on fieldwork will be incorporated in the EIA report after access to the relevant farms has been obtained.

4.6.1 Soils

4.6.1.1 Land types

A survey of land types was conducted at a scale of 1:250 000in the early 1970s in order to compile inventories of the natural resources of South Africa in terms of soil, climate and terrain. The land type information is not a substitute for a detailed soil map, but gives a very good indication of where certain soil patterns are located.

The land type memoirs and associated maps of 2228 Alldays and 2230 Messina indicate that the site lies within the Ae266, Fa646 and Fc483 land types. The Ae266 land type occupies 53%, Fa646 20% and Fc483 26% of the project infrastructure area. The main land types and the locations where the soil will be sampled during the field investigation are shown on Figure 4-7. The land type and soil type distribution across the project area is indicated in Table 4-5

Table 4-5: Land types at mine infrastructure site and dominant soil forms

Mine infrastructure	Area (ha)	Landtype	Dominant Soil form
Molly Pit Area	20.7	Ae266	Hutton
	68.3	Fc483	Mispah
67 Area	31.3	Ae266	Hutton
	1.6	Fa646	Glenrosa
Tailings Storage Facility	27.8	Ae266	Hutton
	111.8	Fc483	Mispah
	40.9	Fa646	Glenrosa
Waste Rock Dump East	104.3	Ae266	Hutton
Waste Rock Dump West	358.6	Ae266	Hutton
Heap Leach Pads	19.7	Fc483	Mispah
Topsoil Stockpile East	2.5	Ae266	Hutton
	6.8	Fa646	Glenrosa
Topsoil Stockpile West	36.0	Ae266	Hutton
Plant Footprint	99.2	Fc483	Mispah
	0.7	Fa646	Glenrosa
Contractor Laydown Area	13.1	Ae266	Hutton
	14.3	Fc483	Mispah

Notes: Ae266: Red-yellow apedal, freely drained soils; Red, high base status > 300 mm deep (no dunes),

Fa646: Glenrosa and/or mispah forms (other soils may occur); Lime rare or absent in the entire landscape,

Fc483: Glenrosa and/or mispah forms (other soils may occur); Lime generally present in the entire landscape

4.6.1.2 Dominant soils

The soils occurring on the farms Plaatjie, Tralee and Hereward have been described as freely drained and structureless, whereas the soils on Papenbril are described as lithosols. Most of the soils in Portion 40 of the Farm Messina 4 MT and the remaining extent of the Farm Uitenplaas 2 MT are described as being freely drained, structureless soils. Based on the land type data, the dominant soil forms are Hutton (Ae 266), Glenrosa (Fa 646) and Mispah (Fc 483).

The key soil properties as recorded in the respective land type memoirs are listed in Table 4-6.

Table 4-6: Dominant soil form properties (Landtype Survey Staff, 1976-2006)

Dominant soil form	Effective depth (mm)	Textural Class	Clay content (%) of A horizon	Clay content (%) of B horizon
Hutton	500 – 1200	Medium sandy loam – sandy clay loam	10 – 20	15 – 35
Glenrosa	200 – 400	Loam fine/coarse sand - sandy loam	10 – 20	
Mispah	100 – 200	Medium/coarse sand – loamy sand	4 – 12	

Hutton soils are characterised by relatively uniform red, apedal (structureless) subsoil. The red colour is due to hematite. Hutton soils occur in well drained positions in the landscape and on well drained underlying material and they very seldom become saturated with water. Fine sand variants of this form are sensitive to wind erosion and are easily compacted by cultivation.

The Glenrosa soil form consists of an Orthic A-horizon on a lithocutanic B-horizon. The lithocutanic subsoil represents the more advanced stage of *in situ* parent rock weathering with the B-horizon having similar colour, structure and consistency as the parent rock. This horizon is often more dense and subsequently impermeable to air, water and plant roots than the overlying Orthic A horizon.

The Mispah soil form consists of an Orthic A-horizon on Hard Rock. The Hard Rock encompasses bedrock and silcrete. The effective depth of this soil form is restricted by the presence of the rocky material. Water movement and root penetration are also restricted.

4.6.1.3 Soil erodibility

Silt and fine sandy soils are usually more easily erodible than more clayey soils. Erodibility increases with increasing slope. The soils' susceptibility to wind and water erosion based on textural class and slope in the project area is listed in Table 4-7.

Table 4-7: Erosion susceptibility of soils in project area, per mine infrastructural unit

Mine infrastructure	Area (ha)	Erosion susceptibility	Dominant soil textural class
Molly Pit Area	20.3	Generally moderately sloping land. Soils have low to moderate erodibility. Moderately susceptible to wind and water erosion	Loamy sands dominant
	68.6	Very steep slopes with soils of low erodibility; moderately - strongly sloping land with soils of low - high erodibility; moderately sloping land with soils of very high erodibility. Susceptible to wind erosion	Sands dominant
67 Area	32.9	Generally moderately sloping land. Soils have low to moderate erodibility. Moderately susceptible to wind and water erosion	Loamy sands dominant
Tailings Storage Facility	68.7	Generally moderately sloping land. Soils have low to moderate erodibility. Moderately susceptible to wind and water erosion.	Loamy sands dominant
	111.7	Very steep slopes with soils with low erodibility; moderately - strongly sloping land with soils of low - high erodibility; moderately sloping land with soils of very high erodibility. Susceptible to wind erosion.	Sands dominant

Waste Rock East	104.3	Generally moderately sloping land. Soils have low to moderate erodibility. Moderately susceptible to wind and water erosion.	Loamy sands dominant
Waste Rock West	358.5	Generally moderately sloping land. Soils have low to moderate erodibility. Moderately susceptible to wind and water erosion.	Loamy sands dominant
Heap Leach Pads	19.7	Very steep slopes with soils with low erodibility; moderately - strongly sloping land with soils of low - high erodibility; moderately sloping land with soils of very high erodibility. Susceptible to wind erosion.	Sands dominant
	0.1	Generally moderately sloping land. Soils have low to moderate erodibility. Moderately susceptible to wind and water erosion.	Loamy sands dominant
Topsoil Stockpile East	9.2	Generally moderately sloping land. Soils have low to moderate erodibility. Moderately susceptible to wind and water erosion.	Loamy sands dominant
Topsoil Stockpile West	35.9	Generally moderately sloping land. Soils have low to moderate erodibility. Moderately susceptible to wind and water erosion.	Loamy sands dominant
Plant Footprint	0.8	Generally moderately sloping land. Soils have low to moderate erodibility. Moderately susceptible to wind and water erosion.	Loamy sands dominant
	99.1	Very steep slopes with soils with low erodibility; moderately - strongly sloping land with soils of low - high erodibility; moderately sloping land with soils of very high erodibility. Susceptible to wind erosion.	Sands dominant
Contractor Laydown Area	12.9	Generally moderately sloping land. Soils have low to moderate erodibility. Moderately susceptible to wind and water erosion.	Loamy sands dominant
	14.5	Very steep slopes with soils with low erodibility; moderately - strongly sloping land with soils of low - high erodibility; moderately sloping land with soils of very high erodibility. Susceptible to wind erosion	Sands dominant

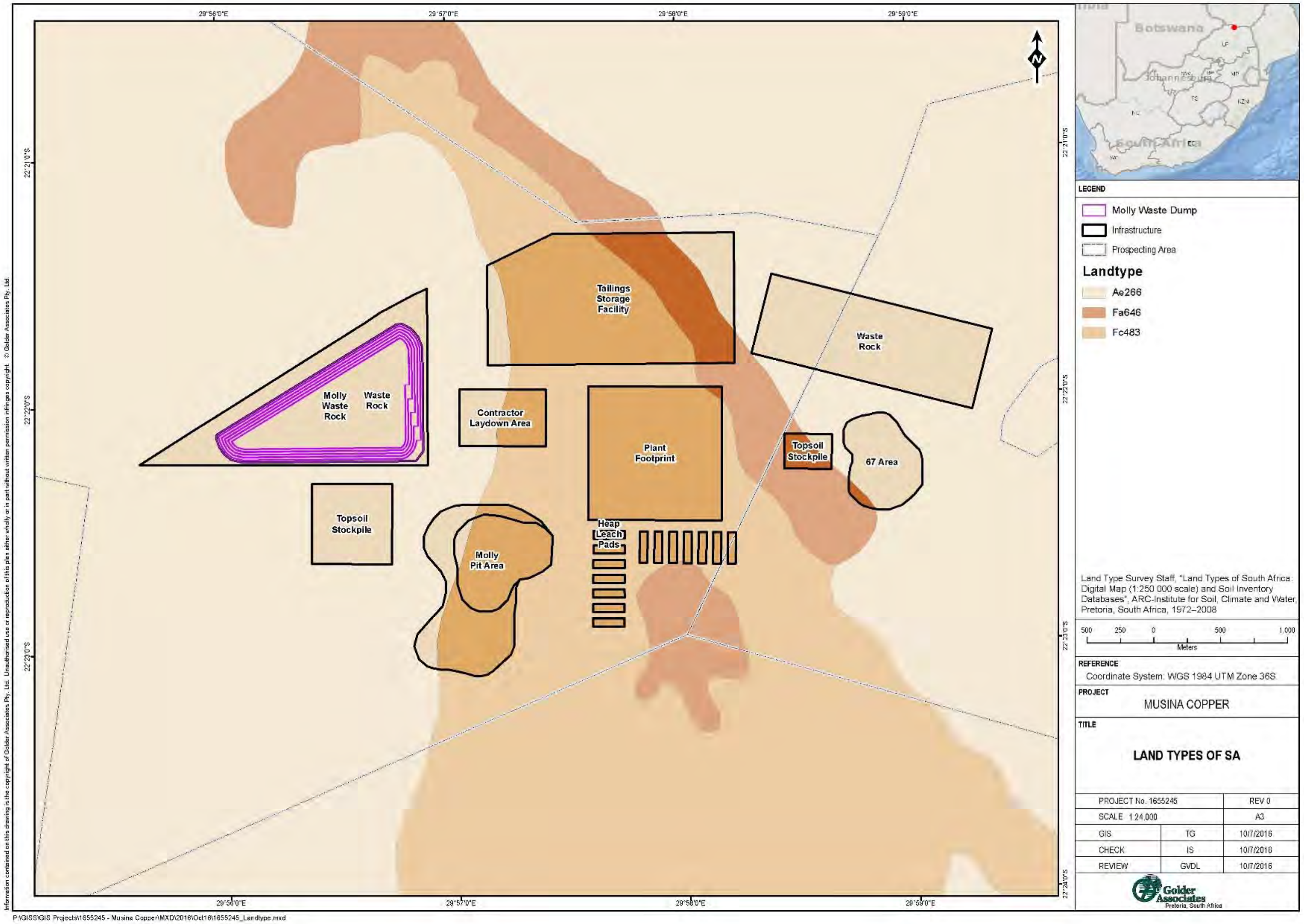

Figure 4-7: Land types within project area

4.6.2 Pre-mining Land Capability

Land capability classification (LCC) is a system of grouping soils into map units based on the ability of the land to sustain rain-fed arable crops. The map units are classed as *arable* (classes I – IV) or *non- arable* (class VI- VIII) depending on the degree of physical limitations. The LCC does not indicate soil fertility status, which can be ameliorated by additives.

The land capability for the project area is classified as Class V (62%) and Class VI (38%) which is non-arable land that is only suitable for limited pastoral or forestry (if rainfall is sufficient) use, and generally not suited to cultivation.

The land capability for the project area is shown in Figure 4-8. The approximate area and land capability for each mine infrastructural unit is listed below.

Table 4-8: Land capability classes for mine infrastructure

Mine infrastructure	Land Capability Class	Area (ha)
67 Area	V	31.4
	VI	1.6
Contractor Laydown Area	V	13.0
	VI	14.5
Heap Leach Pads	VI	19.7
Molly Pit Area	V	20.3
	VI	68.6
Plant Footprint	VI	99.9
Tailings Storage Facility	V	27.8
	VI	152.6
Topsoil Stockpile East	V	2.5
	VI	6.7
Topsoil Stockpile West	V	36.0
Waste Rock East	V	104.3
Waste Rock West	V	358.6

Notes: Class V & Class VI - Non-arable; Grazing, Woodland or Wildlife

4.6.3 Agricultural potential

The agricultural potential reflects the production capacity of the land. It is dependent on the characteristics of the land and the specific management input. Most of the project area is grassland, woodland/open bush and dense bush (refer to section 4.7.2). A small portion of land is also cultivated, though this falls outside the planned mine infrastructure footprint. These areas are likely to be well-drained, deep Hutton soils. The dry climatic conditions are not ideal for dryland crop production The grassland and woodland areas are most likely where the low to medium potential Glenrosa and Mispah soil forms occur. The soil agricultural potential rating is summarised in Table 4-9.

Table 4-9: Soil agricultural potential for dryland crop production in the project area

Dominant soil form	Effective depth	Depth limiting material	Climate	Soil agricultural potential rating
Hutton	500 – 1200	Hard Rock	Semi-arid	Medium
Glenrosa	200 – 400	Weathering rock		Low
Mispah	100 – 200	Hard Rock		Low

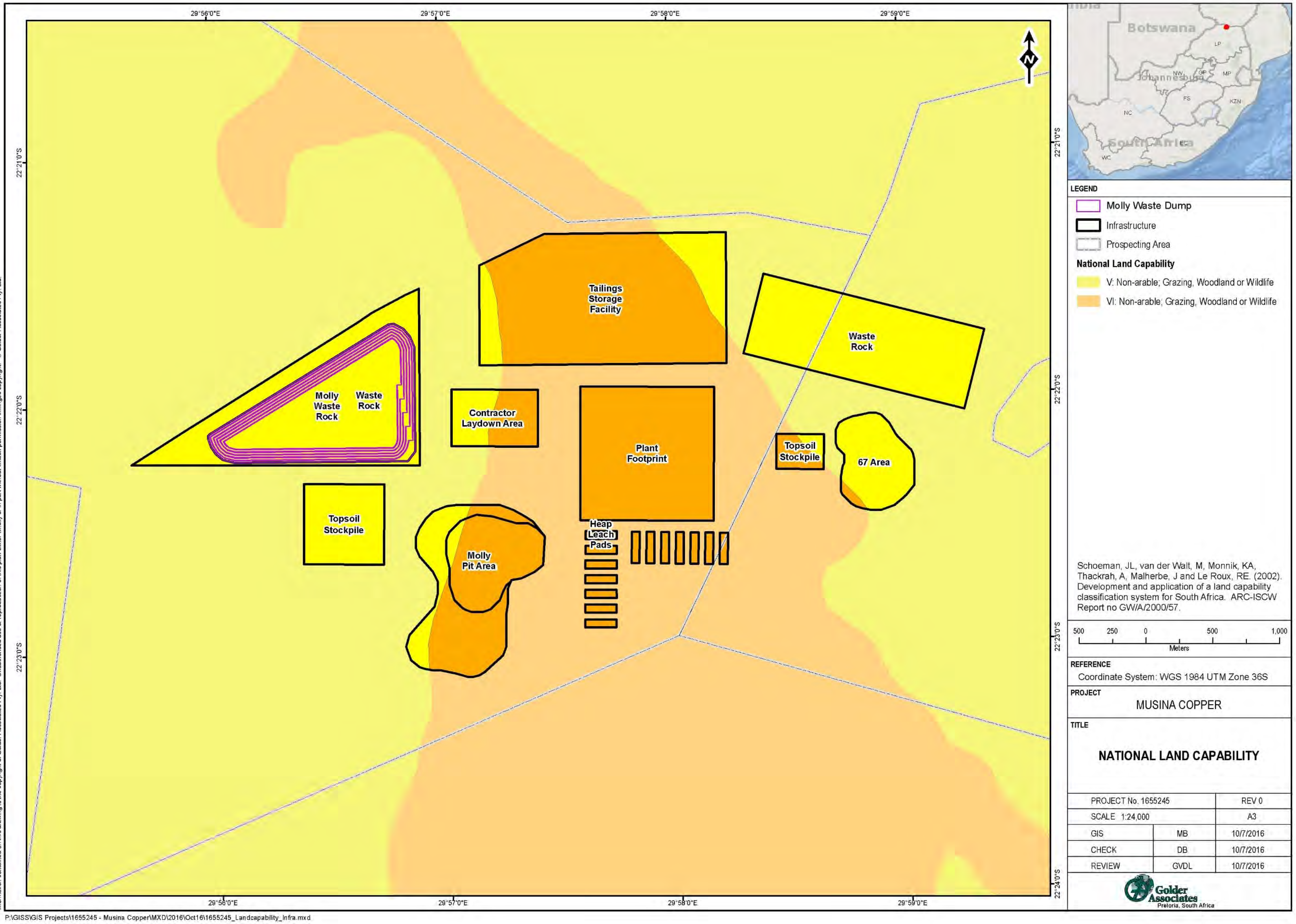

Figure 4-8: Land capability for project area

4.7 Land use

4.7.1 Approach

The land use and land cover for the project area were determined from recent aerial imagery (Google Earth image dated 26 April 2016), the South African National Land Cover Map and relevant reports on the project area. The land use assessment is limited to the area envisioned for the planned mine infrastructure.

Only 19 of the 72 land cover / land use information classes are present in the study area. These were further condensed for mapping purposes as shown in the table below.

Table 4-10: Land cover (use) classification

No	Land cover /use class	Shown on map as
1	Bare none vegetated	Bare none vegetated
2	Cultivated commercial fields (high)	Cultivated commercial fields
3	Cultivated commercial fields (low)	
4	Cultivated commercial fields (med)	
5	Cultivated commercial pivots (low)	
6	Grassland	Grassland
7	Mines 1 bare	Mining
8	Mines 2 semi-bare	
11	Thicket /Dense bush	Thicket /Dense bush
12	Woodland/Open bush	Woodland/Open bush
13	Urban built-up (bare)	Urban built-up / commercial / industrial
14	Urban built-up (dense trees / bush)	
15	Urban built-up (low veg / grass)	
16	Urban built-up (open trees / bush)	
17	Urban commercial	
18	Urban industrial	
19	Urban residential (bare)	Urban residential (bare)

4.7.2 Land use classification

The surrounding land uses as reported in 2006 are made up of game and hunting farms, with some areas being used for grazing. There is an airstrip in the north-western portion of the project area and a defunct mine (Molly Too Mine) on the farm Hereward 203 MS.

There is a rock crushing operation on Portion 40 of the farm Messina 4 MT and there are a number of rock dumps, a slimes dam, a sewage disposal works and a cemetery on the remaining portion of the farm Uitenplaas 2 MT, but these features do not fall within the proposed mining infrastructure area.

From the recent aerial imagery most of the project area appears to be sparsely vegetated to bare in some areas. Some land on the farm Vogelenzang 3 MT appears to be cultivated (Figure 4-9) and also has some industrial or mining/quarrying activity to the west of the cultivated portions. These areas fall outside the planned mine infrastructure area.

Figure 4-9: Cultivated parcels of land on the farm the Vogelenzang 3 MT.

The National Land cover map for the project area is shown in Figure 4-10. The majority, 71.3%, of the project area land use is classified as grassland, 22.9 % as woodland/open bush, 3.5% as thicket or dense bush, 2.2% as cultivated commercial fields and 0.1% as mines and semi-bare. The approximate area the various land uses occupied per mine infrastructural unit in the project area is listed below.

Table 4-11: Land use classification for project area

RefName	Class_Name	Area (ha)
67 Area	Thicket /Dense bush	0.5
	Woodland/Open bush	4.4
	Grassland	27.8
	Mines 2 semi-bare	0.2
Contractor Laydown Area	Woodland/Open bush	1.2
	Grassland	26.2
Heap Leach Pads	Thicket /Dense bush	3.7
	Woodland/Open bush	4.5
	Grassland	11.6
Molly Pit Area	Thicket /Dense bush	6.9
	Woodland/Open bush	23.4
	Grassland	48.8
	Cultivated commercial fields (med)	0.5
	Cultivated commercial fields (low)	9.3
Plant Footprint	Thicket /Dense bush	13.6

RefName	Class_Name	Area (ha)
	Woodland/Open bush	21.3
	Grassland	65.0
Tailings Storage Facility	Thicket /Dense bush	8.8
	Woodland/Open bush	30.6
	Grassland	141.0
Topsoil Stockpile East	Woodland/Open bush	0.1
	Grassland	9.2
Topsoil Stockpile West	Woodland/Open bush	10.4
	Grassland	25.6
Waste Rock Dump East	Thicket /Dense bush	0.4
	Woodland/Open bush	15.8
	Grassland	76.9
	Cultivated commercial fields (low)	11.3
Waste Rock Dump West	Thicket /Dense bush	0.1
	Woodland/Open bush	107.3
	Grassland	250.7
	Mines 2 semi-bare	0.4

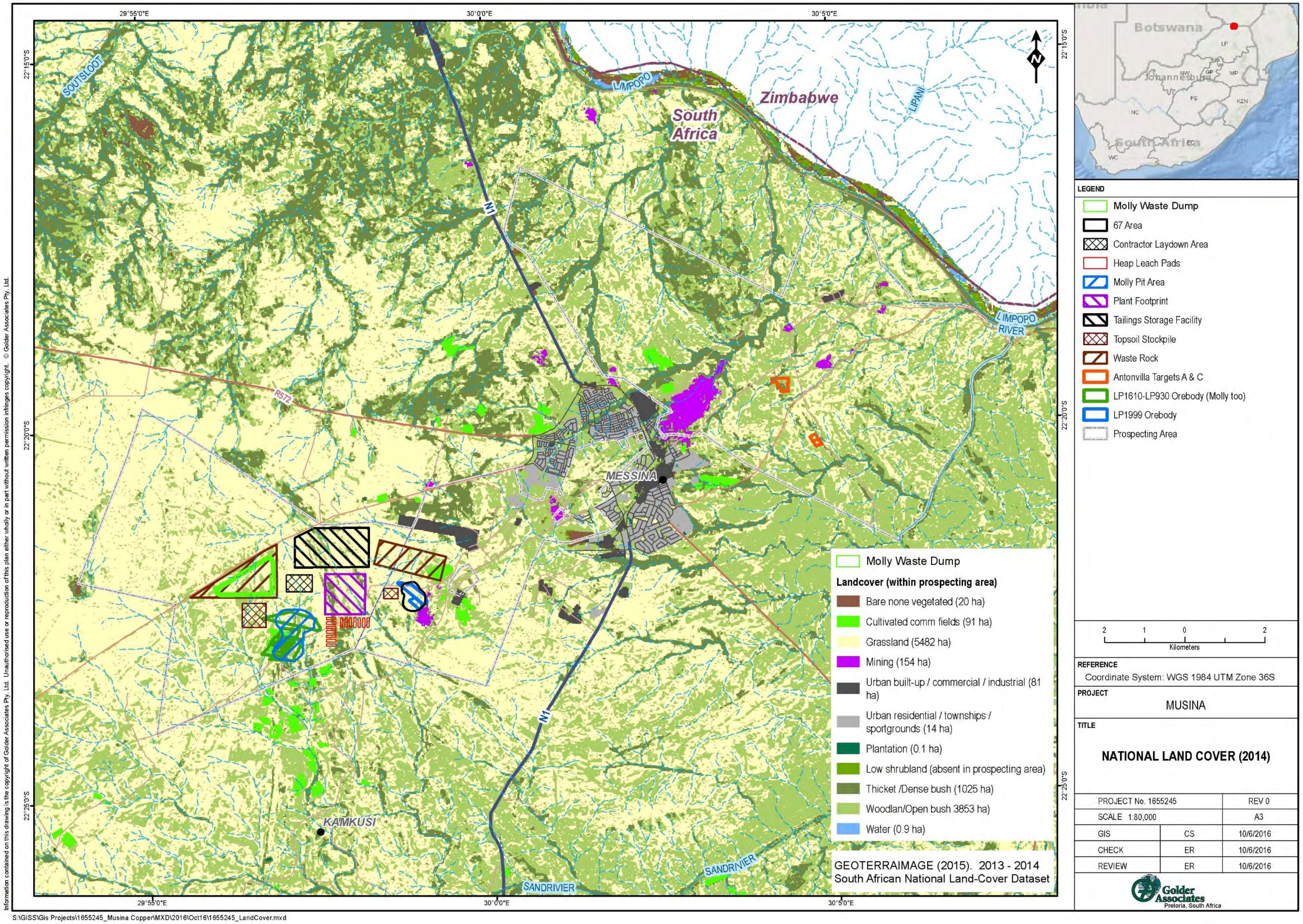

Figure 4-10: Land cover and vegetation types

4.8 Ecology

An evaluation of the existing terrestrial ecological conditions on the proposed mining areas was undertaken in August 2016 by means of a literature study and satellite imagery (Zinn, A; Roux , E;, August 2016). It will be augmented by field work as soon as access to the land is granted.

Seven farms comprise the area over which Smarty holds prospecting rights and has applied for a mining right, hereafter collectively referred to as the study area. The study area covers approximately 10 719 ha, and extends on an east-west orientation with the town of Musina located near its centre – see Figure 2-2. The east of the study area is bounded by the Limpopo River, which acts as the international border between South Africa and Zimbabwe. Beitbridge Border Post is located about 6 km north of the study area.

Apart from urban and commercial infrastructure associated with the town Musina and a few small sites of development or disturbance, much of the study area, as well as the surrounding land, comprises natural habitat consisting of grassland, low shrubland, woodland/open bush, with dense bush along the drainage lines, and cultivated fields – see Figure 4-10.

4.8.1 Vegetation

The study area is located within the Musina Mopane Bushveld and Limpopo Ridge Bushveld vegetation types of the savanna biome (Mucina & Rutherford 2006), both of which occur on undulating to very irregular plains, with scattered ridges and hills.

The western extent of the Musina Mopane Bushveld vegetation type in the area is dominated by open woodland to moderately closed shrubland, with *Colophospermum mopane* prevalent on clayey valley bottoms and *Combretum apiculatum* on the hillsides. In the east, vegetation is characterised by moderately closed to open shrubveld dominated by *Colophospermum mopane* and *Terminalia prunioides.* The herbaceous layer is generally well developed, except in areas of dense *Colophospermum mopane* cover.

The Limpopo Ridge Bushveld vegetation structure consists of moderately open savanna, with a poorly developed herbaceous layer. *Kirkia acuminata* typically dominates hilltops, while large *Adansonia digitata* trees occur on areas of calcareous gravel.

The provincial coverage of Musina Mopane Bushveld and Limpopo Ridge Bushveld are approximately 880 218 ha and 278 375 ha, respectively. About 2.2% of the former and 19% of the later are formally protected (Limpopo Conservation Plan V2 2013). Despite the relatively low level of formal protection, both vegetation types are listed as Least Threatened at a national (NEMBA Threatened Ecosystems 2011) and provincial (Limpopo Conservation Plan V2 2013) level.

The Limpopo Conservation Plan recognises parcels of land in the eastern portion of the study area as Critical Biodiversity Areas (CBA) 1 and CBA 2, with remaining portions either uncategorised or considered Ecological Support Areas (ESA) – see Figure 4-11. Much of the western portion of the study area is unclassified, with the balance mostly categorised as Ecological Support Areas and a small land portion as Critical Biodiversity Area 1.

The Musina Nature Reserve is located immediately south of the study area, the Maremani Nature Reserve to the north and the Soutpansberg Important Bird Area (IBA) approximately 30 km south of the study area. This IBA encompasses the Soutpansberg mountain range, which is characterised by a diverse range of habitats including high-altitude grassland and Afromontane forest (BirdLife South Africa 2016).

The South African National Biodiversity Institutes (SANBI) Plants of South Africa (POSA) database lists 151 flora species for the 2229BD and 2230AC QDS. Of these, only the Vulnerable *Orbea woodii* is on the regional IUCN Red List (SANBI 2015). The flowering plant *Dicliptera cliffordii*, which is listed as Rare (SANBI 2015) has been recorded in the Musina Nature Reserve (Nature Conservation Coporation 2013) and may potentially occur in the study area.

Several protected trees, as listed under the National Forests Act (1998), may also potentially occur in the study area. These include *Adansonia digitata, Afzelia quanzensis, Boscia albitrunca, Combretum imberbe, Philenoptera violacea, Sclerocarya birrea* and *Spirostachys africana.*

4.8.2 Fauna

4.8.2.1 Mammals

The northern Limpopo region comprises large tracts of undisturbed natural bushveld habitat, with many farms dedicated to game ranching, thereby keeping the region's original small to medium-sized mammal assemblages intact, and it is likely that many large mammals, particularly those not dependent on formal conservation operations, such as Kudu (*Tragelaphus strepsiceros*), may be fairly abundant.

The distribution maps presented in Stuart & Stuart (2007) indicate that, based on historic extent of occurrence[3], about 114 mammals potentially occur in the study area, including both conservation dependent[4] and conservation independent[5] species. The potentially occurring mammals are listed in the specialist report (Zinn, A; Roux , E;, August 2016)

4.8.2.2 Avifauna

The study area encompasses a rich diversity of potential bird habitat, including open and closed bushveld, mountainous terrain and riparian woodland and reedbeds. The SABAP2 lists 287 birds for the pentads in which the study area is located. Documented birds include a range of species typical of arid bushveld. Areas of riparian habitat occurring along the Limpopo and Sand Rivers are particularly important bird habitat, providing large nesting trees for species such as raptors.

Eighteen species of conservation importance are potentially present. These are listed in the specialist report and include one Critically Endangered, seven Endangered, four Vulnerable and five Near Threatened species, as per the IUCN – Regional List (2016). Several species are further recognised on the NEMBA TOPS List (2013) and the Limpopo Environmental Management Act (2003) list of Specially Protected species[6].

4.8.2.3 Herpetofauna

Relatively high summer rainfall, warm temperatures and high humidity in the region are conducive to high reptile and amphibian diversity. The distribution maps presented in Bates *et al*. (2014) indicate that 122 reptile species have been recorded in the region (see the specialist report for the list). Of these, 17 are of conservation importance and may potentially occur in the study area. These include three Vulnerable and five Near Threatened species, as per the IUCN regional statuses (Bates *et al*. 2014), as well as several other species listed under either the NEMBA ToPS List (2013) and the Limpopo Environmental Management Act (2003). The region also supports numerous endemic reptile taxa, with 19 regarded as Endemic and nine as Near Endemic.

Thirty two amphibians potentially occur in the study area (Minter *et al*. 2004; du Preez & Carruthers 2009). The Near Threatened Giant Bullfrog (*Pyxicephalus adspersus*) has been recorded far to the east and far to the west of the study area (Minter *et al*. 2004), but its presence within the study area is considered unlikely.

4.8.2.4 Arthropods

Henning *et al*. (2009) lists nine Red List butterflies for Limpopo Province. Apart from *Telchinia induna salmontana,* which is found in the Soutpansberg Mountains, these butterflies are mostly confined to the Wolkberg area, which is located about 170 km south of the study area (Henning *et al*. 2009).

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[3] Geographical area bounded by the outermost known /projected species' record (Thorn *et al.* 2011).

[4] Species that are generally confined to formal nature reserves and protected areas, or that are actively bred on game farms. Typically includes large ungulates and predators- the presence of conservation dependent species will be determined upon discussions with the land owners.

[5] Species that are free-range, i.e. not confined or dependant on formal nature reserves and protected areas.

[6] All birds, except those listed as Specially Protected or as common game birds, are considered Protected according to the Limpopo Environmental Management Act (2003).

SpiderMAP records indicate that *Idiothele nigrofulva* has been recorded in the 2230AC QDS. This species is a member of the baboon spider family (Family Theraphosidae), which is considered to be of conservation value. Other members of the Theraphosidae that may present in the study area are listed in the specialist report.

Members of the genus *Opistophthalmus* – the burrowing scorpions (Family Scorpionidae) may also be present in the study area. These are also considered to be of conservation value.

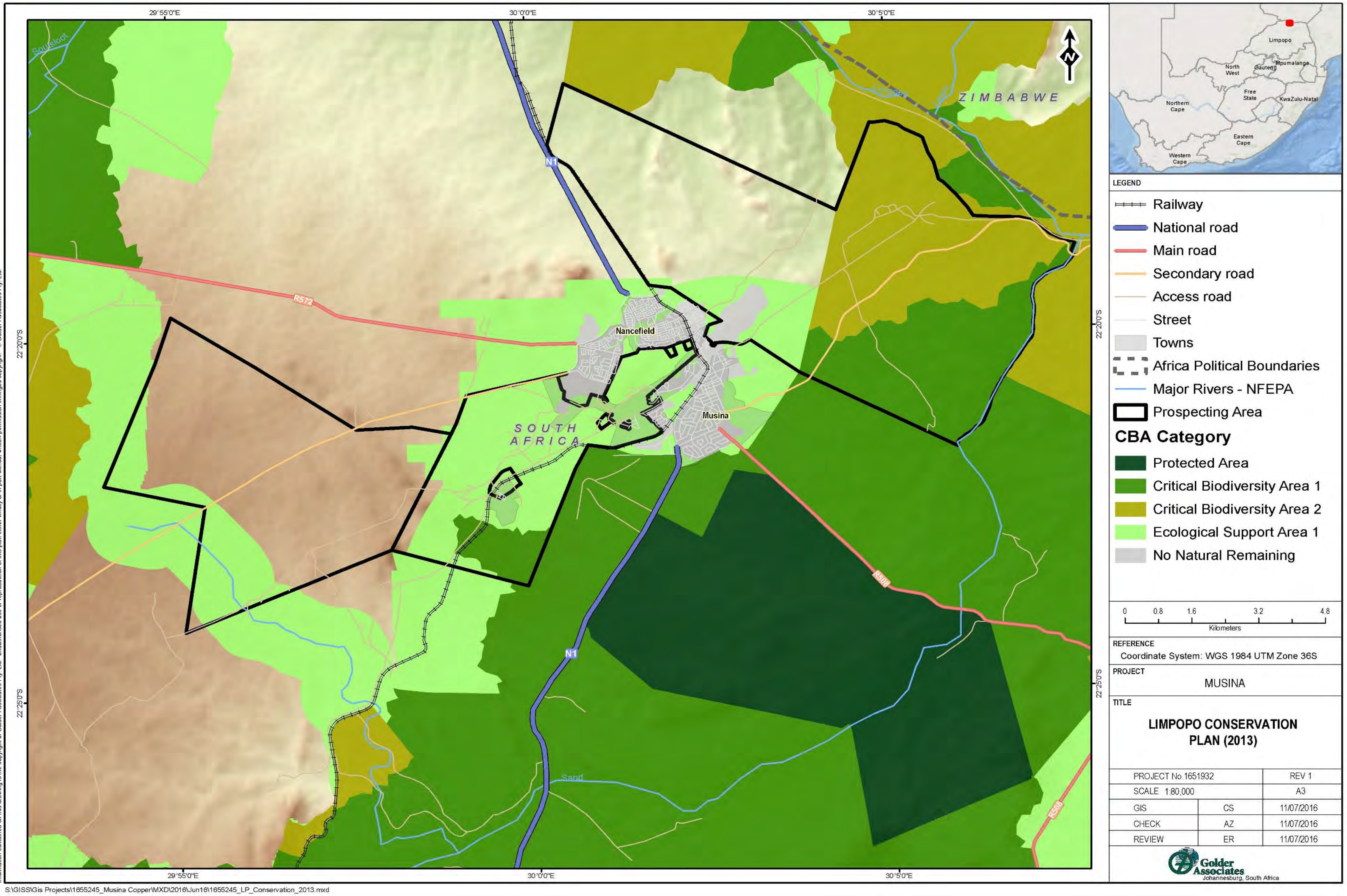


Figure 4-11: Study area in relation to Limpopo Conservation Plan V2 (2013)

In order to assess the Red Data status of species in the study area, the following sources were consulted:

- National Environmental Management: Biodiversity Act (No. 10 of 2004) – Lists of critically endangered, endangered, vulnerable and protected species (NEMBA, 2007);
- National Forests Act (No. 84 of 1998) – List of Protected Tree Species;
- Rare, endangered and endemic flora of the Bojanala Platinum District, North West Province (Hahn, 2011);
- North West Biodiversity Inventory and Database (2003);
- Limpopo Environmental Management Act (No. 7 of 2003);
- International Union for the Conservation of Nature (IUCN) Red List of Threatened Species (2011); and
- International Union for the Conservation of Nature (IUCN) Red List Categories and Criteria (2008).

4.8.3 Ecological Integrity

The precautionary principle was applied to the determination of the ecological function of the study area. If ecological function was found to be borderline between two categories, the site was classified in the higher category.

The preferred site for the proposed mining and infrastructure development is undeveloped and largely in its natural condition, but parts of the surrounding area have been impacted by historic agricultural activities, mining, business and residential developments.

Considering these factors and the recorded species diversity, the ecological integrity of the study area is regarded as being moderate to high in places.

4.8.4 Conservation Importance

The precautionary principle was also applied to the determination of the conservation importance of the various vegetation communities. In instances where conservation importance was found to be borderline between two categories, the community was classified in the higher category.

Due to the widespread occurrence of the same vegetation types over a large area in the vicinity of the preferred site, the conservation importance of the vegetation on the site is regarded as low.

4.9 Surface Water

A literature based baseline surface water study was undertaken to characterise the hydrology of the proposed mining area and its surroundings and to provide input for the water use licence application (WULA) (Dateling, J; Coleman, T;, September 2016). Information generated during fieldwork, after access to the relevant farms has been obtained, will be incorporated in the EIA Report.

As shown on Figure 4-12, the proposed copper mine site is located within the A71K Quaternary catchment in the Limpopo province. A tributary runs through the proposed project area in a south-easterly direction and for about 14 km until it joins the Sand River, which flows in a north-easterly direction until it meets the Limpopo River. There are several non-perennial rivers on the proposed copper mine site.

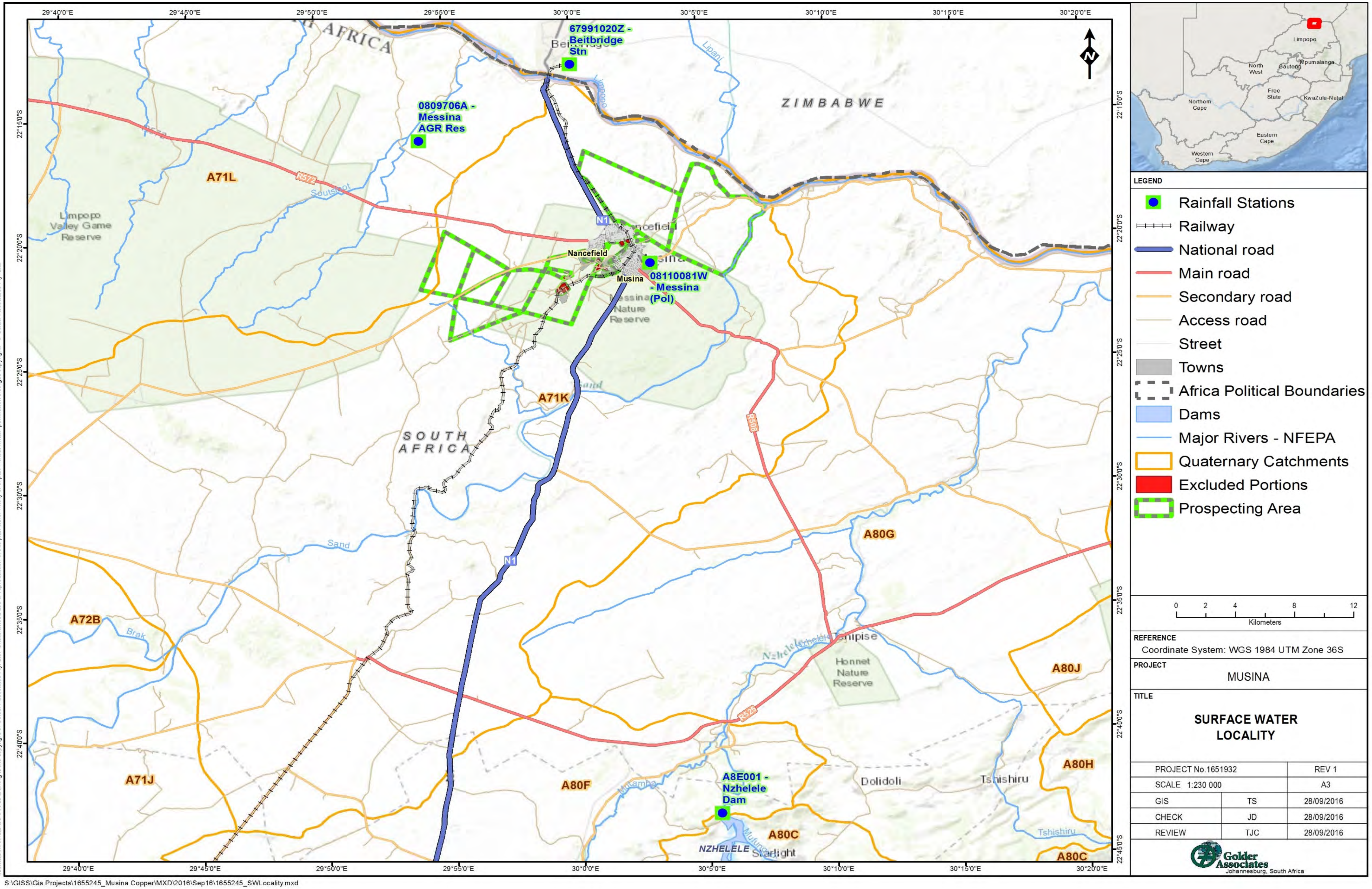


Figure 4-12: Catchments and climate stations relevant to project area

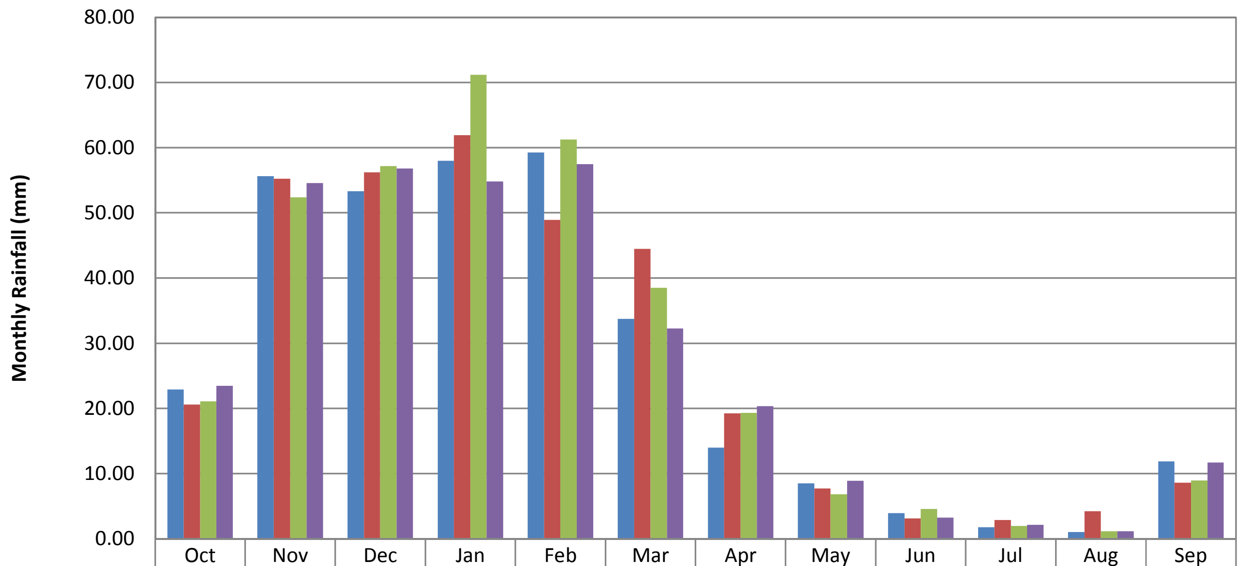
4.9.1 Rainfall

Rainfall information was obtained from the weather stations listed in Table 4-12.

Table 4-12: Weather stations in vicinity of project area

Station	Name	Altitude (masl)	From	To	No of Years	MAP(mm)
0810081 W	Messina (Pol)	535	1965	2009	44 (1% patched)	324
A8E001	Nairobi @ Nzhelele Dam	779	1971	2016	45 (1% patched)	333
0809706 A	Messina AGR Res.	520	1933	2000	67 (26% patched)	344
67791020 Z	Beit Bridge Station	451	1959	1999	40 (1% patched)	327

The average monthly rainfall recorded at the above weather stations over the periods indicated in Table 4-12 are shown in Figure 4-13.



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
0810081_W	22.90	55.64	53.32	58.01	59.28	33.75	13.98	8.49	3.94	1.77	1.05	11.88
A8E001	20.58	55.23	56.19	61.93	48.92	44.47	19.25	7.72	3.12	2.88	4.24	8.63
0809706_A	21.06	52.39	57.20	71.20	61.25	38.50	19.32	6.82	4.57	1.97	1.17	8.96
67791020Z	23.48	54.59	56.80	54.81	57.46	32.26	20.34	8.90	3.23	2.16	1.15	11.72

Figure 4-13: Monthly rainfall distribution for rainfall stations in the vicinity of the proposed project

Cumulative rainfall graphs do not indicate any irregularities or anomalies in the data. The monthly cumulative plots do not highlight any anomalies in the data. Data recorded at the 0810081 W station Messina (Pol) was chosen for use in the study for the following reasons:

- 0810081 W's rainfall record is of a long duration (1965 – 2009);
- 0810081 W is the closest station to the site and is at a similar altitude;
- The patched data applied to the 0810081 W records is minimal, thus providing a reliable set of data; and
- The 0810081 W station's MAP falls within a suitable range of other stations in the region.

It was that noted that the 0810081 W station had experienced a large storm during the 1999 hydrological year which was also experienced at the A8E001 and 0809706 A stations.

Figure 4-14 shows the annual rainfall for each year compared to the MAP of the combined rainfall record.

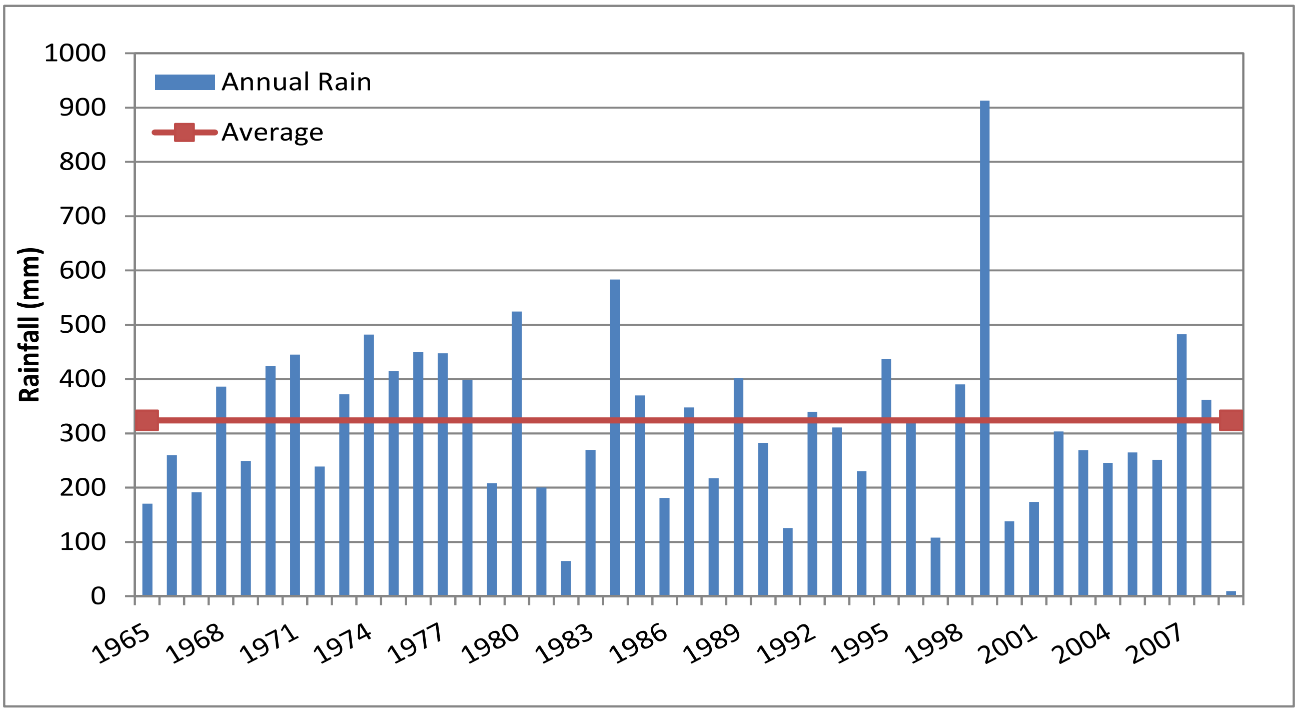


Figure 4-14: Annual rainfall for the 0810081 station

The highest annual rainfall was in the 1999 hydrological year at 913 mm. The average Mean Annual Precipitation (MAP) for the 0810081 W weather station is 324 mm.

The 5, 50 and 95 percentiles of the annual rainfall totals for the rainfall station are presented in Table 4-13.

Table 4-13: 5, 50, and 95 percentiles of the annual rainfall totals

Station Number	Station name	5th percentile	50th percentile	95th percentile
0810081 W	Messina (Pol)	127	311	520

Table 4-14 lists the five highest daily rainfall events measured at the 0810081 W station.

Table 4-14: High Rainfall Events

Maximum Recorded Daily Rainfall (mm)	Date
126	1993/01/09
113	2000/02/23
110	2000/02/04
100	2000/02/05
92.5	2000/02/24

In order to determine the likely magnitude of storm events, a statistical approach, using the Reg Flood program (Alexander, van Aswegen, & Hansford, 2003) was applied to the available recorded daily rainfall depths. The maximum 24 hour rainfall depth for each year was analysed. The 24-Hour rainfall depths for the 1 in 2, 1 in 5, 1 in 10, 1 in 50, 1 in 100 and 1 in 200 year recurrence intervals were determined and are provided in Table 4-15.

Table 4-15: 24 Hour Rainfall Depths for Different Recurrence Intervals (mm/day)

Recurrence Interval (years)	1 in 2	1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 200
24 Hour Rainfall Depth (mm)	49	69	85	99	117	130	144

4.9.2 Temperature

Temperature data sourced from (World Weather Online, 2016) is shown graphically in Figure 4-15.

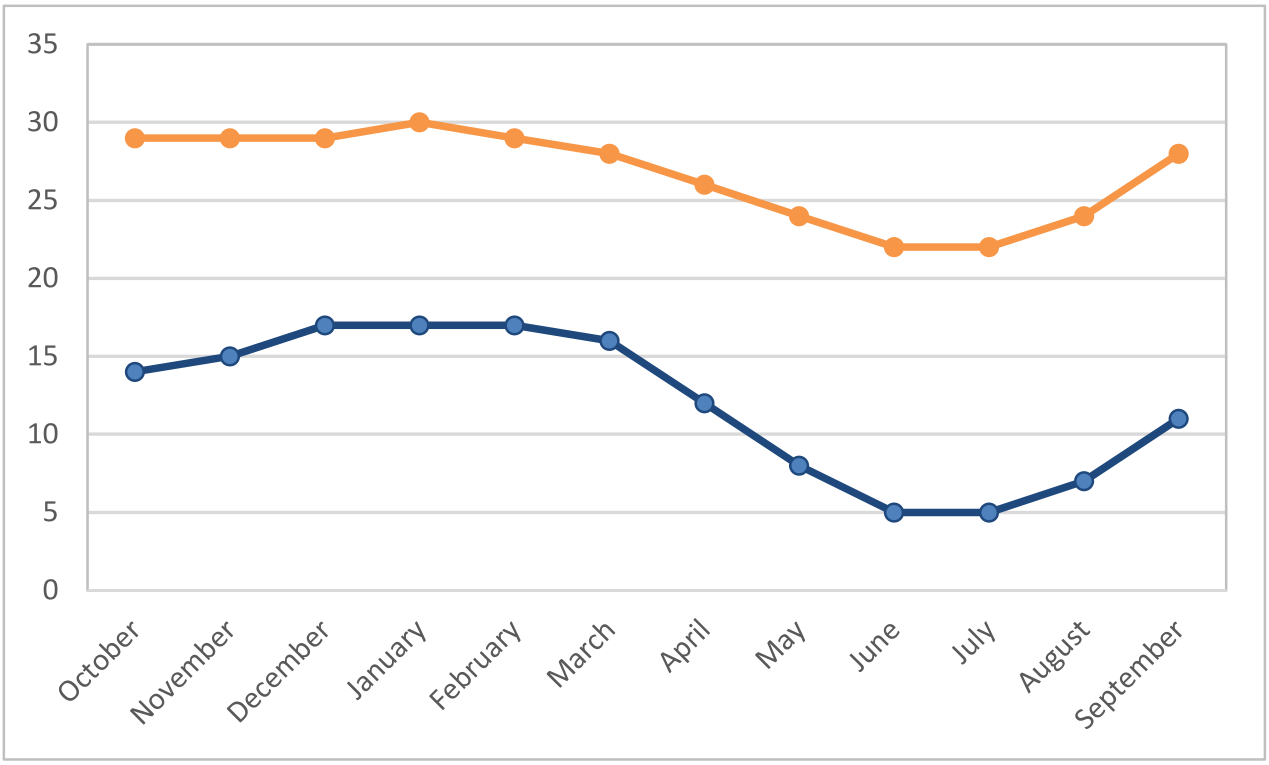


Figure 4-15: Average daytime and night time temperature (ºC)

4.9.3 Evaporation

Climate station A8E001 was used as the source of evaporation data. The mean annual S-pan evaporation depth measured is 2248 mm/annum. Figure 4-16 summarises the average monthly evaporation values for the station A8E001.

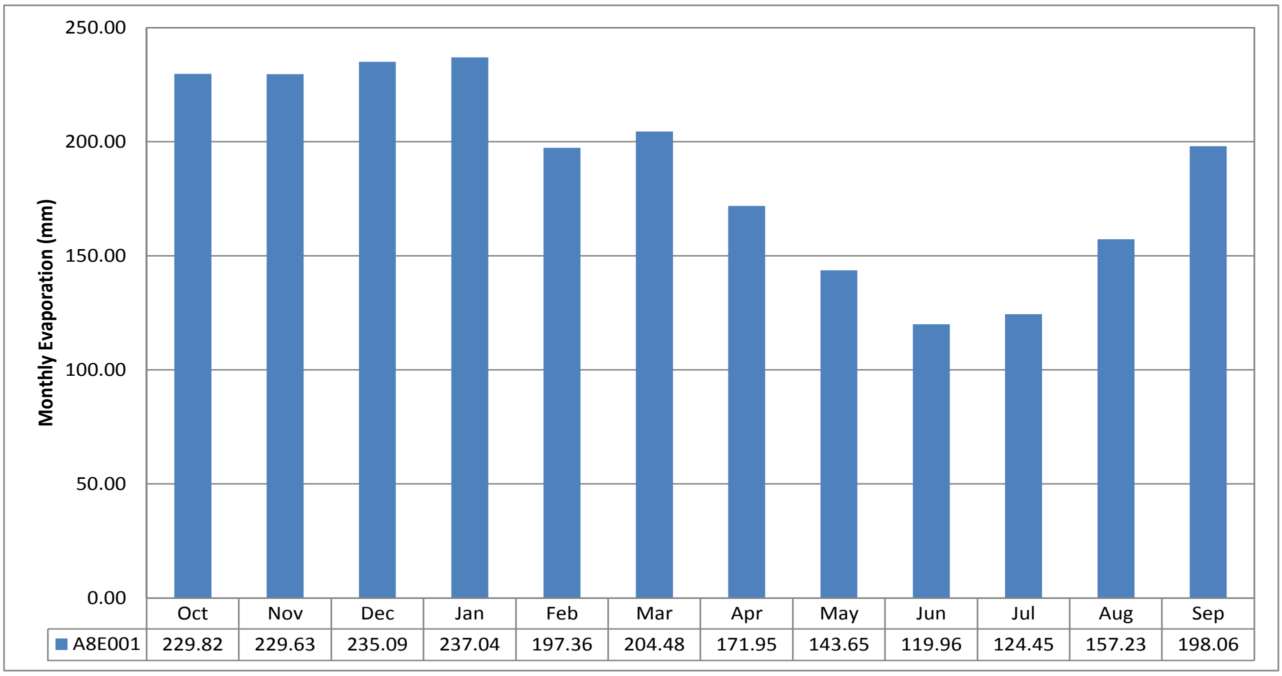


Figure 4-16: Mean monthly evaporation values for station A8E001

4.9.4 Water Quality and Flow Monitoring

The streams within and adjacent to the project area are non-perennial and with the recent drought, the area is particularly dry, with little or no surface water flow in the local streams.

The Department of Water and Sanitation (DWS) undertakes river flow and water quality monitoring in the area. The locations of the flow stations are shown in Figure 4-17 and their descriptions are listed in Table 4-16. Figure 4-18 presents the average monthly flow measured at each station.

Table 4-16: Flow monitoring stations closest to project area

Station Name	Station	Date from	Date to	Catchment Area (km^2)	River	Location relative to site
Limpopo River @ Beit Bridge	A7H004	1954	1991	201 000	Limpopo	Upstream
Limpopo River @ Beit Bridge	A7H008	1991	2015	202 985	Limpopo	Upstream
Sand River @ Beit Bridge	A7H009	1993	1999	12 873	Sand	Upstream

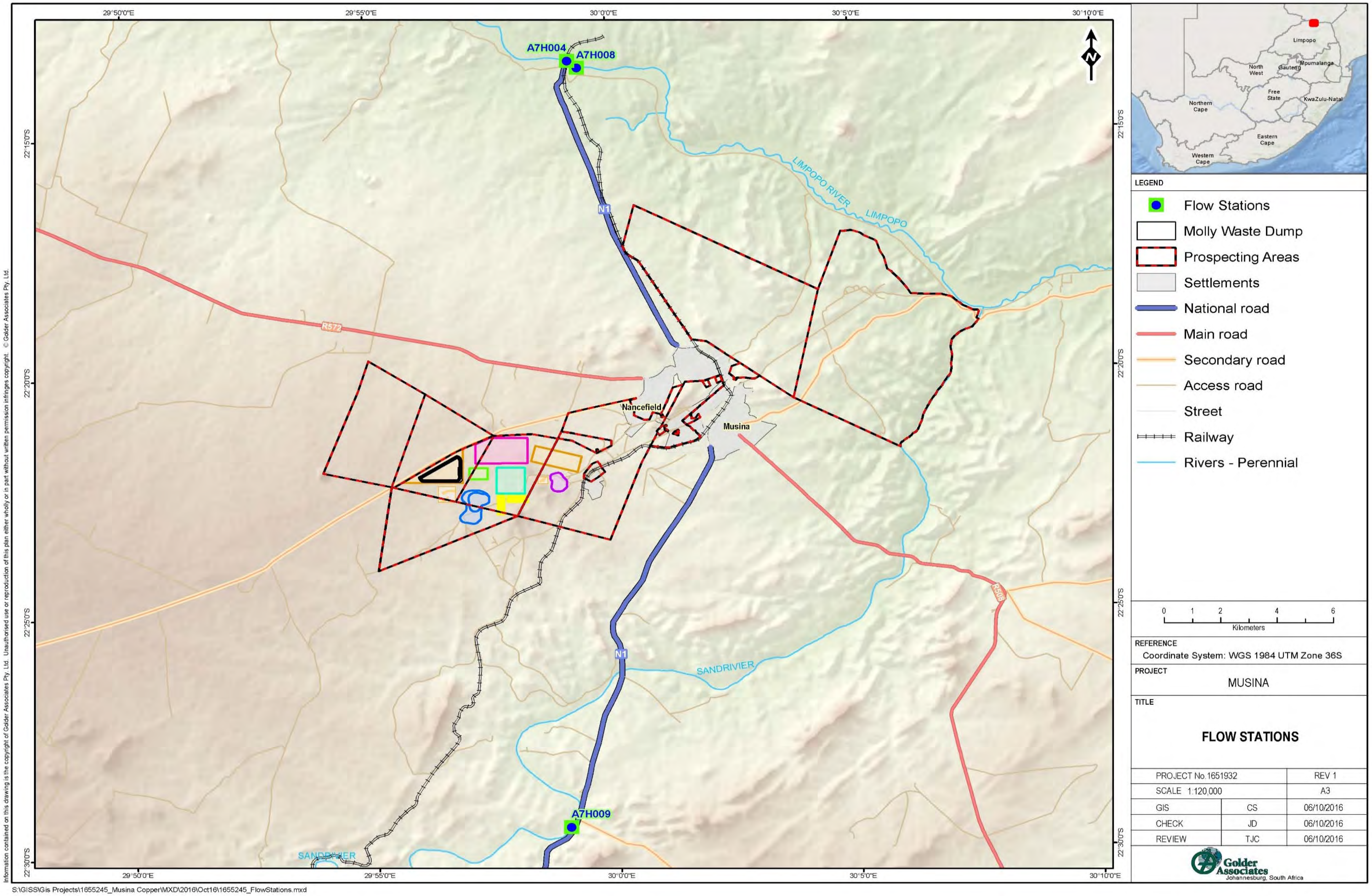
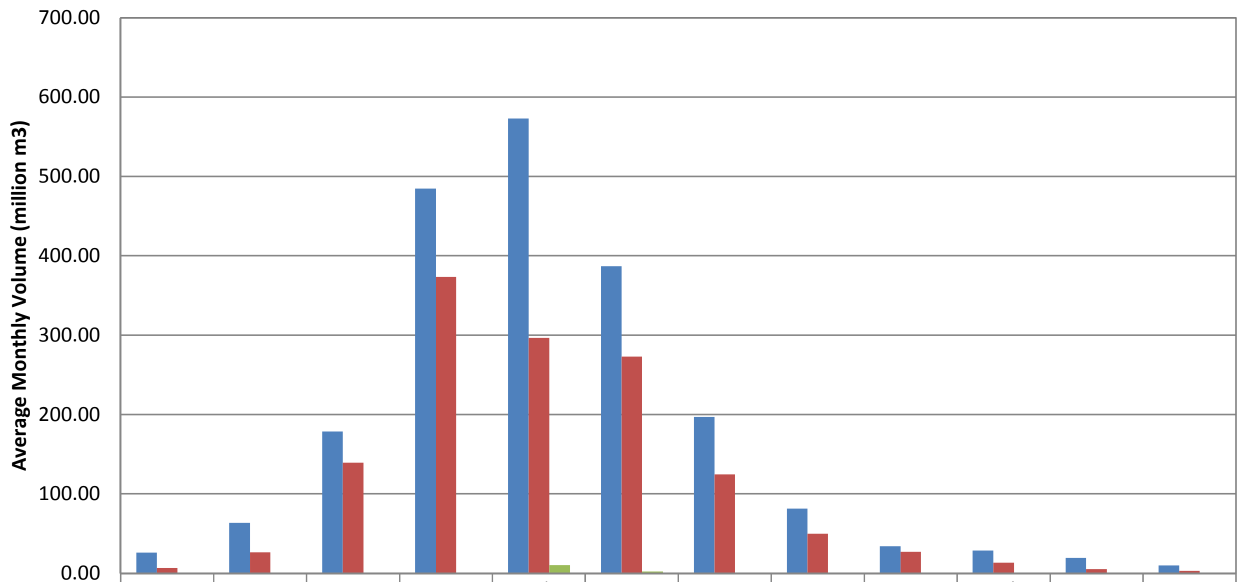


Figure 4-17: Locations of flow monitoring stations



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
A7H004	25.80	63.24	178.62	484.59	572.78	386.76	197.15	81.42	34.07	28.48	19.18	9.92
A7H008	6.37	26.19	139.27	373.54	296.45	272.73	124.36	49.73	27.02	13.12	5.25	2.89
A7H009	0.00	0.00	0.00	0.09	10.06	2.05	0.00	0.00	0.00	0.00	0.00	0.00

Figure 4-18: Average Monthly flow at stations A7H004, A7H008, and A7H009

4.10 Groundwater

A high level investigation of the groundwater regime at and in the broader vicinity of the proposed mining area was undertaken to characterise baseline conditions (Brink , D; van der Linde, G;, September 2016). It will be updated after access to the land has been obtained and fieldwork has been completed.

4.10.1 Regional Geohydrology

Igneous and metamorphic rock formations are relatively impermeable and generally represent poor aquifer systems, with groundwater occurring in openings that developed through fracturing, faulting, or weathering of the rock.

The fractured fault zones of the Messina and Dowe Tokwe faults in the study area are possible areas of increased groundwater potential. These two geological structures are sub-vertical (Coffee 2106). The permeability of these fault zones will need to be investigated and confirmed.

Within metamorphic formations, groundwater typically occurs in upper weathered and fractured underlying aquifer systems.

According to the published hydrogeological map series by DWAF (1996) the regional aquifer is classified as an intergranular and fractured aquifer system and the average borehole yield in the area is between 0.5l/s and 2.0l/s. The reported borehole yield on the groundwater database is 0.04 to 11.36 l/s with an average of 3.0l/s.

Groundwater vulnerability is shown on the national groundwater vulnerability map as low to the east of the proposed mining area and medium to high in the central area.

4.10.2 Local Groundwater levels and Flow Directions

The published hydrogeological maps (DWAF 1996) indicate the water level to be between 20 to 40 metres below ground level (mbgl) with an average of 22.54 mbgl. With the only available groundwater level data being the groundwater database, it must be assumed that the groundwater contours will mimic the topography and the regional flow will be towards the Sand and Limpopo Rivers.

4.10.3 Groundwater Quality

Domestic water quality classes are defined as follows in terms of electrical conductivity (EC) (Holmes , S;, 1996):

- EC = <70mS/m = Class 0;
- EC = 70 - 150mS/m = Class 1;
- EC = 150 – 370 mS/m = Class 2;
- EC = 370 – 520 mS/m = Class 3; and
- EC = >520 mS/m = Class 4

No detailed groundwater quality information is available from literature sources, but 29 measured EC values were recorded on the groundwater database. They range from 110 to 770 mS/m with an average of 211mS/m, which represents Class 2 drinking water.

The published hydrogeological map series by DWAF (1996) show EC values of 0 to 70mS/m (Class 0 water quality) immediately west of proposed mining area and 70 to 1000mS/m (Class 1 to 4) over the remainder of the project area.

The published hydrogeological maps (DWAF 1996) show the average recharge for the study area as being between 1 and 5 mm per annum.

4.11 Noise

A baseline noise level survey could not be undertaken as landowners refused to grant access to the relevant farms. Baseline measurements will be undertaken as soon as access is obtained and the results will be included in the impact assessment report.

The primary noise sources identified in the area and their associated potential for noise generation are detailed in Table 4-17 (Allan & Bennet, August 2016). The prevailing ambient noise levels will vary because of the existing farming activities, roads (gravel and tarred) and the distant N1 National Road. The noise levels experienced by a receptor are a function of:

- The distance between the receptor and the noise source;
- The intervening topography and structures that may shield the receptor from the noise; and
- Meteorological conditions such as wind speed, temperature and the season.

Table 4-17: Existing noise sources identified in the vicinity of the proposed Smarty infrastructure

Noise source	Description
Rural environmental noise sources	Birds, animals and insects. These sources are particularly prevalent at night. The prevailing ambient noise levels will be higher during the summer periods when insects such as crickets and beetles increase the ambient noise level. Typical noise levels for rural environments are given in SANS 10103 as: ■ Day-night ($L_{R,dn}$) or “average” and daytime ($L_{Req,d}$) – 45 dB; and ■ Night time ($L_{Req,n}$) – 35 dB.
Residential (suburban)	Typical noise levels for residential/ suburban environments with little traffic are given in SANS 10103 as: ■ Day-night ($L_{R,dn}$) or “average” and daytime ($L_{Req,d}$) – 50 dB; and ■ Night time ($L_{Req,n}$) – 40 dB.
Road traffic noise	■ Most of the roads within 10 km of the proposed Smarty infrastructure are gravel farm access roads;

Noise source	Description
	■ The tarred R572 road runs past the proposed waste rock dump. Traffic volumes on this road are anticipated to be low; and ■ The N1 National Road is located 5 km from the proposed Smarty infrastructure. Road traffic noise levels fluctuate over time. There are short-term changes over one or two seconds as an individual vehicles passes. Variations over a number of minutes due to the changing composition of the traffic (i.e. ratio of cars to trucks etc.). Daily oscillations due to peak and off-peak traffic flows. Road traffic noise is the combination of all sources of noise from a vehicle and includes propulsion (i.e. engine, exhaust, intake etc.), tyre/road (i.e. noise or road surface noise is that which is generated as the tyre rolls), and aerodynamic noise sources (turbulence around a vehicle as it passes through the air) (NZ Transport Agency, 2014).
Rail	Wayside noise is generated by the train's propulsion system, the auxiliary equipment such as compressors, motor generators, brakes, interaction of wheels and rails, speed and length of the train, and noise radiated by vibrating structures such as bridges.
Musina Aerodrome	The airfield is located approximately 600 m north of the proposed waste rock dump. Due to the perceived scale of this operation it is assumed that the aerodrome only hosts light aircraft and flights are infrequent. The aerodrome is therefore thought to be a minor source of noise in the area.

Identified receptors within 5 km of the proposed mining activities are indicated on Figure 4-19.

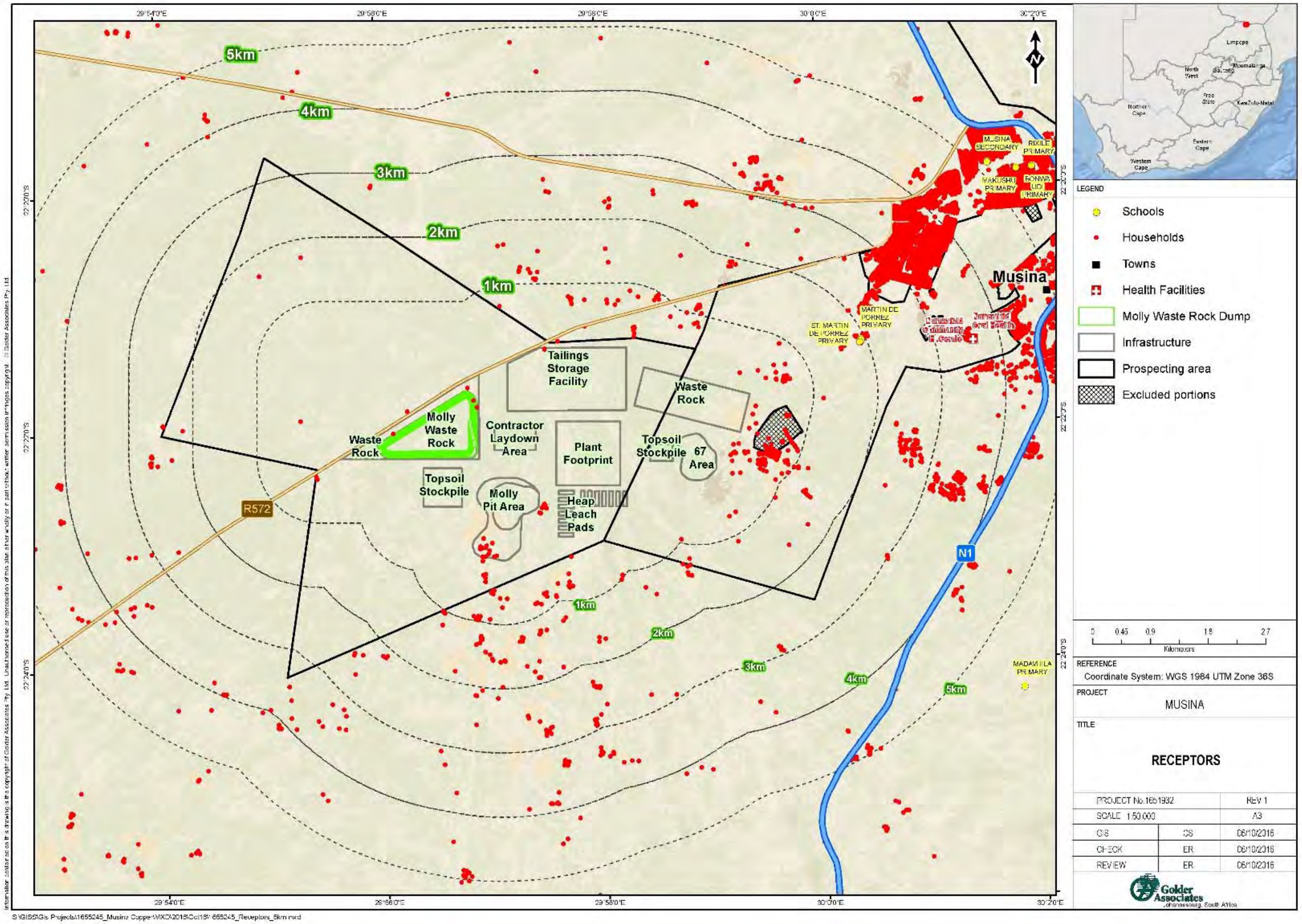


Figure 4-19: Receptors within 5 km of proposed mining activities

4.12 Visual Aspects

An initial visual baseline assessment was compiled based on observations made and photographs taken from public roads in the project area during late September 2016.

4.12.1 Visual Characteristics of the Project Area

For the purposes of the assessment, the study area was defined as a 10 km radius around the physical footprint of the proposed surface components of the mine. The human eye cannot distinguish significant detail beyond this range. Although it may be possible to see over greater distances from certain elevated locations such as hilltops, visual impacts such as manmade structures or artificial landforms that are this far away from the viewer are no longer clearly discernible or are mostly inconspicuous, and the visual impact beyond this range is considered to be negligible.

The study area is located within the Musina Mopane Bushveld and Limpopo Ridge Bushveld vegetation types of the savanna biome (Mucina & Rutherford 2006), both of which occur on undulating to very irregular plains, with scattered ridges and hills. The proposed infrastructure site is located on a relatively flat area at an average elevation of 610 mamsl, without any prominent ridges or hills. The elevation decreases from west to east at a slope of 1:155 and from south to north at a slope of 1:330. See Figure 4-6. The area is on a water divide, with drainage lines running northwards and south-south-eastwards from the perimeter of the infrastructure site.

The following features that contribute to the visual character of the project area and its surroundings occur within a 10 km radius around the site:

- A rocky outcrop located about 5 km to the west of the infrastructure site rises to about 30 metres above the surrounding terrain, which places the top of the outcrop at an elevation of about 80 metres higher than the site;
- The Musina aerodrome located about 2.5 km to the east-north-east of the site;
- The edge of the urban area about 5.3 km to the east-north-east;
- The new N1 by-pass about 6.3 km to the east;
- The new Musina interchange about 7.4 km to the south-east; and
- An active crusher plant adjacent to and south of the proposed 67 area opencast mine.

The Soutpansberg mountain range lies about 30 km to the south, too far away for the proposed structures on the site to be readily visible to the naked eye.

4.12.2 Value of the Visual Resource

Apart from the crusher operation adjacent to and south of the proposed 67 area opencast mine, the proposed mining and infrastructure site is undeveloped and is covered in dense bushveld, with the iconic baobab *(Adansonia digitate)*, which contributes significantly to the "sense of place" of the area, much in evidence - see Figure 4-20 and Figure 4-21.

Due to the homogenous vegetation cover and flat topography, the project area does not have a high visual absorption capacity (VAC), but the existing vegetation cover offers significant visual screening, even over relatively short distances. The vegetation cover is largely undisturbed and is one of the most appealing features of the area. There are no prominent water bodies or watercourses present within viewing distance of the project area, but views of the Limpopo River and Sandrivier have strong visual appeal.

Areas such as the crusher plant site (Figure 4-23) and the N1 by-pass construction Figure 4-24, have low visual resource value.

Figure 4-20: Typical bushveld with baobab and mopane trees on undisturbed parts of proposed mining and infrastructure site

Figure 4-21: Large baobab typical of project area

Figure 4-22: Entrance to Musina Game Reserve about 11 km south-east of project area

Figure 4-23: Quarry and crusher plant adjacent to proposed area 67 opencast mine

Figure 4-24: N1 by-pass under construction

4.13 Sites of Archaeological and Cultural Significance

Due to the lack of access to the relevant farms, a proper phase I heritage impact assessment (HIA) study, as required in terms of Section 38 of the National Heritage Resources Act (Act 25 of 1999), could not be undertaken, but the cultural and heritage specialist has provided a literature based overview of the project area (Pistorius, J;, August 2016). The necessary fieldwork on the areas where Smarty has applied for a mining right will be undertaken when access has been granted and the results will be included in the impact assessment report.

The Musina Copper Project falls within a regional cultural landscape which is host to a wide range of heritage resources that have been outlined by earlier archaeological and heritage studies. According to these studies, the most common types and ranges of heritage resources in the vicinity of the project area are:

- Settlements dating from the Stone Age.
- Settlements dating from the Iron Age or the last two thousand years.
- Historical farmsteads with houses older than sixty years are not uncommon and also occur within the town of Musina itself.
- Graveyards and graves, many of an informal nature, which are scattered across the wider Project Area.
- The remains of pre-historic copper mining at Musina, which were observed and reported by geologists during the first half of the twentieth century. These remains have not been investigated archaeologically and large parts were destroyed in order to make way for contemporary copper mining activities.

4.13.1 Pre-historical background

The Limpopo and North-West Provinces are rich in heritage resources that include remains dating from the pre-historical and from the historical (or colonial) periods of South Africa. Pre-historical and historical remains in the Limpopo and North-West Provinces constitute a record of the heritage of most groups living in South Africa today. The project area is surrounded by cultural landscapes of significance, some of which have been researched and documented in the past.

Scattered finds of Stone Age sites have been recorded in the Limpopo Valley and rock paintings have been found on rocky outcrops such as those at Mapungubwe. Numerous rock art sites have been recorded in the Soutpansberg mountain range further to the south.

Stone Age hunters occupied the area from the Acheulian period as evidenced by finds of Acheulian hand axes at Mapungubwe and near the Soutpansberg. Middle Stone Age (MSA) sites may be expected in or near the project area. Late Iron Age (LIA) sites also have been recorded at Mapungubwe, which flourished during AD 900 to AD 1200 as the first complex socio-political community in Southern Africa.

At this flat-topped sandstone hill, farmer-herders established a royal kinship which dominated the Limpopo Valley and which was characterised by an intricate and experienced gold working industry that contributed to its participation in the Indian Ocean trade network of that era. The between the Soutpansberg and the Limpopo Valley was also home to many of today’s communities who have Sotho-Tswana, Venda and Lemba ancestors.

Pre-historic copper working activities in and around Musina were extensive and stretched in an almost continuous line for more than 29km from Musina in a south-westerly direction. There were about 120 workings and it is estimated that several tens of thousands of tons of copper were mined. All of them have been filled up and appear as cup-like hollows varying in shape and extending for about 1.6 km in length and sometimes running along three parallel lines.

The general methods of mining mainly comprised the mining of surface outcrops, followed by digging trenches and pits to depths of up to 15 metres. The ore lodes were followed in trenches or underground drives, sometimes branching off into short tunnels. In the larger mines, vertical and inclined shafts were sunk to considerable depths, but not deeper than 25m when water, bad ventilation, or transportation difficulties stopped further work.

The copper mining industry in Musina was founded by the Musina and Thsope people who came from the Phalaborwa region where a large ancient copper working industry existed, probably contemporary with that in Musina. According to radio carbon dating prehistoric mining and copper working in both areas may have continued, although perhaps intermittently, over a period of more than a thousand years, from AD700 to AD1850.

4.13.2 Modern historical background

The copper deposits in the Musina area were investigated in 1903 by Colonel John P Grenfell, who subsequently established the Messina (Transvaal) Development Company Limited in 1904 to exploit the deposits. Most of the deposits were revealed by investigating the ancient workings, although many new sources were also identified. Mining commenced in 1906 and continued until the closure of the mine in 1991. Control of the mine moved from London to South Africa in 1950. The plant was modernised and ore production reached a peak of 1.7Mt per annum in the early 1970s.

The town of Messina (renamed Musina in 2002) was founded in 1904 on the farm Berkenrode as a result of the exploitation of the copper deposits. It was proclaimed as town in 1957.

4.13.3 Findings of the heritage study

The findings of the Phase I HIA study, after completion of fieldwork, will be incorporated in the EIA report.

4.14 Traffic

4.14.1 Traffic survey

A traffic count and a service level evaluation of intersections on the proposed transport route for the mine's personnel and product, as shown on Figure 4-25, was undertaken on 21 July 2016 (Makala, J; Purchase, P;, August 2016).

The road network planning in the area entails realignment of the existing N1 Route past Musina (Musina Ring Road), with two interchanges in the vicinity of the mine site, one to the north (Nancefield) and other one to the south (Musina) of the site boundary – see Figure 4-26. Construction of the realignment commenced in April 2016 and is scheduled for completion by the end of 2018, i.e. before the mine commences with production. A section of the existing Harper Road alignment will also change to accommodate a new overpass over the railway line and Harper Road. The mine site will be accessible from Harper Road.

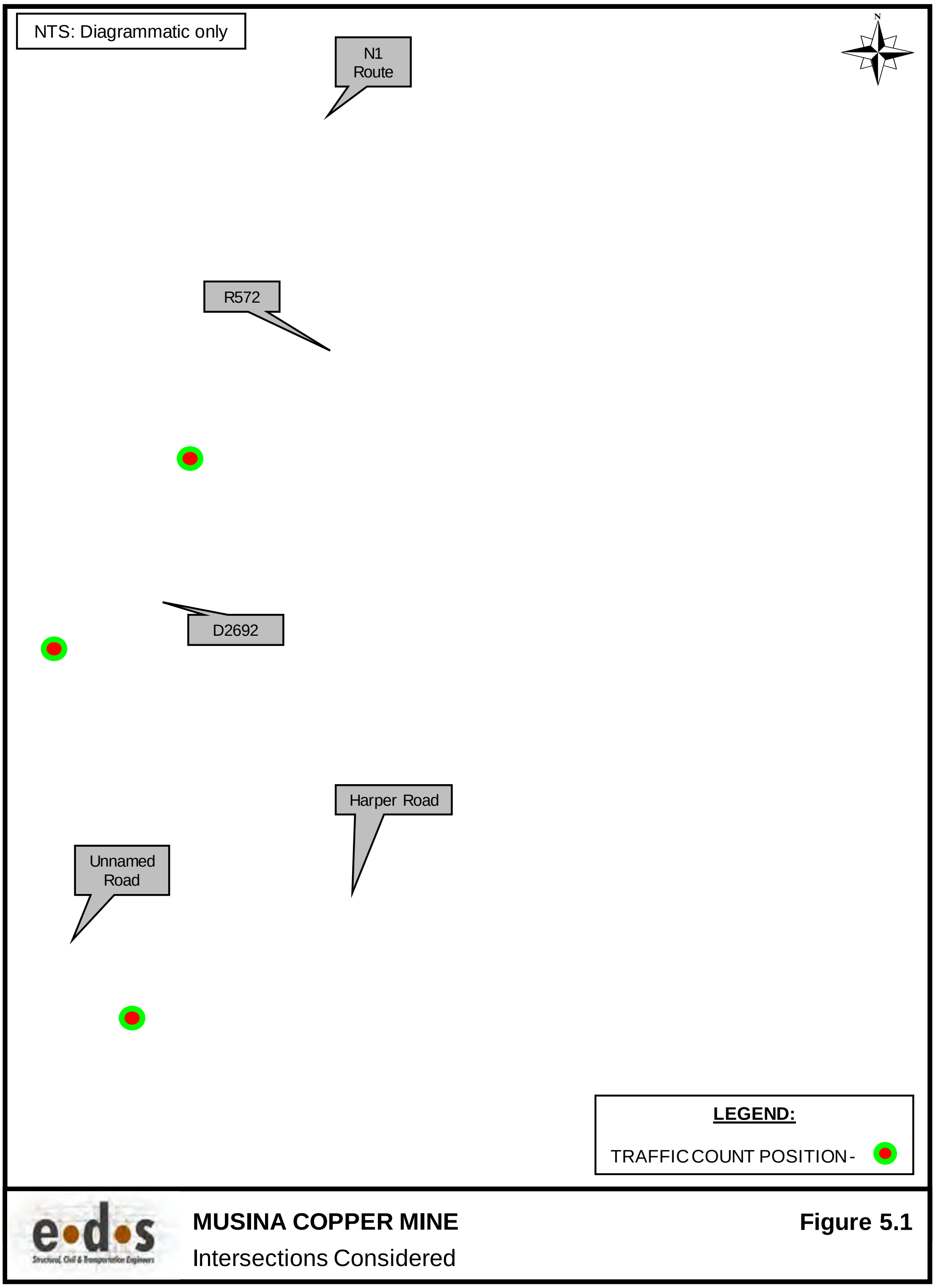


Figure 4-25: Intersections where traffic counts were undertaken

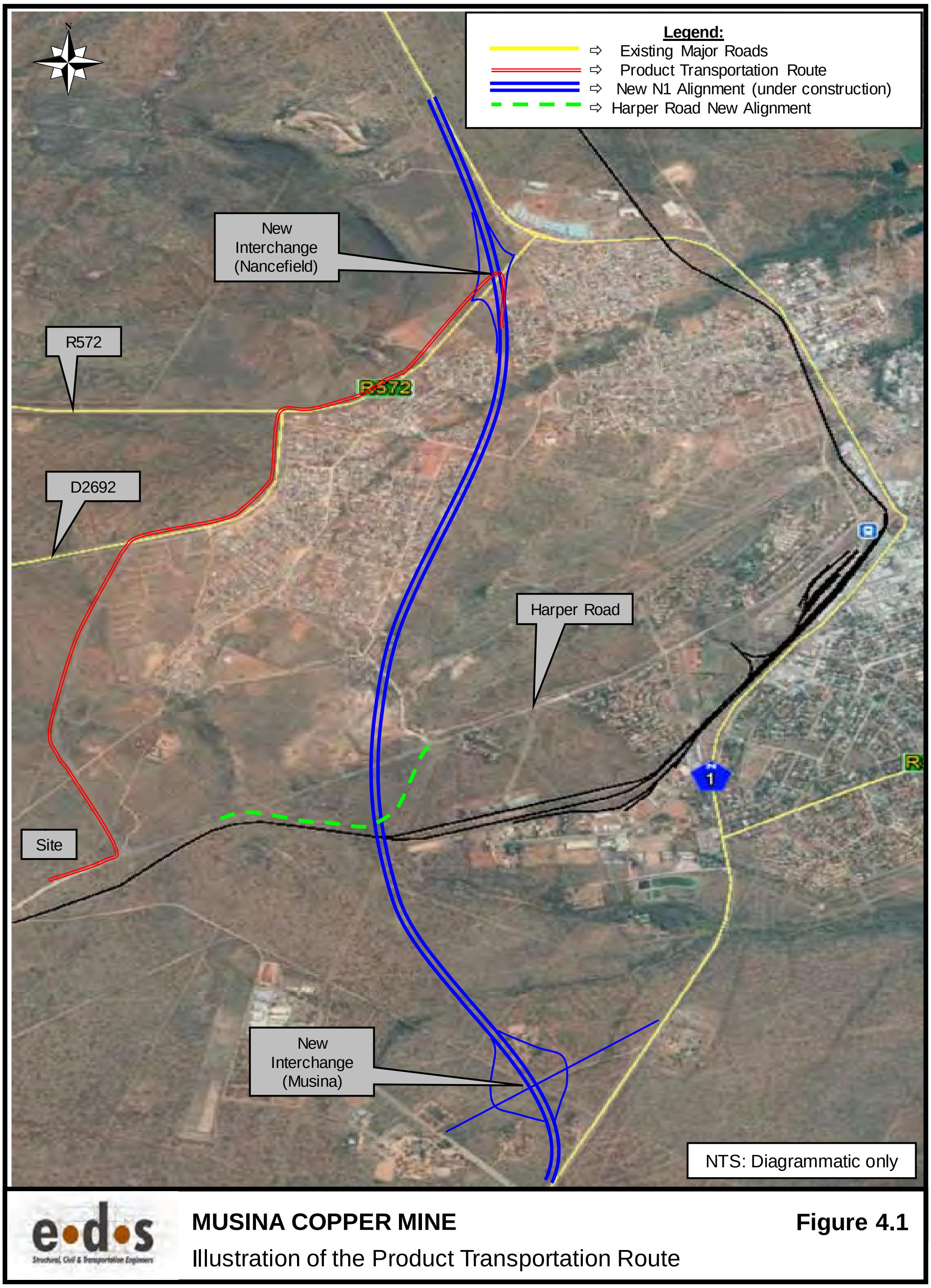


Figure 4-26: Preferred transport route

Manual traffic counts were undertaken during the weekday morning and afternoon peak hour periods (06h30 – 07h30 and 15h45 – 16h45 respectively) at the key intersections shown in Figure 4-25. A capacity analysis was carried out using ***Sidra Intersection 6***, a traffic engineering software package, to determine which intersections already have capacity problems, if any, and to define geometric upgrades that would be required to restore the intersections to acceptable performance.

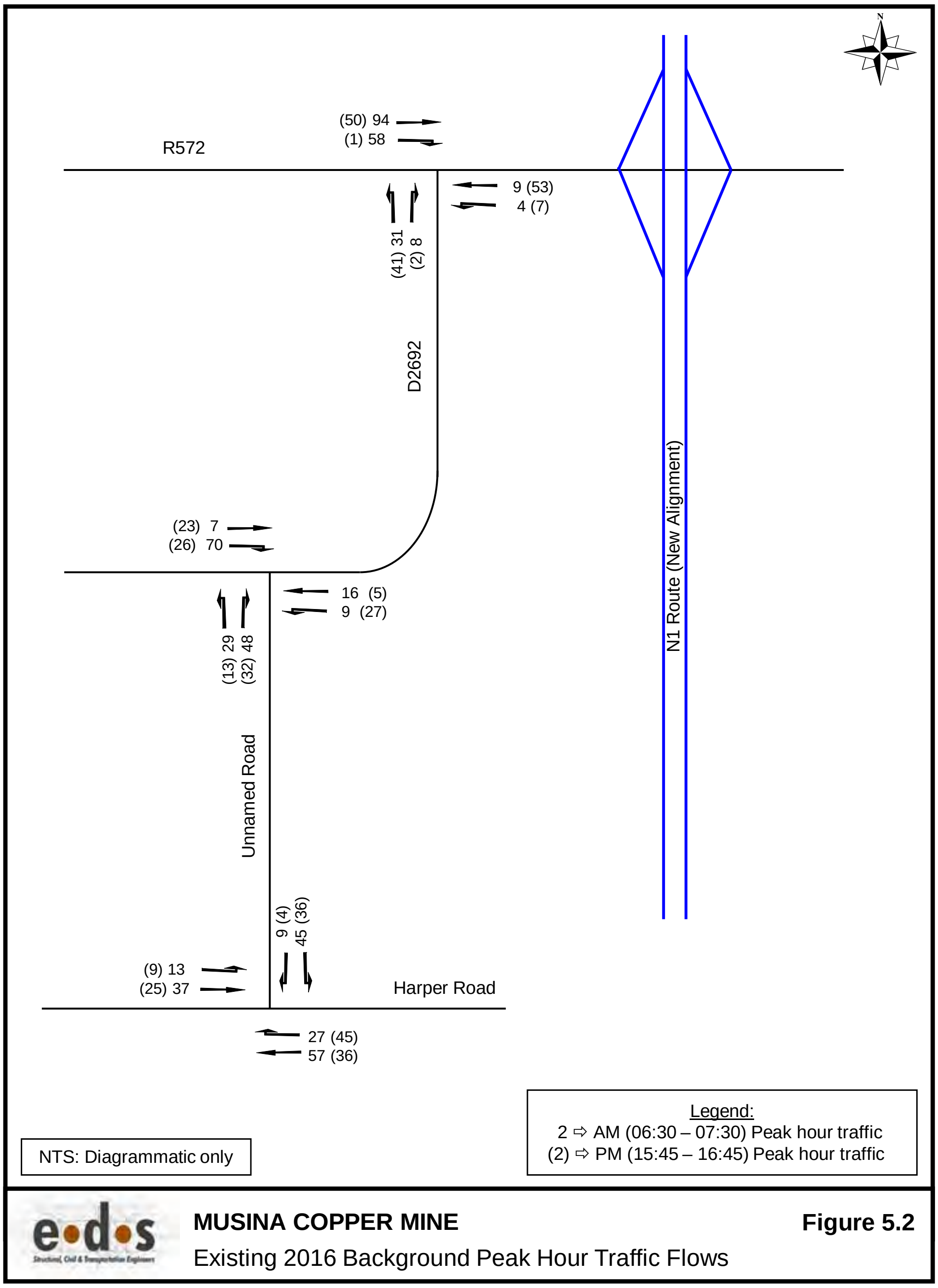


Figure 4-27: Peak hour traffic flows counted in August 2016

The following definitions from the 2000 Highway Capacity Manual are applicable:

- Capacity - c: The maximum hourly rate at which vehicles can reasonably be expected to traverse a lane or roadway during a given period under prevailing conditions;
- Volume - v: The hourly rate of vehicle arrivals at an intersection;
- Volume to capacity ratio - v/c: The ratio of volume to capacity;
- Level of service - LOS: The LOS is defined in terms of delay, which affects driver discomfort, frustration, fuel consumption and lost travel time. The levels of service for signalised and non-signalised intersections as defined in the Highway Capacity Manual are tabulated in Table 8.1 below.

Table 4-18: Delay & v/c (HCM 2010) definitions for LOS Based on delay and v/c ratio

Level of Service for v/c≤1.0	Rating	Average delay per vehicle in seconds (d)			Level of Service for v/c>1.0
		Signals	SIDRA Roundabout LOS option	Priority Control *(HCM2010 default for roundabouts)*	All Intersection Types
A	Excellent	d ≤ 10	d ≤ 10	d ≤ 10	**F**
B	Very Good	10 < d ≤ 20	10 < d ≤ 20	10 < d ≤ 15	**F**
C	Good	20 < d ≤ 35	20 < d ≤ 35	15 < d ≤ 25	**F**
D	Acceptable	35 < d ≤ **55**	35 < d ≤ **50**	25 < d ≤ **35**	**F**
E	Poor	**55** < d ≤ 80	**50** < d ≤ 70	**35** < d ≤ 50	**F**
F	Very Poor	80 < d	70 < d	50 < d	**F**

Note: V/c (demand volume / capacity) ratio or degree of saturation: v/c > 1.0 represents oversaturated conditions.

An intersection is deemed to be operating acceptably at levels of service A to D. If an intersection operates at a level of service E or F or has a volume to capacity ratio higher than 0.95 the intersection is considered to be operating at capacity.

The existing levels of service, based on current (July 2016) traffic volumes as per Figure 4-27 are shown in Table 4-19. With reference to the level of service ratings as explained in Table 4-18, all three intersections are rated as having an excellent (A) LOS during both the morning and afternoon peak hours.

Table 4-19: Intersection performance – July 2016

Intersection	Existing control	Peak Period	
		AM	PM
1 – D2692 / Unnamed Road Intersection	Stop (2-way)	A (6.1) {0.085}	A (5.3) {0.049}
2 – R572 / D2692 Intersection	Stop (2-way)	A (3.3) {0.062	A (2.6) {0.041}
3 – Harper Road / Unnamed Road Intersection	Stop (2-way)	A (2.8) {0.041}	A (3.4) {0.034}

Intersection	Existing control	Peak Period	
		AM	PM
Legend		B – Level of service (LOS)	
		(16.4) – Delay in seconds	
		{0.527} – Volume/Capacity Ratio (v/c)	

4.15 Socio-economic

A baseline socio-economic scan of the project area and its surrounds was undertaken during the scoping phase of the EIA (Ramsaroop, P; de Waal, D;, October 2016).

4.15.1 Administrative Setting

The project area spans Wards 2,3,4,5 and 6 in the Musina Local Municipality (MLM) within the Vhembe District Municipality (VDM) in the Limpopo Province. For this project, the local, district municipalities and provincial level have been termed the regional study area.

The Vhembe District Municipality (VDM) covers an area of some 2 140 700 ha and consists of the four local municipalities of Makhado, Musina, Thulamela and Mutale.

It covers a geographical area that is predominantly rural with the majority of settlements being clustered east of the N1 in Thulamela and Mutale. Only major settlements in Makhado are located west of the N1.

The VDM is home to many sacred places of the vhaVenda people including Lake Fundudzi and Phiphidi Waterfalls. Unique attractions such as Tshiungani Caves and Musina Nature Reserve, home to "The Big Tree", which is the largest baobab tree in South Africa, are located within the VDM.

4.15.2 Economic Activities

The Limpopo Province is rich in mineral deposits and the mining sector contributes more than a fifth of the provincial economy. The provincial economy is typical of a developing area, exporting primary products and importing manufactured goods and services.

Extensive cattle and game ranching is supplemented by controlled commercial hunting, which accounts for about 80% of South Africa's hunting industry. Limpopo produces a significant portion of the country's mangoes, papayas, avocados, tomatoes, bananas, litchis, pineapples, citrus, tea, sunflower, cotton, maize, peanuts and table grapes. Extensive forestry plantations are also found in the region, including hardwood that is used for furniture manufacture. A large section of the rural population relies on subsistence farming.

Although the Vhembe District Municipality is strategically located on the N1 corridor, it serves mainly as a throughway for trade traffic to and from countries to the north, with very little direct spin-off accruing to the local economy (apart from the relatively limited shopping in Musina and at Beit Bridge).

4.15.3 Population Demographics

The population demographics in the various administrative tiers and areas are summarised in Table 4-20. A possible reason for the higher percentage of males in the province and the Vhembe DM could be the availability of job opportunities in the area which attract male workers from other areas of the country.

The total number of households was recorded as 20 042 in 2011 which is a 57.8% increase on the 2001 total of 11 577. The total population increased from 39 310 in 2001 to 68 359 in 2011. It was noted in the Stats SA 2011 census that 45% of the population was within the 15-34 year age group (Musina LM IDP, 2016/2017-2021).

The Stats SA 2011 census recorded Ward 1 as having the highest number of tribal or traditional households at 1 140 and Ward 2 as having the highest number of farm households at 4 284. Ward 3 had the highest number of urban households at 3 513 followed by Ward 6 at 2 678, Ward 5 at 2 579 and Ward 4 at 1 668 (Musina LM IDP, 2016/2017-2021).

Table 4-20: Population Profile

	Black	Coloured	Indian	White	Other	Male%	Female %	Total
Limpopo Province	96.7%	0.3%	0.3%	2.6%	0.2%	46.7%	53.3%	5 404 605
Vhembe DM	98.2%	0.1%	0.4%	1.1%	0.1%	45.7%	54.3%	1 294 671
Musina LM	94.0%	0.3%	0.5%	4.8%	0.3%	50.5%	49.5%	68 359
Ward 2	94.6%	0.1%	0.1%	5.1%	0.1%	52.0%	48.0%	16 747
Ward 3	99.7%	0.1%	0.0%	0.0%	0.1%	47.7%	52.3%	12 758
Ward 4	96.1%	0.3%	0.5%	2.9%	0.3%	52.0%	48.0%	5 098
Ward 5	99.0%	0.1%	0.1%	0.0%	0.8%	50.3%	49.7%	10 461
Ward 6	74.8%	1.4%	2.7%	20.2%	0.9%	50.1%	49.9%	9 929

** Stats SA, 2011*

4.15.4 Levels of Education

The education status in the various administrative tiers and areas as reflected in the 2011 census figures is shown in Table 4-21.

Table 4-21: Average Education Levels

	No schooling	Some primary	Completed primary	Some secondary	Completed secondary	Higher
Limpopo Province	17.3%	11.6%	4.4%	35.7%	22.7%	8.3%
Vhembe DM	17.8%	11.2%	4.6%	35.5%	21.9%	9.0%
Musina LM	11.3%	9.6%	7.9%	43.1%	21.7%	6.3%
Ward 2	11.8%	10.2%	13.6%	49.2%	11.9%	3.3%
Ward 3	7.6%	6.3%	3.8%	41.9%	31.4%	9.0%
Ward 4	6.7%	7.8%	3.3%	41.0%	30.7%	10.4%
Ward 5	10.8%	7.6%	5.8%	45.9%	26.1%	3.8%
Ward 6	8.6%	5.9%	3.2%	33.8%	34.5%	14.1%

** Stats SA, 2011*

In 2015, 26 535 learners in the VDM wrote the Grade 12 exams, with 19 809 of them passing. This 74.7% pass rate was 6.5% lower than the 2014 figure of 81.1%[7].

There are nine secondary schools with 4 607 pupils, 29 primary schools with 9 791 pupils and four combined schools with 1 023 pupils in the MLM. There are no schools for learners with special needs in the MLM. Generally, there is an educational facility within a 30-minute walking distance for 90% of the population The majority of these educational facilities are primary schools and are more easily accessible than secondary schools. The secondary schools also do not have enough maths and science teachers, which limits the students' future career options. These are further limited by the lack of technical high schools in the area. In The high level of illiteracy in the VDM is a challenge for local people who want to enter the skilled and semi-skilled employment market (Musina LM IDP, 2016/2017-2021).

4.15.5 Health

Health and HIV/AIDS Prevalence

South Africa has the highest prevalence of HIV/AIDS compared to any other country in the world with 5.6 million people living with HIV, and 270 000 HIV-related deaths recorded in 2011 (HSRC, 2014).

Table 4-22 summarises the HIV prevalence in Limpopo Province from 2010 to 2012. More than half of the districts in Limpopo recorded increasing HIV rates from 2010 to 2012. Although VDM recorded the lowest HIV prevalence rates in the district in 2010 and a 2.4% decrease from 2010 to 2011, it has unfortunately recorded a 3.1% increase from 2011 to 2012.

Table 4-22: Estimated HIV prevalence (%) among antenatal clinic attendees – Limpopo Province

District	2010	2011	2012
Capricorn	23.7%	25.3%	22.4%
Mopani	24.9%	25.2%	25%
Sekhukhune	20.2%	18.9%	23%
Vhembe	17%	14.6%	17.7%
Waterberg	26.1%	30.3%	27.3%
LP Province	21.9%	22.1%	22.3%

**2012 National Antenatal Sentinel HIV and Herpes Simplex Type-2 Prevalence Survey in South Africa*

Table 4-23 summarises the number of antenatal women living with HIV from 2010 to 2012. The highest (31.9%) antenatal HIV prevalence occurs amongst women in the age bracket of 30-34 years. Women under the age of 24 have the lowest (7.7%) antenatal HIV prevalence.

Table 4-23: HIV prevalence among antenatal women by age group, Limpopo, 2010 to 2012

Age Group	Population of Antenatal Women Living with HIV					
	2010		2011		2012	
	Number	%	Number	%	Number	%
<15 Year(s)	13	7.7	14	7.1	12	8.3
15-19 Year(s)	618	7.1	675	7.4	669	7.3
15-24 Year(s)	1520	14.2	1753	13.6	1678	12.3
20-24 Year(s)	902	19.1	1078	17.5	1009	15.6
25-29 Year(s)	726	28.7	877	27.4	780	29.9

[7] http://www.edu.limpopo.gov.za/index.php?option=com_phocadownload&view=category&id=6:mec-speech (accessed 04/07/2016)

Age Group	Population of Antenatal Women Living with HIV					
	2010		2011		2012	
	Number	%	Number	%	Number	%
30-34 Year(s)	452	31.9	571	33.5	595	34.0
35-39 Year(s)	245	29.4	335	33.7	367	30.8
40-44 Year(s)	100	24.0	96	22.9	119	26.1
45-49 Year(s)	4	25.0	19	15.8	14	42.9
>49 Year(s)	1	100	-	-	-	-

**Quantec Data, 2010*

The National Development Plan 2030 vision is to implement a district-based approach that will assist in ensuring quality healthcare for all the people in the community. The development plan will focus on improved management, better training of health professionals, better patient information systems and improved maternal and infant health care.

HIV/AIDS is one of four epidemics affecting South Africa; the others being injury, both accidental and non-accidental, infectious diseases such as TB and pneumonia and escalating lifestyle diseases, such as obesity and diabetes.

Medical facilities within the region include:

- Local clinics:
  - Messina LA LHC Clinic;
  - Masisi EMS Clinic;
  - Messina West Mobile Health services;
  - Messina East Mobile Health services; and
  - Nancefield Community Health Centre.
- Public Hospitals:
  - Donald Fraser Hospital;
  - Louis Trichardt Hospital;
  - Malamulele Hospital;
  - Elim Hospital;
  - Tshilidzini Hospital;
  - Silaom Hospital; and
  - Messina Hospital.

There is a need for clinics to be built at Tanda, Tshikhudini, Domboni, Malale and Mopani to provide adequate services for the population that has grown rapudly since the establishment of the original clinic (Musina LM IDP, 2016/2017-2021).

Although there has been an overall decline in the total number of reported malaria cases in Limpopo, from 9 487 in 2000 to 4 215 in 2010, of the three endemic provinces this province has become the largest contributor to malaria incidence and deaths. Given the proximity of the study area to borders with countries that have high malaria transmission rates and poor malaria control, the potential exists for importation of insecticide resistant mosquitoes and drug resistant parasites. The successes of cross-border initiatives such as the Lubombo Spatial Development Initiative (LSDI) in Kwa-Zulu Natal have demonstrated that this challenge is not insurmountable. [8]

4.15.6 Levels of Employment

The unemployment rate measures the percentage of employable people in the country's workforce who are over the age of 16 and who have either lost their livelihoods or have unsuccessfully sought jobs previously and are still seeking employment.

Regional and local employment trends are reflected in Figure 4-28.

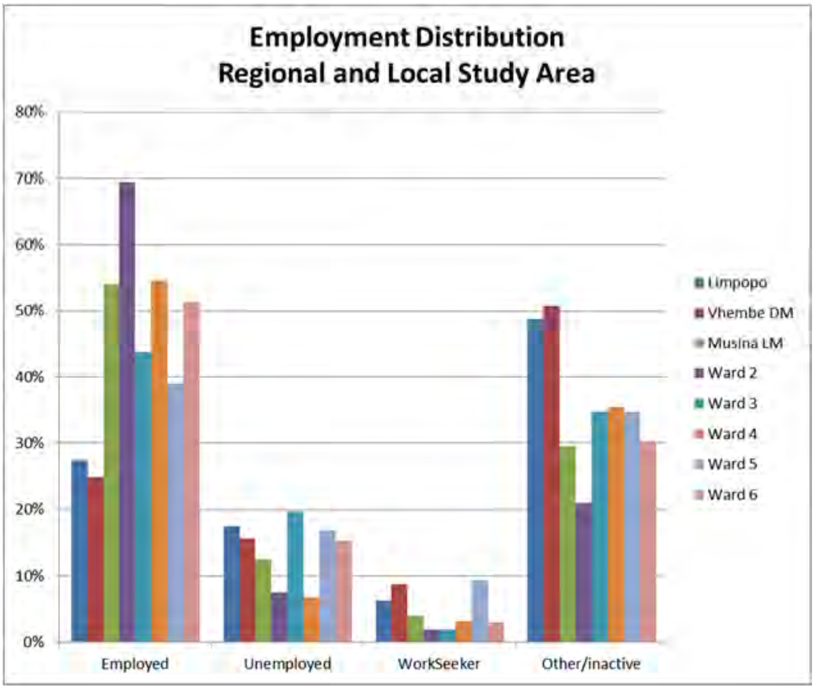


Figure 4-28: Employment Distribution in the Regional and Local Study Area

4.15.7 Household Income

The regional household income levels in the Limpopo Province and Vhembe District Municipality are illustrated in Figure 4-29.

[8] http://www.samj.org.za/index.php/samj/article/view/7441/5461 (accessed 08/07/2016)

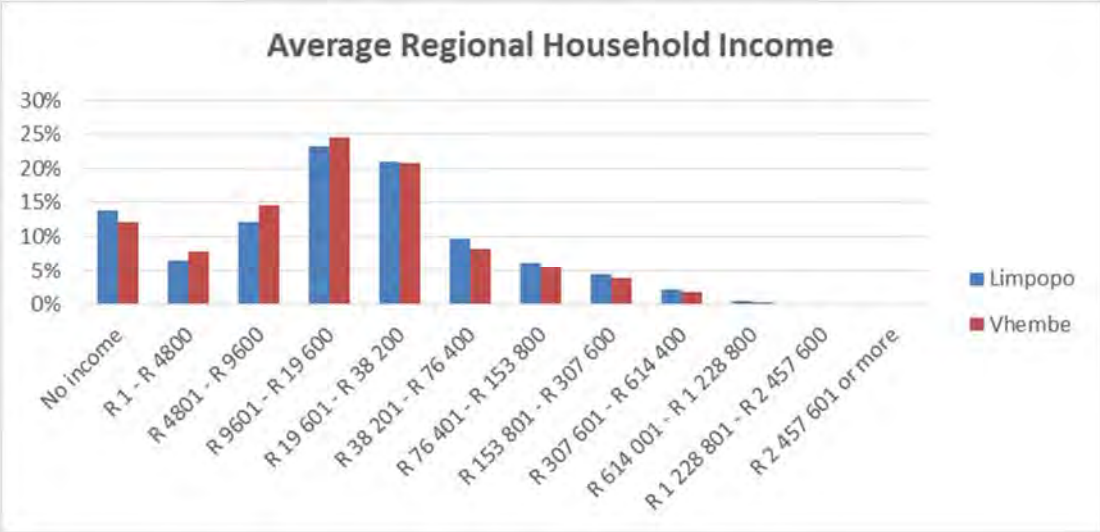


Figure 4-29: Average Regional Household Income

4.15.8 Infrastructure

4.15.8.1 Roads

The roads within the VDM are well connected to national, provincial and district roads. The N1, R37, R71, R81, R510/R572 and R521/R523 all form part of the primary route network in the area (Musina LM IDP, 2016/2017-2021).

High traffic volumes and inadwequate road maintenance have contributed to a rapid deterioration in road conditions. Regional access roads, which are commonly used by buses and taxis are surfaced with gravel and are mostly in a state of disrepair. Streets within local villages are generally in a poor condition but can only be upgraded once the major roads have been attended to. The Musina Local Municipality (MLM) maintains 413 km of surfaced and 650.9 km of unsurfaced roads. The backlog in tarring of gravel roads is 20 kilometres and the backlog in tarred roads that need to be upgraded or resurfaced is 25 kilometres (Musina LM IDP, 2016/2017-2021).

Only 37% of the 3 940 km of provincial road in the VDM is tarred or paved, but roads that are surfaced are not always in good condition. Various road building and resurfacing projects are currently underway, which should improve accessibility and mobility within the community in due course (Vhembe DM 2015/16 IDP Review).

4.15.8.2 Rail

The railway line runs from Johannesburg, through the MLM with stops in Musina and Mokopane, and continues into Zimbabwe. The line intersects Portion 6 of the farm Vogelenzang 3 MT, which is currently owned by the Musina Local Municipality, and the farm Messina 4 MT.

4.15.8.3 Bulk Water Supply

VDM is a Water Services Authority (WSA) and Provider. Bulk raw water is purchased from the Department of Water and Sanitation, processed and distributed. VDM is currently in the process of developing a revenue enhancement strategy to ensure local municipalities are correctly billed for bulk water consumed (Vhembe DM 2015/16 IDP Review).

4.15.8.4 Housing

The regional housing characteristics are summarised in Figure 4-30. The Musina Local Municipality has plans for additional residential developments.

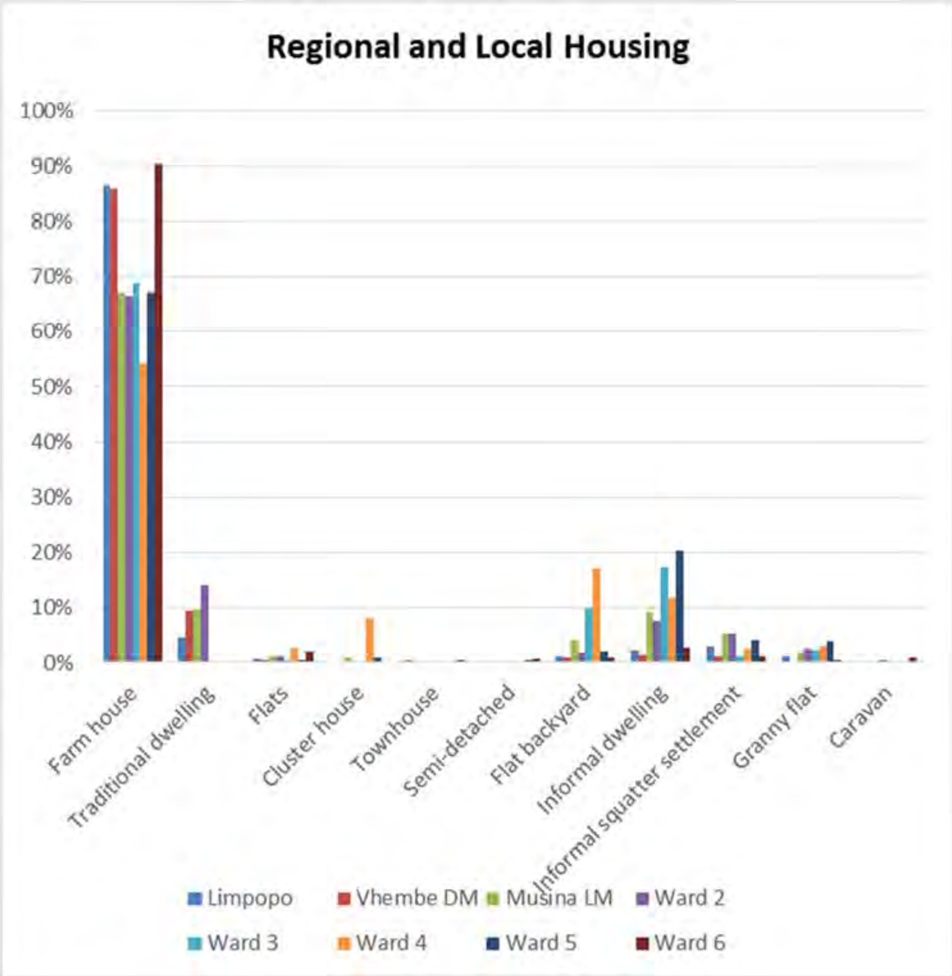


Figure 4-30: Housing Summary

4.15.8.5 Water and Sanitation

The province's has four Water Management Areas (WMAs), namely the Limpopo, Olifants, Luvuvhu-Letaba and Crocodile West Marico WMAs. The Vhembe district is supplied from 12 dams, three weirs and approximately 38 000 boreholes. These sources include the Nandoni, Nzhelele, Damani, Tshakhuma, Mutshedzi, Vondo, Capesthorne, Cross, Nwanedi, Lupepe, Middle Letaba and Albasini dams and the Mutale, Khalavha, and Magoloni weirs. Some dams have no allocation for domestic use and boreholes do not always yield water in sufficient quantities or of a good enough quality to supply the needs of local communities (Musina LM IDP, 2016/2017-2021).

The sources of water supply are summarised in Figure 4-31.

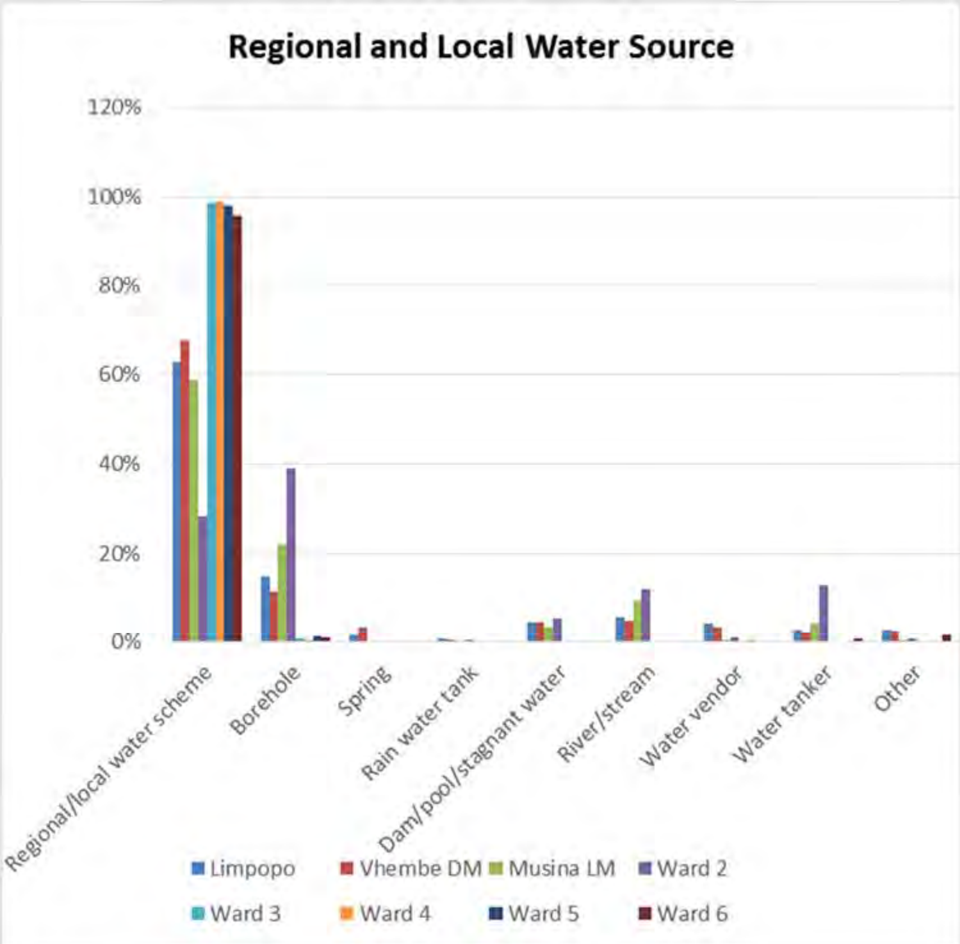


Figure 4-31: Sources of Water

The regional sanitation characteristics are summarised in Figure 4-32.

The VDM has been criticised for its unsatisfactory performance in regard to provision of adequate sanitation services in the district. The MLM has two sewage treatment plants, at Nancefield and Musina respectively. The following was noted Musina LM IDP of 2016/2017-2021:

- The municipality does not have a bucket system in its area of operations;
- In the urban areas, 8 108 households are connected to a waterborne sewer system or on-site septic tank systems; 2 811 of these households benefit from free basic sanitation; and
- In the rural villages of Madimbo, Malale, Tshikhudini, Domboni and Tanda, 1 856 households have Ventilation Improved Pit (VIP) toilets, thus receiving free basic sanitation. The backlog on VIP toilets is 510 households.

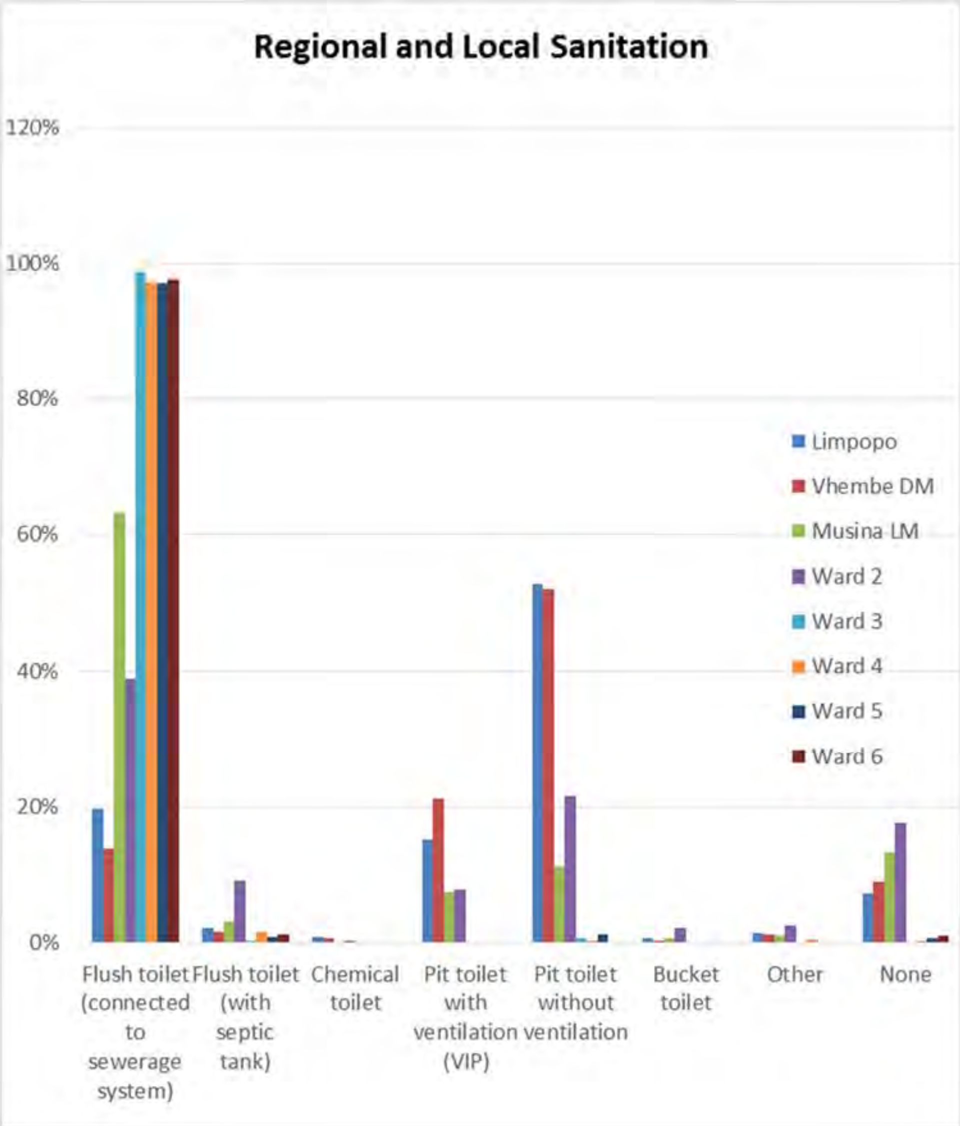


Figure 4-32: Sanitation

Energy Sources

There are 12 substations in the district, namely Sanari, Makonde, Malamulele, Tshikweta, Leeudraai, Paradise, Flurian, Pontdrif, Musina and Nesengani. The backlog is currently 9 x 132/22KV that will need to be built at Singo, Mashau, Mamaila, Mageva, Mbahe, Jilongo, Mandala, Tshilamba, and Lambani. Challenges faced by the district include energy supply and interruption, lack of capacity to supply the demand, insufficient capacity of the power station to supply all areas in the district, cable theft, illegal connections, poor project management and slow rate of construction (Musina LM IDP, 2016/2017-2021).

Musina local municipality is a licence holder in the urban area of Musina and Nancefield while Eskom is the licence holder in the rural villages and farming areas. There is no backlog on electricity in municipal urban areas. There is however a 1 013 household backlog on electricity supply in the rural villages. Electricity is supplied to within the urban and rural regions as follows (Musina LM IDP, 2016/2017-2021):

- 10 051 households in urban areas have metered (conventional and pre-paid) electrical connections;
- 2 811 indigent households receive free basic electricity;

- 523 households in rural villages receive free basic electricity;

The regional and local study area relies predominantly on electricity as an energy source for lighting, cooking and heating within a household as seen below in Figure 4-33.

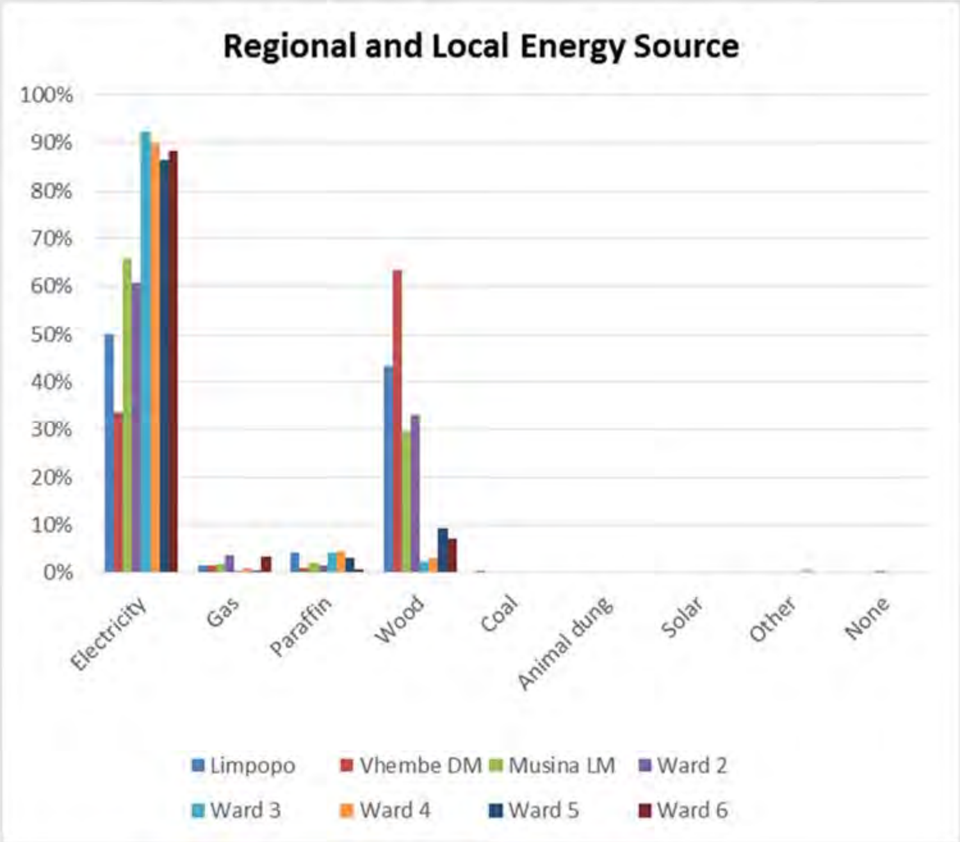


Figure 4-33: Regional and Local Energy Sources

Green Economy

Green economy is defined as a system of economic activities related to the production, distribution and consumption of goods and services that result in improved human well-being over the long term, while not exposing future generations to significant environmental risks or ecological scarcities. Through funding made available by the Industrial Development Corporation (IDC) the district together with University of Venda, Eskom and other key role players are supporting bio-energy projects and generation of solar power in the district with particular focus on the Musina region. In addition, an assessment done on biogas usage in the district shows that there is potential for using it as an alternative source of energy (Vhembe DM 2015/16 IDP Review).

4.15.9 Economic Activities

The economy in the VDM is dominated by three active sectors which include mining, agriculture and tourism. Commodities such as copper, coal, corundum, diamond, dolomite, feldspar, garnet, graphite, iron, kieselguhr, limestone, magnesite, marble, phosphates and talc are mined in the region. The VDM makes an intermediate contribution towards the provincial agriculture sector (11.1% in 1980 and 18.6% in 1994). The most important agricultural commodities are nuts (about 50% of provincial production) and subtropical fruit (26% of provincial production). Well known tourist attractions include Dongolo Trans-National Park, Soutpansberg Conservation, Baobab Nature Reserve, Kruger National Park, Langjan Nature Reserve and Happy Rest Nature Reserve (Vhembe DM 2015/16 IDP Review).

MLM has been identified as a provincial growth point with significant potential to accelerate the industrialisation process in the province. This is evidenced by the commitment from Limpopo Premier Stanley Mathabatha of R38.8 billion towards the establishment of a South African Energy Metallurgical Base Project in the Musina Special Economic Zone (SEZ). The region has seen further significant investment in other key areas of the local economy such as retail, agricultural production through mechanisation programmes, construction and property development (Musina LM IDP, 2016/2017-2021).

The main contributors to the economy of the MLM are agriculture, forestry and fishing (35%), mining (30%), transport and communication (15%), manufacturing (11%), finance and business services (9%), wholesale and retail trade, catering and accommodation (6%), community, social and personal services (6%), government services (5%) and construction (5%). The unemployment rate stands at 25% with the highest percentage among the youth aged between 15 to 19 years. MLM contributes 11% of GDP of the VDM (Musina LM IDP, 2016/2017-2021).

MLM boasts a variety of popular tourist destinations. These include Mapungubwe National Park and World Heritage Site; Honnet Nature Reserve; Limpopo River; the old Messina Copper Mine; Messina Nature Reserve; Poppalin Ranch; Ratho Crocodile Farm; Venetia Limpopo Nature Reserve; Beit Bridge; De Beers Diamond Mine; De Beers Game Farm; Nwanedi-Luphephe Resort and Aventura Tshipise Resort. Some initiatives aimed at boosting tourism in the region are currently in progress.

The regional Gross Value Added (GVA) contribution for 2010 is depicted in Table 4-24. In the VDM, General Government is listed as the main industry at 26% whereas in the MLM, Mining and Quarrying at 34% is the main industry. Finance, insurance, real estate and business services contribute 20% and 15% in the VDM and MLM respectively.

Table 4-24: GVA (2010)

Industry	Limpopo Province	Vhembe DM	Musina LM
Agriculture, forestry and fishing	3%	3%	8%
Mining and quarrying	23%	9%	34%
Manufacturing	4%	4%	4%
Electricity, gas and water	3%	2%	1%
Construction	2%	3%	2%
Wholesale and retail trade, catering and accommodation	12%	17%	12%
Transport, storage and communication	10%	10%	12%
Finance, insurance, real estate and business services	19%	20%	15%
Community, social and personal services	5%	6%	2%
General government	19%	26%	10%

**Quantec Data, 2010*

Local Economic Development (LED) is the process by which public, business and non-governmental sector partners work collectively to create better conditions for economic growth and employment generation. LED is based on local initiatives, driven by local stakeholders and it involves identifying and using primarily local resources, ideas and skills in an integrated way to stimulate economic growth and development in the region (Vhembe DM 2015/16 IDP Review).

4.16 Community Development Planning

4.16.1 Vhembe District Municipality

The Vhembe LED Strategy notes that the district's economic growth potential is in agriculture, tourism and mining. Through its Supply Chain Policy, the VDM endeavours to encourage procurement from local business, thereby driving economic transformation among Historically Disadvantaged Individuals (HDIs) (Vhembe DM 2015/16 IDP Review).

Vhembe district has developed enterprise, tourism, agriculture and forestry strategies for smooth prioritisation and proper planning in the relevant fields. Feasibility studies have been undertaken on the following projects (Vhembe DM 2015/16 IDP Review):

- Footsteps of the Ancestors;
- Poultry abattoirs;
- Development of a fish farm;
- Preservation of dried fruit/vegetables;
- Goats milk dairy products;
- Mutale goat farming; and
- Beneficiation of forestry products.

The areas for potential development within the VDM that were identified within the Vhembe DM 2015/16 IDP are in the mining, agriculture and tourism sectors. The major needs in the area are jobs and employment opportunities. Through the development of small and medium enterprises, more indirect employment opportunities would be available.

4.16.1.1 SMME Development

The district undertook a strategic evaluation of the potential of SMMEs with the goal of identifying trends and specific gaps. Various types of businesses distributed among different sectors within the four local municipalities in in the VDM were identified along with an uneven distribution of enterprises across different sectors. Retail was identified as the largest single contributor in each local municipality as well as in the district as a whole. The majority of retail enterprises consist of one employee or family businesses and hence there is minimal contribution to employment opportunities and income generation (Vhembe DM 2015/16 IDP Review).

4.16.1.2 Local Economic Development Challenges for the District Municipality

Challenges faced by SMMEs in the district include (Vhembe DM 2015/16 IDP Review):

- The negative effect of a lack of contracts with producers;
- An unskilled workforce;
- Poor infrastructure;
- Lack of access to finance;
- Lack of suitable space;
- Lack of business management skills and market research;
- Food insecurity;
- Transfer of indigenous skills; and
- Lack of information about available opportunities.

4.16.2 Musina Local Municipality

Through a detailed analysis and consultations with various relevant local stakeholders and role players, a list of high-priority focus areas were identified that require immediate attention in the MLM (Musina LM IDP, 2016/2017-2021). These priority focus areas are set out below in Table 4-25.

Table 4-25: High priority focus areas

Sector	Potential Development
Manufacturing and SMME Support	■ Establishment of a Manufacturing Incubator in Musina town; ■ Undertake a poster campaign to entice business start-ups on projects that have been identified in the LED Strategy; ■ Investigate potential and promote opportunities for development of retail, industrial, storage, distribution and wholesale enterprises and a transportation hub; ■ Establish a local Business Support Centre in Nancefield; ■ Create rural community support cooperatives in Madimbo, Malale and Domboni, Tshikhudini and Tanda; and ■ Provide land claims support.
Agriculture	■ Undertake expansion of aquaculture production and extension of aquaculture value chain linkages; and ■ Establish a vegetable processing plant in Musina town.
Tourism	■ Develop maps and brochures of local tourism facilities and attractions; ■ Improve and increase road signage to villages, major attractions and facilities; ■ Establish arts and crafts, jewellery and ornament incubators; ■ Exhibition and workshop stalls and curio shop linked to tourism information centre in Musina town; ■ Train tour guides and tour operators to facilitate and coordinate awareness campaign with SANPARKS and LEDET; ■ Promote game farming by developing a database of all farms in MLM; and ■ Promote birding, hiking and sport.
Mining	■ Establish database of available land for mining development and encourage commencement of mining activities with existing mineral rights holders; ■ Investigation/prospecting to identify untapped resources; ■ Promotion of mineral deposits to potential investors; ■ Skills development and training; ■ Local mineral processing and beneficiation activities; ■ Small-scale mining operations; ■ Magnesite production and beneficiation through the production of heat resistant bricks for the steel industry.

Sector	Potential Development
	■ Production of moulds for glass manufacturing; ■ Producing fire retardant construction materials from vermiculite; ■ Plastics production; ■ Facilitate financial and funding support for small-scale mining activities; ■ Providing skills training for higher level skills needs; ■ Sub-contracting cleaning and transport services; ■ Supplying manufactured inputs to mines; ■ Linkages with tourism sector for guided tours; ■ Expand current brick manufacturing facilities; and ■ Produce concrete.

Local Economic Development Challenges for the Local Municipality

Key constraints to growth in the MLM local economy include (Musina LM IDP, 2016/2017-2021):

Agriculture

- Agricultural activities take up large portions of land in the municipality, with more than half of the employed population being employed in this sector;
- A lack of resources to ensure proper transport of perishable goods;
- A lack of production facilities;
- A lack of start-up capital;
- No marketing;
- No access to producers for emerging farmers;
- Distance to market;
- Consistency of supply of raw materials;
- Competition from imports;
- An ageing population within the agri-industry; and
- Access for tourists to agricultural attractions.

Mining

- Mining and quarrying is currently a declining sector within the MLM with only two active mines, namely Venetia and Vele Mine. There is however a plethora of closed and derelict mines throughout the municipality that in some cases constitute an environmental problem;
- Lack of both mining skills and more advanced engineering skills;
- Inconsistent electricity provision;
- Cost and supply of water services;

- Lack of capital for efficient production;
- Inaccessibility and poor road infrastructure;
- High transport costs;
- Distance to markets;
- Depletion of resources due to inefficient extraction; and
- Quality, consistency and cost of locally manufactured products.

Tourism

Security in the MLM requires attention. In particular, the regions of Songozwi, Nwanedi, Mapungubwe and Pafuri require urgent attention. The main factors that negatively affect tourist safety in the district are insufficient registered tourist guides, lack of available and suitably trained security personnel and vandalism of fences around the area of Nwanedi. Poor road conditions, poaching, racism and tribalism at Makuleke game farm are also noted as contributing factors to poor safety and security in the area.

5.0 POTENTIAL IMPACTS IDENTIFIED

The following potential impacts were identified during the scoping phase:

1) **Groundwater**: Abstraction of groundwater to provide safe mining conditions and water for use in the mine and plant will result in two cones of depression (lowering of the groundwater table) around the two mines. The use of explosives and spillages of hydrocarbons could cause groundwater pollution. The profiles of these cones of depression will change as the mining progresses. The project may be expected to have an impact of ***moderate*** significance on the groundwater regime and groundwater users during the life of the mine;

2) **Surface water**: Runoff from the overburden, waste rock, heap leach and tailings storage areas could have a high silt load, low pH, high sulphate and metal levels, and runoff from the plant and workshop areas could be contaminated with hydrocarbons. Such dirty runoff from the project area could cause surface water pollution in the local watercourses. Without appropriate mitigation measures, the project could have a ***high*** impact on the surface water regime during the life of the mining operations;

3) **Ecology**: The project will result in the temporary removal of vegetation from the combined footprint area (opencast mines and infrastructure) of about 879 ha. Due to the destruction of their habitat, any current faunal population in the project area will have to relocate until suitable habitat has been restored by the rehabilitation programme. The long term impact is expected to be ***moderate to low;***

4) **Air Quality**: Particulate mobilisation by drilling, blasting, loading, hauling, stockpiling, backfilling and tailings storage has the potential for an impact of ***moderate*** significance on air quality within and in the vicinity of the project area, particularly in the downwind direction. Gaseous emissions due to blasting and the diesel engines on mining vehicles are expected to have an impact of ***low*** significance on air quality.

5) **Noise**: The noise impact could range from ***high to moderate*** significance during the operational life of the mine. The noise from the mining machinery will be audible, but will not exceed the daytime level for urban districts, beyond the 500 m blast zone boundary and at some sensitive areas. If opencast mining operations are undertaken during the night time, exceedances of all but the guidelines for industrial districts would be experienced and the noise levels at the nearest sensitive receptors would be objectionable;

6) **Blasting and vibration**: High air blast sound pressure levels may be expected within 500 to 1 000m of the two mines. The duration at any particular receptor will depend on the detailed mining operations at the time. Blasts will have to be designed and monitored with the objective of avoiding any damage from fly rock, air blast and ground vibration at these or any other identified potentially vulnerable receptors.

Some sensitive receptors may experience impacts of ***high*** significance. Vibration levels experienced at surface from underground blasting are expected to be well below the levels at which structural damage could occur;

7) **Visual**: Due to the flat terrain and the screening vegetation on adjacent areas, the opencast mine and infrastructure will have a ***high*** visual impact at close range only;

8) **Cultural and heritage**: The cultural and heritage fieldwork has yet to be done. Unless unknown graves are unearthed during construction or mining, the expected impact on cultural and heritage resources is likely to be of ***negligible*** significance; and

9) **Socio-economics:** The mine will employ about 55 people directly and some 450 indirectly *via* contactors. The total wage bill will be about R240 million per annum. Given the levels of unemployment in the area, the impact is expected to be of moderate significance.

6.0 EIA PROCESS AND METHODOLOGY

The overall process and methodology that was followed for the scoping phase of the EIA was based on best practice guidelines and the requirements of South African legislation (specifically NEMA and MPRDA).

The approach included the following key stages:

- Gap Analysis of existing information against the regulatory requirements;
- Project Definition and Analysis of Alternatives – inclusive of data review, red flag and constraints mapping, input to alternatives analysis and preferred layout planning and project description;
- Screening (legal and process review) – review of all applicable compliance criteria;
- Environmental and Social Baseline Studies – carrying out monitoring, data collection and fieldwork to determine the baseline conditions of the environment that could be affected by the Project;
- EIA Scoping (identification of key issues and development of plan of study for carrying out the impact assessment). This report is presented to the public and to relevant South African Government departments for comment and to the DMR for a decision on whether the scope proposed for the EIA is appropriate;
- Stakeholder Engagement – was undertaken throughout the Scoping process to record issues and comments received from the public. These issues and comments are integrated into the process and will be considered in the impact assessment phase of the EIA.

The following activities will be undertaken during the next phase of the EIA:

- Impact Assessment – evaluation of potential impacts and benefits of the Project utilising qualitative and quantitative evaluation as determined by the scoping phase;
- Environmental and Social Management Systems Development – establishment of a system for the management of environmental and social impacts supported by action plans;
- Preparation of an EIA report – documenting all processes and presenting the findings of the impact assessment. The EIA report will be presented to the public and to the relevant South African Government departments for comment and to the DMR for a decision on whether the Project may proceed and if so, under what conditions; and
- Stakeholder Engagement – will continue throughout the remainder of the EIA process to record issues and comments received from interested and affected parties. All issues and comments will be integrated into the process and considered during the EIA.

The overarching principles that guide the EIA include:

- Sustainability – development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs;
- Duty of care towards the environment and affected people; and
- Mitigation hierarchy – a step-wise approach that illustrates the preferred approach to mitigating adverse impacts as follows (the governing principle is to achieve no net loss and preferably a net positive impact on people and the environment as a result of the Project):

  10) The preferred mitigation measure is **avoidance;**

  11) Then **minimisation;**

  12) Then **rehabilitation** or **restoration**; and

  13) Finally, **offsetting** of residual, unavoidable impacts.

The assessment of the impacts of the proposed activities will be conducted within the context provided by these principles and objectives.

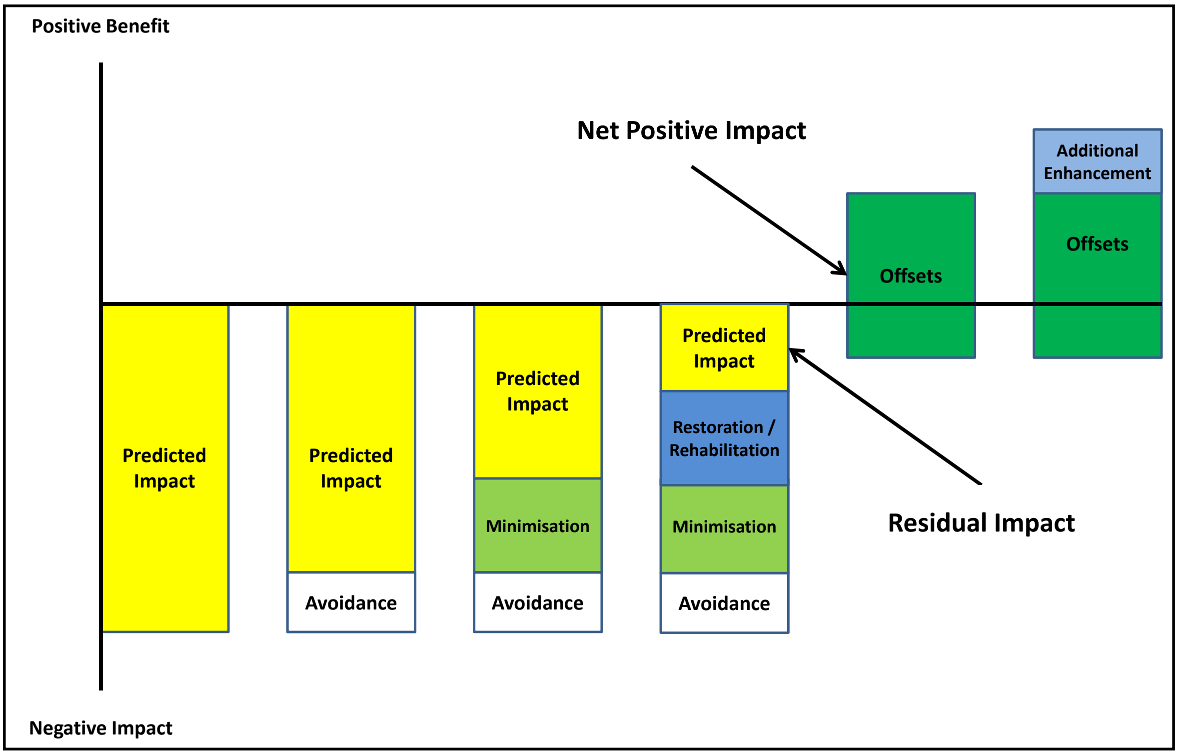


Figure 6-1: Mitigation Hierarchy Adapted from BBOP, 2009

6.1 Scoping Methodology

The methodology specifically adopted for the scoping phase included the following:

- Stakeholder consultation as described in section 3.8.2;
- Review of existing data;
- Fieldwork by the EIA specialist team to obtain additional baseline data;
- Workshops with the specialist team to identify key impacts and issues and to outline the plan of study; and
- Compiling the Scoping report.

6.2 Positive and negative impacts of initial site layout and alternatives

All infrastructure site layouts must avoid the sterilisation of open cast minable copper ore reserves. They must therefore be located adjacent to, but not on the footprint of such reserves. The layout of the infrastructure components as shown on Figure 2-3 reflects areas that are not underlain by shallow copper ore resources for which opencast mining would be suitable.

See section 6.4 for a discussion on the alternative layouts and their positive and negative impacts.

6.3 Possible mitigation measures and levels of risk

The issues discussed with I&APs during the scoping process were as follows:

14) **Air Quality:** The project's main potential effect on air quality will be particulate mobilisation by drilling, blasting, loading, hauling, dumping, stockpiling, crushing and screening of the copper ore and by tailings storage. Wet suppression will be employed in the mine, on haul roads, at stockpiles and on the tailings storage facility. The objective will be to maintain a ***low*** risk of exceeding national standards for PM_{10} concentrations and rates of dust fall.

15) **Soil, Land Capability and Land Use:** The risk of causing a significant degradation of topsoil quality and associated loss of land capability after rehabilitation will be minimised to a ***low*** level by:

    a. Taking care to strip and stockpile topsoil, subsoil and overburden layers selectively and to prevent mixing of especially topsoil with any of the other layers;

    b. Backfilling the opencast void with discard material, overburden, subsoil and topsoil, in that order;

    c. Analysing the topsoil, fertilising it appropriately and re-vegetating it with locally indigenous flora to re-establish the pre-project land use, which was natural veld suitable for grazing.

16) **Ecology:** Successful restoration of the land capability will encourage natural re-colonisation of the rehabilitated area by mammals, birds, reptiles and insects, but it may require re-introduction of some species over time in order to reduce the risk of a low-functioning or unbalanced ecosystem to a ***low*** level;

17) **Surface water:** The proposed opencast mining and infrastructure establishment areas are located on a topographical high. There are no perennial watercourses within this area, only ephemeral drainage lines to the Limpopo River about 13.5 km to the north-east and the Sand River, about 8.5 km to the south-east. The risk of contaminated runoff from the project area reaching the Limpopo or the Sand River is ***moderate***. It will be reduced to a ***low*** level by constructing clean water diversion berms to divert uncontaminated runoff around potential sources of contamination and collection channels to transport contaminated water to a pollution control dam, as required by Regulation 704 under the National Water Act;

18) **Groundwater levels, availability and quality:** The abstraction of groundwater *via* boreholes for mine dewatering purposes will be aimed at controlling, but not eliminating, seepage into the mine workings. Safe and acceptable working conditions will be maintained by pumping out the seepage. This approach will minimise the cone of depression around the mine, but it will increase the risk of flooding in the unlikely event that undetected pockets of groundwater are encountered. The oxide copper ore is generally not acid forming and the acid used in the heap leach process will be managed within well engineered containment systems. Accordingly, the risk of significant pollution of groundwater as a result of the opencast mining project is considered to be ***low***. Mitigation measures such as the following could be implemented:

    a. Regular pH monitoring of runoff from waste rock and ore stockpiles;

    b. Regular inspection of acid containment systems;

c. Monthly sampling of monitoring boreholes with regard to water levels and water quality;

d. Placing drip trays under vehicles when parked;

e. Servicing vehicles in a workshop, not in the field;

f. If in-field refuelling is done from a tanker, doing it in a designated dirty area and keeping a spill kit and clean-up team available on site; and

g. Providing environmental awareness training for workers on site.

19) **Noise:** The closest residential area is located about 560 m to the east of the proposed 67 area opencast mine and the waste rock stockpile. There are a few farmhouses to the south, within about 570 m of the proposed Molly Too opencast mining area. The risk of members of the public being exposed to unacceptable levels of noise is ***moderate.*** Off-site noise levels will be mitigated by:

a. Selection of mining vehicles and ore beneficiation equipment for lower sound levels;

b. Regular maintenance of sound attenuation equipment;

c. Locating topsoil and overburden stockpiles to act as acoustic barriers between the opencast mine and receptors where practical; and

d. Enclosing noisy equipment, such as crushers, in buildings clad with sound-absorbing materials where necessary.

20) **Blasting and vibration:** South African opencast mines typically consider a buffer zone of 500 m as an area within which it is practical to reduce the probability of damage from fly rock to acceptable levels.

Blasts will be monitored and each blast will be designed to avoid exceedances of guidelines for air blast, fly rock and ground vibration. Vibration levels experienced depend on distance from the blast, the energy density of the blast and the characteristics of rock formations between the blast and the observer. The ground vibration levels will be controlled by monitoring each blast and taking the results into account when designing subsequent blasts. Residential buildings of sound construction can safely withstand a peak particle velocity (PPV) of 50 mm/s. Poorly constructed buildings should not be subjected to PPVs of more than 10 mm/s. There are no residential areas on or closer than 500 m from the proposed mining area, but the blasts will be designed for off-site PPVs <50 mm/s. If underground mining is undertaken at a later stage, the underground blasts would not result in any air blast effects on the surface.

The risk of causing injuries or vehicle damage by fly rock will be minimised by closing off sections of public road within 500 m of a blast, immediately prior to each blast;

21) **Visual aspects:** The terrain is quite flat and not much of the opencast mine will be visible from the local roads. The haul trucks traveling over the haul roads along the perimeter of the mining areas to and from the ore beneficiation plant will be visible from the local public roads. Judicious placement of topsoil and overburden stockpiles can screen the mine from certain viewshed areas, but the stockpiles would also be visually prominent and potentially intrusive, unless they were vegetated to mitigate the visual impact. The main visibility risk is inadequate dust suppression, when dust plumes will be highly visible above the mine from distances of up to 7 km. Diligent application of wet suppression or chemical binders on unpaved roads would reduce this risk to a ***low*** level;

22) **Cultural and Heritage aspects:** If any graves or other cultural and heritage resources are discovered, the construction and mining activities will be appropriately adapted to avoid impacting them if practicable. If the relocation or destruction of such resources is unavoidable, the prescribed procedures will be followed; and

23) **Socio-economics**: The mine will employ about 54 people, at a cost of R 40 million per annum and provide employment for about 450 contractor employees and service providers, with a wage bill of about R 200 million per annum. Given the levels of unemployment in the area, the impact is expected to be of ***moderate*** significance.

Capital expenditure over the first 5 years has been estimated at R 3.7 billion and annual replacement capital at about R 34 million. Annual operating costs are expected to be in the region of R 1.3 billion. These expenditures are expected to have an impact of ***moderate*** significance on the economy of the Musina Local Municipality.

6.4 Site selection matrix and final site layout plan

Alternative site layouts to the one illustrated in Figure 2-3 were evaluated on the basis of the following criteria:

- Sterilisation of opencast minable copper ore reserves. If infrastructure is placed on an area that contains ore that can be mined by opencast methods, Smarty will be unable to mine the reserves underneath the footprint of the infrastructure;
- Size of area available for infrastructure. About 879 ha is needed to accommodate the run-of-mine (RoM) ore stockpile, topsoil and waste rock stockpiles, heap leach pads, ore beneficiation plant, tailings storage facility, workshops, offices, change rooms, access roads etc.;
- Environmental features. The aim is to minimise the environmental impacts; and
- Traffic considerations for transport of equipment and personnel to the mine and plant and for transporting copper product away from the mine.

6.4.1 Mine layout

The layout of the opencast mining areas and the infrastructure areas as shown on Figure 2-3, Figure 2-4 and Figure 2-5 is dictated by the mining costs, which are in turn determined by the thickness of the overburden, the depth and grade of the copper ore, the ratio of waste rock to ore and the mining equipment chosen.

Based on current knowledge about the copper resource, opencast mining will be done to a maximum depth of about 250 m on the two areas shown as Molly Too and 67 Area on Figure 2-3. It is possible that future exploration drilling might define mineral resources at greater depth, which might then be converted to ore reserves.

The in-pit haul roads will move around as the pit geometry develops, but the locations of the exterior haul roads are dictated by the perimeter of the final open pits shown on Figure 2-3. Topsoil and overburden berms will be constructed between the perimeter of the open pits and adjacent public roads.

6.4.2 Site Location and Layout

Alternatives to the currently preferred site and layout shown on Figure 2-3 included:

- Placing the waste rock stockpiles to the south of the two opencast areas;
- Swapping around the positions of the ore processing plant and the heap leach pads; and
- Various combinations of the above.

The currently preferred site and layout and the selection matrix in Table 6-1 are preliminary in nature, being based on very limited information about conditions on the ground. The positioning of the infrastructural components will be reconsidered once access to the land has been gained.

Table 6-1: Site and layout selection matrix

Site	Available area	Environmental	Traffic	Cost of roads	Total score
Preferred layout	8	8	6	8	30
Waste rock stockpiles and/or tailings storage facilities to the south of opencast areas	1	3	5	8	17
Swapping ore processing plant and heap leach pads around	8	2	5	7	22
Combinations of above two options	1	2	5	7	15

6.5 Motivation for not considering alternative sites

Not applicable. Alternative sites were considered as discussed in section 6.4.2 above.

6.6 Statement motivating the preferred site and layout

The sites and infrastructure layout shown on Figure 2-3 represent the best overall option as determined *via* the site selection and layout matrix – see Table 6-1.

7.0 ENVIRONMENTAL IMPACT ASSESSMENT

The proposed mining of the copper ore reserves on the farm portions indicated in Table 2-2 has a potential to impact on some biophysical and socio-economic aspects of the local environment.

One of the main purposes of the EIA process is to understand the significance of these potential impacts and to determine to what extent they can be minimised or mitigated. Based on experience with past studies on similar mining operations, supported by site-specific specialist studies, it should be possible to predict the impacts on soils, surface water, groundwater, air quality, the ecology and the local socio-economic fabric and to formulate appropriate mitigation measures.

The EIA process for this project has been designed to comply with the requirements of the MPRDA and the EIA Regulations that commenced on 8 December 2014 (See section 3.2). Cognisance has also been taken of the following key principles contained in the National Environmental Management Act (Act No. 107 of 1998) (NEMA), which is South Africa's framework environmental legislation:

- Sustainability – development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs;
- Mitigation hierarchy – avoidance of environmental impact, or where this is not possible, minimising the impact and remediating the impact; and
- The duty of care of developers towards the environment.

The assessment of the impacts of Smarty's proposed mining operations on the farm portions listed in Table 2-2 will be conducted in accordance with these principles.

Based on the findings of the EIA, a comprehensive Environmental Management Programme (EMPr) will be developed and implemented to control and minimise the impacts during the construction, operation and decommissioning of the proposed mining operations.

7.1 Alternatives to be considered

The alternatives that have been considered during the technical and economic pre-feasibility evaluation and the initial environmental feasibility assessment undertaken to date are discussed in section 3.8.1.

The identification and consideration of additional alternatives and/or variations of the alternatives described in section 3.8.1, including the alternative of not proceeding with the proposed project, will depend upon the findings of the specialist studies described in section 7.2.

7.2 Plan of study for impact assessment

Determination of the environmental and socio-economic impacts of the project during the construction, operation and closure/rehabilitation phases will involve several specialist fields of study. The findings of the specialist studies will be integrated into the EIA report and EMPr. The significance of the impacts will be assessed in terms of the methodology described in section 7.3 of this report.

The terms of reference for the specialist investigations are set out below. The description is presented in fairly general terms, but all the issues that need to be addressed by the studies are captured. Where applicable, the cumulative effects of this project on existing impacts experienced in the surrounding areas will be assessed.

7.2.1 Geology

The effects of the proposed project on the current geological properties of the intended mining area, as described in section 4.1.2, will be described and assessed, together with any potentially feasible mitigation measures.

7.2.2 Air Quality

Determination of the impacts of the project over its lifetime will involve the following:

- Purchase of recent modelled meteorological data (MM5) in line with the requirements of the National Environmental Management Air Quality Act (Act No. 39 of 2004) (NEM:AQA) Regulations Regarding Air Dispersion Modelling (GN R.533, 2014);
- Establishing a comprehensive inventory of emissions from the mining and ore processing activities, as well as emission sources in the surrounding area, to enable consideration of the cumulative effect;
- Detailed information required for modelling purposes will be sourced from Smarty and its technical consultants;
- For identified sources, emission rates will be used where available; otherwise the US EPA AP-42 or NPI EET documents will be consulted to obtain emission rates for the identified sources;
- Developing concentration isopleths for atmospheric pollutants by dispersion modelling. The model proposed for this assessment is ICS-AERMOD, which is a widely used steady-state plume model capable of simulating the fugitive emissions typically expected for the proposed activities. The dispersion meteorology will be generated using the AERMET pre-processor. Construction phase emissions will not be modelled, but a professional opinion will be provided;
- Dispersion modelling results and associated air quality impacts will be analysed and presented in an Air Quality Impact Assessment Report; and
- Recommendations for mitigating/managing the impact of air emissions will be provided.

7.2.3 Soils, Land Capability and Land Use

In addition to having determined the baseline conditions as described in section 0, this study will involve the following:

- Classification and mapping of soil types on a scale of 1:50 000;
- Taking at least 24 soil samples of about 1.5 kg each at depths of 300 mm to 1 200 mm with a 100 mm hand auger on areas that will be affected by the project;

- Performing the analyses indicated in Table 7-1;
- Wetland delineation, based on soil properties;
- Determining the effective depth of the soils;
- Assessment of the agricultural potential of the soils under dry land and irrigated conditions;
- Assessment of the erodibility of the soils (i.e. exchangeable sodium percentage exceeding 15% of the cation exchange capacity);
- Description of chemical, physical and mineralogical properties of representative soil forms;
- Compilation of a soil utilisation guide and plan (stripping & stockpiling for later rehabilitation);
- Assessment of anticipated positive and negative environmental impacts on soils during the construction, operational and decommissioning phases and after mine closure; and
- Description of recommended mitigation measures for incorporation into the EMPr.

Table 7-1: Soil Analyses

Aspect	Method
Sample Preparation	Standard
pH	Standard
CEC+Ca+Mg+K+Na	NH4Ac-extraction
EC+SO_4+NO_3+B	Saturated distilled water extract
P	Bray 1-extract
Zn+Cu+Co+Cr+Fe+Se+Ni+Pb+Cd+As+Hg+V+ Mo+Sn+Ba+Al+Be+Ti+Mn+Br+Sr+In+Sb+Te+ W+Pt+Tl+Bi+U+Cn+Li	ICP Scan-saturated distilled water extract
Lime Requirement	SMP Double Buffer Titration
Mineralogy	
Clay fraction (<0.002 mm) identification	XRD-scan (6 treatments)
Physical	
Particle size distribution (3 fractions - sand+ silt + clay)	Hydrometer

7.2.4 Terrestrial Ecology

There are no perennial streams or natural wetlands within the project area. The ecological study will therefore focus on the terrestrial ecology and will involve the following:

- A desktop review of available ecological literature relevant to the project area and available satellite and aerial imagery to characterise the existing baseline ecological conditions;
- The desktop study will be augmented with two field surveys, conducted during the wet/growing and dry seasons;
- Flora and fauna will be surveyed using standard scientific sampling methodologies.

Vegetation communities will be delineated and described, and all observed fauna and flora will be identified and recorded. Special attention will be paid to important habitats and sensitive species, and species of conservation importance (e.g. Red List and protected species);

- Exotic and invasive plant species will be recorded, identified and mapped;
- The potential impacts of the proposed project during the construction, operational and decommissioning phases and after mine closure will be identified and assessed; and
- Appropriate mitigation and management measures will be formulated for inclusion in the environmental management programme (EMPr).

7.2.5 Surface hydrology

The scope of the surface hydrology study will include the following:

- A baseline determination will be undertaken on the mining and infrastructural areas to describe the pre-mining surface water environment, as needed for the scoping report, and to provide context for the subsequent impact assessment. This study will involve:
  - A two day site visit to familiarise the surface water team with the surface hydrology of the project area;
  - Compiling a map showing the catchment areas, mining and infrastructural areas and the major surface water drainage lines;
  - The available daily rainfall data will be collected, checked for integrity. The rainfall data will be patched to produce a daily rainfall record for use in surface water modelling;
  - Rainfall statistics such as monthly averages, number of rain days per month, distribution of annual totals and the 2, 5, 10, 20, 50, 100 and 200 year recurrence interval 24 hour storm depths will be determined;
  - The available climate data will be collected and reviewed to produce monthly potential evaporation and temperature statistics based on regional and local climatic data;
  - The surface water resources in the study area will be mapped and described;
  - The available flow records will be collected from the Department of Water and Sanitation’s database. The available data will be analysed to characterise the flow regimes in the local streams;
  - Gaps in the baseline dataset will be identified and a field monitoring programme will be developed to address the gaps;
  - The 50 year and 100 year flood lines will be determined for any streams that could be impacted by the proposed project. A 1 metre contour interval survey is required for the area, including the streams, to determine the flood lines. Any proposed river crossings will be measured during the site visit; and
  - The flood lines will be calculated using the HEC-RAS programme. The resulting flood lines will be plotted on a map.
- A water quality monitoring programme will be set up for the drainages that could be impacted on by the proposed mining. The streams in the area are non-perennial and with the recent drought, the area is currently particularly dry, with no surface water flows in the local streams. One round of field monitoring during the rainy season will be undertaken once there is flow in these streams. The following field monitoring programme will be undertaken:
  - Local and downstream water users will be identified and recorded; and

- The cross-sections of monitoring sites will be surveyed, flow will be measured and water samples will be collected at 5 sampling sites and analysed.

- The impact assessment will be done by exploring and predicting the effects of the proposed mining project on the pre-project baseline conditions described in the scoping report and acceptable conditions as defined by standards, guidelines and good practice. The surface water specialists will also take cognisance of Regulation 704 under the National Water Act (Act No. 36 of 1998) (NWA) and provide recommendations for achieving compliance with the requirements of this regulation. Accordingly, the study will encompass the following:
  - Determining the quantity and quality of runoff from the proposed mining areas for rainfall events with 50 year and 100 year recurrence intervals to properly size and design stormwater control measures;
  - Delineating clean and dirty areas on the project area from the mining and infrastructure layout plans;
  - A stormwater model (PCSWMM) will be set up and applied to determine the layout and sizes of the conveyance structures required for the clean and dirty water collection systems and pollution control dam(s) to meet the requirements of Regulation 704 of the NWA. A water balance schematic will be developed with the plant designers, mine planners, infrastructure engineers and TSF designers;
  - A spreadsheet based static water balance will be developed of the water system. The output of the water balance will support the EIA as well as the water use licence application;
  - The outputs from the water balance model and geochemical characterisation as well as the available water quality data will be used to prepare a high level salt balance to support the IWULA; and
  - The impacts of the proposed mining operations on the local surface water resources will be assessed and appropriate mitigation measures will be recommended for inclusion in the EMPr.

7.2.6 Groundwater

When developing a mine plan, some of the most important requirements with regard to groundwater are to:

- Assess the extent to which groundwater flow into the mine workings may affect the safety and efficiency of the mining operations;
- Identify local groundwater users and determine their dependence on the groundwater resource;
- Determine the pre-project (baseline) groundwater quality;
- Assess the potential impact of the proposed mining operations on the groundwater quality and yield; and
- Develop an appropriate dewatering plan that will provide safe working conditions while minimising any adverse effects on groundwater quality and groundwater users in the vicinity of the mine.

The groundwater investigation will encompass the following:

- Desktop study of proposed mining plan, available geological information, borehole maps and logs, groundwater reports and monitoring data in the vicinity of the mining and infrastructural areas;
- Site visit and hydrocensus of accessible boreholes within 2 km of the project footprint. In addition to measuring the static water level, pH and conductivity in the field, available information about existing equipment and pump volumes, current use, reported yield, and borehole depth will be gathered;

- The data collected above will be used to define an initial understanding of the hydrogeological features of the project area and to prepare a site-specific conceptual model of the dynamics of the groundwater system at the project area. It is assumed that enough baseline information will become available to do this;
- Geophysical survey to establish suitable locations for monitoring boreholes and such dewatering boreholes as may be required:
  - The geophysical survey will target deep weathering and fractures in the Limpopo mobile belt, an east-northeast trending belt of strongly deformed, largely granulite facies, high grade metamorphic rocks separating the ancient Kaapvaal and Zimbabwe cratons; and
  - The survey will comprise magnetic, electromagnetic and 2D Earth Resistivity Imaging (ERI) methods. The survey will be conducted at 10 m station intervals at selected target areas which will be determined by the geophysical survey.
- Drilling of 5 new monitoring boreholes, which will:
  - Provide direct geological and hydrogeological control information across the proposed mining area as required;
  - Establish facilities to undertake aquifer testing and water sample collection; and
  - Serve as future monitoring points in an initial groundwater monitoring network.
- The boreholes will be drilled to specification under the supervision of a Golder hydrogeologist who will determine final drilling depths and also record the geology intersected, and the depth/blow yield of water strikes;
- Aquifer testing of the new monitoring boreholes to determine hydraulic parameters and update the conceptual groundwater model. This proposal provides for the short term test pumping of 5 new monitoring boreholes, 5 x 12 hour Constant Discharge Tests (CDT). The hydraulic parameters determined from the test data will provide essential inputs to the numerical flow and transport model. Nearby boreholes will be used to monitor the impact of the testing of water levels.

  Aquifer testing will be done under the supervision of a Golder hydrogeologist, who will also perform slug testing on accessible existing boreholes to determine hydraulic parameters;
- Sampling of the newly drilled monitoring boreholes and existing boreholes in the vicinity of the project footprint.

  Water samples will be collected during the hydrocensus (5 samples) and aquifer testing programme (5 samples) and submitted to a SANAS accredited laboratory for chemical analysis, which will include major cations (Na, K, Mg, Ca), major anions (Cl, F, SO_4), physico-chemical parameters (pH, conductivity, total dissolved solids, total alkalinity) and trace elements (including Fe, Cr, Mn, Al, Zn, NO_3 and others determined by ICP-OES). The results will be cross referenced with the existing 2014 and 2015 hydrocensus information to provide an up to date groundwater quality baseline;
- Update of conceptual groundwater model with the new information generated. The conceptual model will indicate the dynamics of the groundwater system, aquifer distribution, role of geological structures and groundwater flow directions and it will provide basic input to the groundwater modelling; and
- Geochemistry and mine residue classification to determine the:
  - Risk of acid rock drainage/metal leaching (ARD/ML) from the rock material which will be exposed/disturbed/deposited during the mining operations;
  - Residue characteristics of the waste rock, ore and tailings (waste assessment in terms of the National Environmental Management Waste Act, NEMWA); and

- Long term seepage quality of the mine and its residue storage facilities (source-terms).

The geochemical characterisation will be carried out according to Best Practice Guidelines for Water Resource Protection in the South African Mining Industry (BPG), in particular BPG G4 (impact prediction), as well as global best practice methodology, which is presented in the Global Acid Rock Drainage (GARD) Guide (INAP, 20102).

The study will recommend conceptual waste and mine water management options to minimise and prevent ARD and ML as input to mine planning processes, such as the design of the tailings storage facility (TSF) and waste rock dumps (WRDs). At least 15 composite samples of rock materials and one tailings sample will be analysed by a suitably accredited laboratory.

The samples will be subjected to:

- Acid base accounting(ABA) tests;
- Whole element analysis by X-ray fluorescence;
- *Aqua regia* digestion and XRF/ICP scans to determine total concentrations of inorganic constituents of concern (CoCs);
- Australian Standard Leach Procedure (ASLP) and analysis of the leachate;
- Net Acid Generation Leach Testing (NAGLT) to determine the leachable concentrations of inorganic CoCs under the maximum possible level of oxidation; and
- Mineralogical analysis by X-Ray diffraction.

Source-terms (concentration loadings of the potential constituents of concern) will be developed on the basis of maximum and minimum leachate qualities from the leach tests and any existing information.

A waste assessment for the waste rock and tailings will be prepared in terms of the National Norms and Standards for the Assessment of Waste for Landfill Disposal (GN R.635 of 23 August 2013).

If the above tests indicate a significant risk of acid rock drainage, then humidity cells will be set up and kinetic tests will be carried out according to standard D 5744 – 13 (ASTM, 2013). The results will enable the development of fully quantitative source-terms conducting seepage flow and geochemical modelling using humidity cell leachate quality data.

- Numerical modelling and impact assessment:

The potential impact of the mine and related infrastructure on the groundwater system, migration of possible contaminant plumes from the mining areas, pollution control dams, stockpile areas, TSF, and heap leach pads will modelled using FEFLOW, a highly sophisticated and powerful 3D finite element modelling package designed to cope with complex hydrogeological and mine scheduling situations.

The model will be used to assess the likely impacts of the mining activities on the existing groundwater regime, including:

- Calculation of passive inflow into the mines;
- Impacts on the existing users in terms of depression of groundwater levels/reduction in yield of existing boreholes, caused by the need to pump water out to maintain safe working conditions in the mines;
- Impacts on the groundwater quality of existing users;
- Possible development of pollution plumes emanating from the mining activities;
- Impacts on the existing groundwater level, and
- Transport model for pollution impact assessment and control.

7.2.7 Noise and Vibration

The scope of this specialist study will include:

- Identifying existing sources of noise in the vicinity of the project area and taking noise measurements at appropriate measuring points along the perimeter of the project area to characterise the pre-project baseline noise regime. The measurements will be done in accordance with SANS 10103:2008;
- Identifying potentially sensitive receptors and their locations;
- Prediction of noise levels at sensitive receptors during the construction and operational phases of the mine;
- Evaluation of the predicted noise levels in the context of the baseline characterisation to identify any significant noise impacts arising from the mining activities;
- Listing local standards and international guidelines for acceptable noise levels in various districts;
- Assessing the noise impact by constructing an acoustic model of the operations, using proprietary modelling software that conforms to international standard ISO 9613. The model will be developed based on local mapping data, project description and site plans provided by Smarty and will include static noise sources, as well as mobile and linear sources such as road traffic and conveyors. Topography will be assumed to be flat and smooth, representing “worst-case” in terms of noise attenuation;
- Evaluation of predicted noise levels at receptor points by comparison with South African and international standards and guidelines. The dominant noise sources will be identified and recommendations provided for mitigation measures to control the noise at source and for on-going monitoring and compliance surveys as may be necessary;
- Providing guidelines for acceptable vibration levels in terms of damage to structures; and
- Describing South African and international guidelines for the design and monitoring of blasts to remain within acceptable limits regarding noise generated by air blast, ground vibration levels and fly rock travel distance.

7.2.8 Visual Impact

The visual impact assessment will be undertaken against the backdrop of the baseline characterisation provided in section 4.12 and will involve the following:

- Identification of potentially sensitive receptors;
- Development of a GIS-based viewshed analysis by applying digital elevation modelling (DEM) to project layout drawings and estimated dimensions of buildings and other infrastructural components;
- Determining the magnitude and significance of the potential visual impacts; and
- Identifying potential visual mitigation strategies and measures that need to be considered during construction, operation and maintenance of the various components of the project, in order to improve the long-term visual appearance of the project.

7.2.9 Cultural and Heritage Resources

Copper ore was mined and copper was smelted in the area of Musina more than 250 years ago, but the history of such early smelting activities is not well documented and it is possible for undiscovered remnants to occur the project area. It is a large area and will require a two man team to survey it adequately within the regulated timeframe available for an EIA.

As required in terms of Section 38 of the National Heritage Resources Act 25 of 1999 (NHRA), the South African Heritage Resources Agency (SAHRA) will be notified of the intended development and provided with all relevant information developed during the EIA.

A Phase I Heritage Impact Assessment (HIA) will be undertaken on the project area to:

- Determine whether there are any cultural or heritage resources on the surface as defined in the NHRA;
- Assess the impact of the proposed project on any such resources; and
- Recommend appropriate mitigation measures, which will include chance find procedures.

Prior to access to the project area being visited, the specialist will undertake a desktop study as follows:

- Consult heritage data bases SAHRIS (national, provincial):
- Review of available reports and background literature for contextual evidence; and
- Consultation with SAHRA about information available on their database.

7.2.10 Socio-economics

The socio-economic study will involve the following:

Data collection via

- A desktop review of existing documents:
  - Population and Housing Census Statistics (2011) and Local Municipal IDPs, SDFs and LEDs; and
  - The proposed site layout and any existing or previous SIAs, BAs, EIAs, EMPs.
- Up to 5 interviews with identified key informants (neighbouring land owners, local community leaders, municipal officials, leaders of civic organisations, etc.) to gain a better understanding of the socio-economic conditions from their perspective in the proposed project area.

The impacts of the proposed project on the current socio-economic fabric of the surrounding area, as described in section 4.15, will be identified. Information on the capital cost (local and imported) and the estimated local spend on remuneration, goods and services will be used to assess the socio-economic impact of the proposed project on relevant socio-economic characteristics of the area such as the population demographics, number of employment opportunities, number of unemployed and Gross Geographical Product. Recommendations for mitigation of adverse impacts and enhancement of positive effects will be provided.

7.3 Impact Assessment Methodology

The significance of the identified impacts will be determined using the approach outlined below (terminology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998). This approach incorporates two aspects for assessing the potential significance of impacts, namely occurrence and severity, which are further sub-divided as follows:

Occurrence		Severity	
Probability of occurrence	Duration of occurrence	Scale/extent of impact	Magnitude (severity) of impact

To assess each of these factors for each impact, the following four ranking scales are used:

Probability	Duration
5 - Definite/don't know	5 - Permanent
4 - Highly probable	4 - Long-term
3 - Medium probability	3 - Medium-term (8 - 15 years)
2 - Low probability	2 - Short-term (0 - 7 years) (impact ceases after the operational life of the activity)
1 - Improbable	1 – Immediate
0 - None	
SCALE	**MAGNITUDE**
5 - International	10 - Very high/don't know
4 - National	8 - High
3 - Regional	6 - Moderate
2 - Local	4 - Low
1 - Site only	2 - Minor
0 - None	

Once these factors are ranked for each impact, the significance of the two aspects, occurrence and severity, is assessed using the following formula:

- **SP (significance points) = (magnitude + duration + scale) x probability**

The maximum value is 100 significance points (SP). The impact significance will then be rated as follows:

SP >75	Indicates high environmental significance	An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.
SP 30 – 75	Indicates moderate environmental significance	An impact or benefit which is sufficiently important to require management and which could have an influence on the decision unless it is mitigated.
SP <30	Indicates low environmental significance	Impacts with little real effect and which should not have an influence on or require modification of the project design.
+	Positive impact	An impact that constitutes an improvement over pre-project conditions.

7.4 Method of assessing duration significance

See section 7.3, where it is explained how durations ranging from immediate (i.e. lasting for only seconds or minutes, such as air blast, noise and vibration caused by a blast) to permanent (e.g. removal of copper ore from economically viable deposits) are assigned scores ranging from 1 to 5.

7.5 Stages at which competent authority will be consulted

The competent authority will be consulted:

- Upon submission of the application for a mining right;
- During the 30 day period for public review of the draft scoping report;
- During the 43 day period of evaluation of the scoping report by the DMR;

- During the 106 day period of development of the EIR and EMPr;
- During the 30 day period for public review of the EIR and EMPr;
- During the 107 day period of evaluation of the EIR and EMPr by the DMR; and
- In the event of an appeal.

7.6 Public Participation during the Impact Assessment Phase

Public participation during the impact assessment phase of the EIA will entail a review by interested and affected parties (I&APs) of the findings of the EIA, presented in the EIA Report and Environmental Management Programme (EMPr), and the specialist studies. These reports will be made available for public comment for a period of 30 days.

7.6.1 Notification of interested and affected parties

All registered I&APs will be advised timeously and by e-mail, fax or telephone call of the availability of these reports, which they could either download from Golder's public website or request from Golder's Public Participation Office. They will be encouraged to comment either in writing (mail or email) or by telephone. Ample notification of due dates will be provided.

7.6.2 Engagement process to be followed

All the issues, comments and suggestions raised during the comment period on the Draft EIA Report/EMPr will be added to the Comments and Response Report (CRR) that will accompany the Final EIA Report/EMPr. The Final EIA Report/EMPr will be submitted to the Department of Mineral Resources (DMR) and the Department of Water and Sanitation (DWS) for a decision about the proposed project.

On submission of the Final EIA Report/EMPr to the authorities, a personalised letter will be sent to every registered I&AP to inform them of the submission and the opportunity to request copies of the final reports.

7.6.3 Information to be provided to I&APs

In addition to all the information provided in this scoping report, specifically the mining and infrastructure layout plan shown in Figure 2-3, the project description provided in section 2.5, the description of the baseline environment provided in section 4.0, the potential impacts identified in section 5.0 and the potential mitigation measures discussed in section 6.3, the results of the specialist assessments and their recommended mitigation measures will be provided to I&APs during the impact assessment phase.

7.7 Tasks to be undertaken during environmental impact assessment process

The various specialist studies that will be undertaken during the environmental impact assessment process are described in section 7.1 and the associated tasks are briefly summarised here.

7.7.1 Finalisation of site layout

The location and preliminary layout of the mine's supporting infrastructure has been determined with consideration of the environmental baseline information generated during the scoping process. The layout will be finalised after taking into consideration additional information generated during the environmental impact assessment process.

7.7.2 Air Quality

The impact assessment study will encompass the following tasks:

- A review of applicable air quality legislation, policies and standards;

- Purchase of recent modelled meteorological data (MM5) in line with the requirements of the National Environmental Management Air Quality Act (Act No. 39 of 2004) (NEM:AQA) Regulations Regarding Air Dispersion Modelling (GN R.533, 2014);
- Establishing a comprehensive inventory of emissions from the mining and ore processing activities, as well as emission sources in the surrounding area, to enable consideration of the cumulative effect;
- Detailed information required for modelling purposes will be sourced from Smarty and its technical consultants;
- For identified sources, emission rates will be used where available. Otherwise the US EPA AP-42 or NPI EET documents will be consulted to obtain emission rates for the identified sources;
- Developing concentration isopleths for atmospheric pollutants by dispersion modelling. The model proposed for this assessment is ICS-AERMOD, which is a widely used steady-state plume model capable of simulating the fugitive emissions typically expected for the proposed activities. The dispersion meteorology will be generated using the AERMET pre-processor. Construction phase emissions will not be modelled, but a professional opinion will be provided;
- Identification of sensitive receptors in the vicinity of the site;
- Identification of potential health effects associated with PM_{10} and $PM_{2.5}$; and
- Development of appropriate mitigation measures and criteria for modelling and monitoring for inclusion in the EMPr.

7.7.3 Surface Hydrology

The following tasks will be undertaken during the surface water specialist study:

- Determining the quantity and quality of runoff from the proposed mining and ore processing areas for rainfall events with 50 year and 100 year recurrence intervals;
- Delineating clean and dirty areas on the project area from the mining and infrastructure layout plans;
- A stormwater model (PCSWMM) will be set up and applied to determine the layout and sizes of the conveyance structures required for the clean and dirty water collection systems and pollution control dam(s) to meet the requirements of Regulation 704 of the National Water Act (Act No. 36 of 1998) (NWA). A water balance schematic will be developed with the plant designers, mine planners, infrastructure engineers and TSF designers;
- A static water balance of the water system will be developed. The outputs from the water balance model and geochemical characterisation as well as the available water quality data will be used to prepare a high level salt balance to support the integrated water use licence application (IWULA); and
- The impacts of the proposed mining operations on the local surface water resources will be assessed and appropriate mitigation measures will be recommended for inclusion in the EMPr.

7.7.4 Groundwater

The following tasks will be undertaken during the geohydrological impact assessment:

- Geophysical survey to establish suitable locations for monitoring boreholes and such dewatering boreholes as may be required:
- Drilling of 5 new monitoring boreholes, which will:
  - Provide direct geological and hydrogeological control information across the proposed mining area as required;
  - Establish facilities to undertake aquifer testing and water sample collection; and

  - Serve as future monitoring points in an initial groundwater monitoring network.
- Aquifer testing of the new monitoring boreholes to determine hydraulic parameters and update the conceptual groundwater model;
- Sampling and analysis of the newly drilled monitoring boreholes and existing boreholes in the vicinity of the project footprint;
- Geochemical testing and mine residue classification to determine the:
  - Risk of acid rock drainage/metal leaching (ARD/ML) from the rock material which will be exposed/disturbed/deposited during the mining operations;
  - Residue characteristics of the waste rock, ore and tailings (waste assessment in terms of the National Environmental Management Waste Act, NEMWA); and
  - Long term seepage quality of the mine and its residue storage facilities (source-terms).
- Numerical modelling and assessment of the likely impacts on the groundwater regime, including:
  - Calculation of passive inflow into the mines;
  - Impacts on the existing users in terms of depression of groundwater levels/reduction in yield of existing boreholes, caused by the need to maintain safe working conditions in the mines;
  - Impacts on the groundwater quality of existing users;
  - Possible development of pollution plumes emanating from the mining activities;
  - Impacts on the existing groundwater level; and
  - Transport modelling for pollution impact assessment and control.
- Formulating appropriate mitigation measures.

7.7.5 Noise and Vibration

The noise and vibration impact assessment will involve the following tasks:

- Identification of sensitive receptors in the vicinity of the proposed mines and ore processing operations;
- Prediction of noise levels at sensitive receptors during the operational phase of the project. A flat and smooth topography, representing the worst-case in terms of noise attenuation, will be assumed;
- Evaluation the predicted noise levels in the context of the baseline characterisation to identify any significant noise impacts arising from mining and ore processing activities;
- Providing guidelines for acceptable vibration levels in terms of damage to structures;
- Formulating recommendations regarding noise mitigation procedures and on-going monitoring and compliance surveys as may be necessary;
- Predicted noise levels at receptor points will be evaluated by comparison with South African and international standards and guidelines. The dominant noise sources will be identified and recommendations provided for mitigation measures to control the noise at source; and
- South African and international guidelines for the design and monitoring of blasts to remain within acceptable levels regarding noise levels generated by air blast, ground vibration levels and fly rock travel distance will be discussed.

7.7.6 Socio-economics

The socio-economic impacts of the proposed mining project in terms of job creation and local spend on goods and services will be assessed against the existing demographics, jobs and skills profile and gross geographic value of the local municipality. Appropriate mitigation measures will be developed.

7.8 Measures to avoid, reverse, mitigate and manage impacts and determine residual risks

Table 7-2: Activities, impacts, mitigation and residual risks

Activity	Potential Impact	Mitigation Type	Potential for Residual Risk
Opencast blasting	Injury or damage due to fly rock, air blast and/or ground vibration	Monitoring and adaptive blast design	Possible injury or damage if a blast is inappropriately designed, but not likely – low residual risk
Underground blasting	Vibration at surface	Monitoring and adaptive blast design	Possible exceedance of acceptable limits if a blast is inappropriately designed, but not likely – low residual risk. Although underground mining is not being considered at this stage, there are underground copper ore resources in the area and underground mining may be undertaken at a later date
Mine dewatering	Lowering of groundwater table and contaminant transport	Numerical modelling, monitoring, tailoring abstraction to inflow of groundwater into underground workings	Variations in rock permeability and transmissivity could temporarily result in higher inflow than expected. Unknown water pockets could be encountered. Contaminant transport could occur when workings are flooded after mine closure
Mining, storage of waste rock and tailings, heap leaching	Pollution of surface water and groundwater by acid rock drainage and acid escape from heap leach operations	Transport modelling, monitoring, compaction of backfill, capping and vegetation of TSF	Decant of contaminated mine water from backfilled voids. Drainage of contaminated water from TSF
Preparation for mine closure	Inadequate development of personnel skills and/or projects that are sustainable after closure	Progress monitoring during life of mine	Inability of former personnel to sustain livelihoods after mine closure

8.0 OTHER INFORMATION REQUIRED BY COMPETENT AUTHORITY

8.1 Impact on socio-economic conditions of any directly affected persons

The socio-economic impacts on the local residents close enough to be directly affected can only be determined properly after the specialist studies described in section 7.1 (Plan of Study for Impact Assessment) have been completed. No involuntary relocation is foreseen.

8.2 Impact on any national estate

No cultural/heritage resources close enough to the proposed mining and ore beneficiation activities to be impacted are indicated in the literature. Fieldwork has not been possible to date, due to lack of access to the affected farms. The possibility of chance finds during construction and mining cannot be ruled out.

9.0 OTHER MATTERS REQUIRED IN TERMS OF SECTIONS 24(4)(A) AND (B) OF THE NEMA

- Section 24(4)(a) (iii) requires that a description of the environment likely to be significantly affected by the proposed activity be provided. This has been done – see section 4.0 of this report;
- Section 24(4)(a) (iv) requires an investigation of the potential consequences for or impacts on the environment of the activity and assessment of the significance of those potential consequences or impacts. See section 5.0 of this report, where potential impacts were identified. Their assessment, as detailed in the Plan of Study for Impact Assessment (section 7.3) will be done during the impact assessment phase of the EIA; and
- Section 24(4)(a) (v) references public information and participation procedures, which have been dealt with in section 3.8.2 and 7.6 of this report.

10.0 UNDERTAKING REGARDING CORRECTNESS OF INFORMATION

I, Etienne Roux herewith undertake that the information provided in the foregoing report is correct, and that the comments and inputs from stakeholders and Interested and Affected parties have been correctly recorded in this report.

6 December 2016

11.0 UNDERTAKING REGARDING LEVEL OF AGREEMENT

I, Etienne Roux herewith undertake that the information provided in the foregoing report is correct, and that the level of agreement with Interested and Affected parties and stakeholders has been correctly recorded and reported herein.

6 December 2016

12.0 REFERENCES

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